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MURCxCJUR | Special Edition

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MURCxCJUR: Multidisciplinary Undergraduate Research Conference 2026

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This issue is published on the traditional, ancestral, and unceded territory of the Coast Salish Nations, including xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh).

For inquiries about the Multidisciplinary Undergraduate Research Conference, please address correspondence to undergraduate.research@ubc.ca. For inquiries about the Canadian Journal of Undergraduate Research, please contact cjur.uro@gmail.com.

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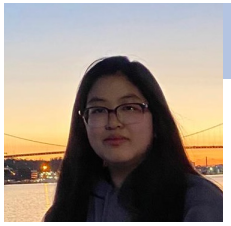

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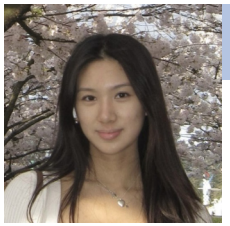

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Introduction from the Co-Chairs

The Multidisciplinary Undergraduate Research Conference (MURC) is the largest undergraduate research conference at the University of British Columbia, and we were pleased this year to feature over 400 student presenters showcasing their research to the UBC community.

The theme for MURC 2026 is “Curiosity Without Borders: Celebrating Student Research” which challenges researchers to venture beyond the boundaries of their own disciplines while embracing the unique perspectives and experiences that shape their work. We aim to foster a spirit of collaboration that encourages attendees to engage in open dialogue, share ideas across fields, and discover new ways of thinking. This year’s conference will highlight how interdisciplinary collaboration can spark innovation and generate impactful answers to some of the most complex academic and societal challenges.

Researchers chose one of two formats to showcase their research: oral or poster presentation. MURC 2026 took place at the UBC Vancouver campus, with poster and oral presentations in Ponderosa North. UBC upper-year undergraduate students, graduate students, and faculty members evaluated presentations based on multidisciplinary-focused rubrics with awards for the top presentations in each category as well as two awards for the top oral and poster botany presentations.

Malika Kahlon
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Abstracts

Abstracts

Visualization of Deep Eye Layers and Blood Vessels Using Optical Coherence Tomography (OCT), a Non-Invasive Imaging Method

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The choroid is a vascular layer of the eye essential for retinal health, making accurate visualization critical for understanding choroidal diseases and evaluating therapeutic outcomes. Optical coherence tomography (OCT) is a non-invasive imaging modality that provides images of the retina and choroid. Despite its clinical importance, conventional OCT has limited ability to visualize deeper choroidal structures, complicating accurate assessment. Because the choroid is rich in melanin, melanin-sensitive contrast mechanisms are particularly valuable for imaging. We therefore leverage polarization-diversity OCT (PD-OCT), which provides melanin-specific contrast to improve visualization. We hypothesize that the choroidal vasculature maps generated by our PD-OCT processing pipeline are consistent with established clinical observations of choroidal structure. To validate our proposed processing pipeline, subjects who had undergone indocyanine green angiography (ICGA) will be imaged using PD-OCT. ICGA, unlike PD-OCT, is an invasive, dye-based imaging procedure that serves as a clinical reference for choroid visualization. For each eye, ten PD-OCT volumes will be acquired and processed using the proposed pipeline. This pipeline improves image quality, identifies the boundaries of the choroid, and highlights choroidal blood vessels to generate vessel maps. Through qualitative comparison of PD-OCT processing outputs with ICGA, we expect to generate 3D maps of choroidal vasculature that correspond with ICGA choroidal maps. This will help validate PD-OCT as a non-invasive method for choroidal visualization while highlighting the contribution of melanin-specific contrast. Future work will apply this approach to patients with high myopia to examine choroidal changes and evaluate performance across diverse patient populations to support clinical translation.

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A Literature Review on Low-Cost Portable Ultrasound Devices: Improving Maternal Health in Rural and Underserved Communities

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In underserved communities, the greatest health burdens fall upon expectant mothers. Their health outcomes often depend on the medical opportunities accessible to them, such as routine examinations. Maternal mortality rates are excessively high in marginalized communities, showing that more accessible techniques are needed for diagnosis. A literature review was conducted to evaluate whether POCUS (Point-of-Care Ultrasound) improves maternal health outcomes in rural communities. POCUS is a contemporary diagnostic technique used in rapid clinical assessment. The training focuses on rapid bedside evaluations of body parts, such as the heart and lungs, using handheld, portable ultrasounds. POCUS was found to be an effective way to address rising maternal mortality rates. With 90.5% diagnostic accuracy in emergency protocols, it serves as an effective addition to traditional techniques. In rural areas where traditional ultrasound examinations are largely inaccessible, the POCUS technique serves as an effective alternative. This new technique is more cost-effective than traditional methods, as medical professionals can support a greater number of patients without referring them to private hospitals. With limited qualified radiologists in underserved communities, POCUS training aids medical professionals by ensuring the safety of expectant mothers while reducing unnecessary referrals. With the implementation of POCUS, abnormalities can be detected earlier, enabling preventive actions and earlier treatment initiation to reduce maternal mortality rates.

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Restoration Revealed: Comparing wildlife monitoring techniques in Gorongosa National Park, Mozambique

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Traditionally, aerial surveys have been the standard method for monitoring species populations globally, while motion-activated camera traps have recently emerged as a cost-effective tool for estimating abundance. Although both are established monitoring tools, gaps remain in understanding how they compare. We compared camera trap-derived Relative Abundance Indexes (RAIs) and aerial counts in Gorongosa National Park (GNP), Mozambique, allowing us to examine the two methods across multiple years using concurrent data sets. We found that gregarious or diurnal species were more likely to be detected by both methods across site-year combinations, whereas nocturnal and/or small-bodied species were detected primarily by camera traps. Additionally, aerial surveys showed reduced ability to detect small-bodied species, while gregarious species were more frequently detected by aerial surveys relative to camera traps. Contrary to predictions, diurnality did not have a significant effect, however this may reflect the exclusion of several nocturnal species that were not detected by aerial surveys. Tree cover also did not have a significant effect on the difference between the two methods for most species. Lastly, we anticipated that species population trends would differ over time between methods due to differences in detection probability, however the majority of species showed similar directional trends across methods, while the magnitude differed. This analysis can inform management decisions regarding the implementation of key interventions and conservation initiatives. In addition, our analysis will enable researchers to determine the most appropriate monitoring approach based on goals, project timelines, target species, and budget.

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Food Insecurity and Mental Health Among Canadian University Students

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Food Insecurity (FI), the limited or uncertain access to nutritious food, is a growing crisis affecting Canadian university students due to rising living costs, rising tuition costs, and limited income. While research consistently associates FI with compromised mental health (MH), including elevated anxiety and depression, the rising prevalence of FI across Canadian campuses necessitates a comprehensive synthesis of current evidence. This project addresses this urgent need by synthesizing existing literature to better understand how FI undermines student well-being. Using a narrative review methodology, we searched the Web of Science and UBC CINAHL databases for peer-reviewed literature focusing on Canadian undergraduate and graduate populations published between 2015 and 2025. Our search strategy utilized four key fields: food insecurity, Canadian geography, post-secondary populations, and mental health outcomes. Two independent reviewers screened search results based on predefined exclusion criteria. The findings reveal significant psychosocial mediators, including chronic worry and social isolation, that link FI to psychological distress. Furthermore, recent 2025 data indicates a surge in FI prevalence, reaching as high as 46.6%, driven by post-pandemic inflation and the removal of tuition freezes. We also identified social support as a key moderator that can buffer the relationship between FI and compromised MH. Ultimately, this synthesis identifies critical research gaps and provides evidence-based recommendations for university policymakers and student services. By clarifying the FI-MH relationship, this research aims to support initiatives that promote both the nutritional security and long-term mental well-being of Canadian university students.

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Digital Storytelling as a Knowledge Translation Strategy: Investigating The Impacts of Digital Stories on Viewers' Attitudes Towards Endometriosis

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Endometriosis is a chronic gynecologic condition where tissue similar to the uterine lining grows outside the uterus, affecting 1 in 10 girls, women, and a similar number of gender-diverse individuals. Its physical symptoms, including pain and infertility, are often compounded by psychosocial impacts such as anxiety, depression, and social isolation. Stigma and limited knowledge about endometriosis and chronic pain further contribute to an average diagnostic delay of ~5.4 years in Canada. One promising approach to addressing these issues is digital storytelling (DST), which uses digital media to create narrative-based videos. In 2024, our team recruited 36 people with endometriosis to create individual digital stories. Some of these participants, along with researchers and students, were invited to form a knowledge translation working group to organize a hybrid Endometriosis Film Festival in Fall 2026 that will showcase the DST videos. At the event, we will collect survey and focus group data from audience members to evaluate DST as a knowledge translation tool and describe the connections between DST viewing and audience members' empathy, understanding, and stigma-related attitudes toward endometriosis. We expect this project to increase endometriosis awareness, enhance empathy, and reduce stigma among film festival attendees, including healthcare providers, policymakers, and community members, while reducing isolation and improving validation, access to care, and relationships for people with lived experience. This DST initiative will lay the foundation for future health education work that eases the psychosocial burden of endometriosis.

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Screen Time and Early Childhood Development: A Review of Recent Evidence

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Digital screens such as televisions, tablets, and smartphones are now part of daily life for many infants and young children, despite recommendations to limit early screen exposure. In 2022, the Canadian Paediatric Society released guidelines advising minimal screen time for children under five. Since then, new research has emerged providing deeper insight into how screen time affects development, yet this evidence has not been comprehensively synthesized. This project presents a narrative review of peer-reviewed studies published between 2022-2025 examining associations between screen time and developmental outcomes in children aged 0-5 years. Studies were identified through database searches using keywords and categorized by developmental domain, including cognitive and language development, emotional and psychosocial outcomes, and physical health. Contextual factors such as screen content, caregiver co-viewing, timing of use (e.g., bedtime), and parent-child interaction were emphasized. Across studies, higher screen exposure was consistently linked to adverse outcomes, including lower cognitive and language scores, weaker executive function, increased behavioural difficulties, and poorer sleep quality. Several studies demonstrated dose-response relationships, with prolonged exposure amplifying risk. Importantly, newer evidence suggests that context matters: screen use involving caregiver co-viewing, active interaction, and shared reading appears less harmful and may partially buffer negative effects. Overall, this review highlights the developmental risks that arise with early screen exposure while recognizing that strictly time-based screen guidelines may be difficult for families to follow. Limiting total exposure remains important, but guidance incorporating content, timing, and caregiver involvement may better support realistic, development-friendly choices and strengthen application of existing recommendations.

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Improving Access to X-ray / CT Imaging in Rural Canada Through Low-Cost Radiology Training Resources for Early Detection of Upper Lobe Lung Cancer

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Lung cancer remains Canada's deadliest cancer, with an estimated 32,900 new cases in 2025, and diagnosis heavily depends on radiographic imaging. Between 2010 and 2020, practicing radiologists increased by 24% in urban regions but only 5% in rural areas, while CT utilization doubled between 2003 and 2019. Health authorities in British Columbia report radiology vacancy rates of up to 30%, limiting timely access to imaging services and increasing the risk of delayed or missed diagnoses. 90% of diagnostic errors in lung cancer occur on chest radiographs, mostly due to observer error and scanning recognition. Hence, accessible and low-cost training is essential for strengthening radiologic capacity in rural settings. This work aims to develop accessible educational tools for practitioners in low-resource settings across Canada. We outline an approach where additive manufacturing can be leveraged to build imaging-accurate anatomical models for hands-on skill development of radiologists, in order to create low cost open-access resources for medical training. To this end, we have conducted interviews with Canadian X-ray/CT imaging specialists to assess training barriers, from which we identify gaps in existing teaching resources. We have compiled a list of low-cost bulk materials to identify candidates with radiopacity comparable to organic tissues. With these resources, we describe our steps to construct an anatomically realistic chest prototype designed to be imaging-accurate for simulated radiographic training. The tools developed from this project may be used to improve skills training in acquisition and interpretation across X-ray/CT imaging professionals.

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Assessment Of Mental Health Symptoms in Pediatric Inflammatory Bowel Disease: A Scoping Review of Measurement Practices (2015–2025)

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Pediatric inflammatory bowel disease (IBD), including Crohn's disease and ulcerative colitis, is often accompanied by anxiety and depressive symptoms that affect quality of life and daily functioning. However, evidence is difficult to compare across studies because researchers use different instruments, reporters, and study designs. This scoping review mapped how mental health symptoms were assessed in pediatric IBD research published between 2015 and 2025. PubMed was searched for English-language human studies including participants aged 18 years or younger, or studies with separable pediatric results, that measured mental health symptoms using a named instrument. Titles, abstracts, and full texts were screened using predefined criteria, and data were charted on instrument type, symptom domain, reporter source, and study design. Of 128 records screened, 20 studies met inclusion criteria. Depression and anxiety were the most commonly assessed outcomes, while stress, distress, and broad internalizing symptoms were less frequently examined. Instrument selection was heterogeneous: PROMIS Anxiety was the most frequently used anxiety measure, and the CDI/CDI-2 family was most commonly used for depression. Most studies relied on youth self-report, with relatively few using multi-informant approaches. Study designs were primarily cross-sectional, with fewer longitudinal and psychometric studies. Overall, pediatric IBD mental health research shows inconsistent measurement practices that limit cross-study comparability; a harmonized core set of measures and reporter strategies may strengthen future longitudinal research and clinical screening.

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Investigating the Effects of Hypoxia on the Metabolic Activity of Three-Spined Stickleback

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The three-spined stickleback (*Gasterosteus aculeatus*) is a small, widespread fish capable of tolerating environmental fluctuations, including decreases in dissolved oxygen (DO), known as hypoxia. Hypoxia limits aerobic ATP production, causing organisms to meet ATP demands with increasing anaerobic metabolism. This study examines how long-term hypoxia alters metabolic enzyme activity in the liver, heart, and brain tissues of stickleback. Adult stickleback were acclimated to either normoxic control tanks (n = 5, salinity = 27.4 ± 0.00 (SD), DO 92.5 ± 0.00%, temperature = 13.0 ± 0.00°C) or hypoxic tanks (n = 4, salinity = 27.4 ± 0.00 PSU, DO 40.4 ± 2.22%, temperature = 12.6 ± 0.56°C) for 14 days. Following acclimation, fish were terminally sampled, and lactate dehydrogenase (LDH) and citrate synthase (CS) activity assays were conducted on the tissues as proxies for anaerobic and aerobic metabolism, respectively. We hypothesized that fish acclimated to hypoxia would increase anaerobic activity and decrease aerobic activity in response to oxygen limitation. Our results showed that hypoxia increased LDH activity in liver and brain tissues, with variable increase in heart tissues. Liver and brain tissues showed relatively balanced CS activity between treatments, whereas heart tissues displayed decreased CS activity. Our understanding of hypoxia's effects on fish metabolism can inform us about how much anaerobic metabolism fish can sustain over long periods of time. It will also provide us with more knowledge on the dangers that climate change and hypoxic environments can have on fish and other animal species around the world.

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Glioma Grading Using Optimized k-Nearest Neighbors as an Alternative to Synthetic Resampling

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Accurate glioma grading is central for determining brain tumor progression and informing clinical treatment strategies. While traditional diagnostic methods rely on standard invasive tissue analysis, machine learning offers a non-invasive alternative through the classification of molecular biomarkers and clinical factors. A recent data-centric study utilizing The Cancer Genome Atlas (TCGA) concluded that high-complexity ensemble models and resampling techniques, such as oversampling (SMOTE) and random under-sampling (RUS), are required to achieve peak diagnostic accuracy in glioma grading. However, the extent to which a more interpretable, highly optimized k-Nearest Neighbors (k-NN) model can match these benchmarks through comprehensive hyperparameter tuning remains under-explored. This study aims to benchmark a multi-parameter k-NN model against the results of various top-performing models reported by Sánchez-Marqués et al. (2024) using a curated dataset of 839 patients. Our methodology involves optimizing neighbor counts, weight functions, and distance powers across original, oversampled, and under-sampled data to determine model stability. Performance metrics, including classification accuracy, are compared to the reported ensemble and Support Vector Machine (SVM) peaks. The optimized k-NN achieved an accuracy of 88.6% on the original dataset, surpassing the baseline k-NN (85.2%) and matching the highest benchmarks set by ensemble and SVM models (88.2%) even after synthetic data augmentation. Performance further improved under synthetic resampling conditions, demonstrating stability across all data environments. These results would support the development of a more transparent pipeline for the evaluation and treatment of gliomas by reducing dependency on non-interpretable models and synthetic data manipulation.

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Using Non-Negative Matrix Factorisation to Identify a Novel B-Cell-Derived Subtype of Pancreatic Ductal Adenocarcinoma

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Pancreatic ductal adenocarcinoma (PDAC) patients show highly heterogeneous molecular profiles that limit immunotherapy efficacy and prognosis, mainly attributed to the complex immunosuppressive tumor microenvironment (TME). Lymphocyte-based subtyping of PDAC can provide insight into TME mechanisms with tumor-associated biomarkers, with T cells and macrophages extensively studied to inform immunotherapies such as CAR-T cell therapies and CD40 stimulation, though with limited success. While B-cell-informed immunotherapies have gained recent attention, the paradoxical roles of B cells, acting both pro-tumorigenic and anti-tumorigenic, in the PDAC TME remain unclear. We hypothesize that novel B-cell-derived subtypes of PDAC will deepen our understanding of the immunosuppressive TME. A total of 1,691 B-cells were extracted from single-cell RNA sequencing (scRNA-seq) profiles across 20 samples (n = 17 PDAC; n = 3 healthy control). An unsupervised machine learning algorithm, non-negative matrix factorisation (NMF), was then used to decompose these B-cell expression profiles into four distinct latent factors. Three factors showed distinct immunoglobulin gene signatures indicative of tertiary lymphoid structure (TLS) formation, while the fourth factor showed a high weighting of IGLL5, a gene characteristic of early B cell differentiation, which plays paradoxical roles in patient survival in different cancer types. To validate these findings, bulk RNA sequencing analysis will compare expression patterns between PDAC patients and healthy controls to determine the impact of these B-cell programs on patient survival. This research identifies IGLL5 as a potential biomarker and provides a framework for resolving the paradoxical role of B cells in the PDAC TME.

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Effects of Organic Acids on the Water Resistance of Sawdust-Magnesium Oxychloride Cement Composites

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Magnesium oxychloride (MOC) cement composites reinforced with plant-based fibers have gained attention as low-carbon alternatives to traditional cement-based materials. Extensive global use of Portland cement and its contribution to CO_2 emissions has motivated the development of sustainable alternatives such as MOC cement. However, MOC cement is inherently water soluble, limiting its durability in moisture-exposed applications. Previous studies have shown that certain organic acids can improve the water resistance of MOC; however, their effectiveness in plant fiber-based composites remains unclear. We hypothesize that sawdust may reduce acid-induced water resistance, as plant fibers can degrade in acidic conditions. This study investigates the effects of organic acid type and concentration on the physical and mechanical properties of sawdust-magnesium oxychloride cement composites (SMOCC). Softwood-derived sawdust is used as the plant-based reinforcement due to its availability and frequent use in wood-cement composite systems. SMOCC mixtures incorporating citric acid and tartaric acid at varying concentrations and sawdust contents are prepared using standardized mixing and curing procedures to ensure repeatability. Material performance will be evaluated through physical characterization and mechanical testing to assess compressive strength, water resistance, and density. We expect that specific acid-sawdust ratios will improve material performance, while others will lead to diminished water resistance due to fiber degradation. The presence of sawdust is anticipated to reduce the effectiveness of acid-induced water resistance. This work aims to clarify the interaction between organic acids and fiber-reinforced MOC systems and support the development of durable cement composites to contribute to the advancement of environmentally resilient construction materials.

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Enhancing Pedagogical Practice: The Impact of Integrated Activity Lunch and Learns on the Incorporation of Evidence-based Pedagogical Strategies into the Entry-to-Pharmacy Program at UBC

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Education-based journal clubs are beneficial for both students and educators by providing a space for professional development and continuous learning. The Entry-To-Practice Doctor of Pharmacy (E2P) Program at the University of British Columbia (UBC) has organized education- based virtual journal clubs known as Lunch-and-Learns (LnLs) to educate on evidence-based teaching strategies. Our aim was to determine if these virtual sessions in the E2P Program at UBC encouraged faculty and staff to implement evidence-based pedagogical strategies, and the effect these changes in personal perception, behaviour, and knowledge have on teaching and learning in the E2P Program. A literature search was conducted, where 10 out of 740 studies were included. To our knowledge, there is a gap in the literature regarding the effectiveness of journal clubs in pharmacy programs and whether they encourage the implementation of evidence-based teaching strategies. To further explore this gap, a research protocol for a mixed-methods design was developed with the hypothesis that participation in LnLs improves faculty and staff knowledge of evidence-based pedagogical strategies, fosters positive changes in perception and teaching behaviour, and reduces barriers to implementing these strategies. The foundation of the study was drafted, including a research protocol, an ethics application, and survey and interview questions. The next steps will be submitting the ethics application and employing the surveys to collect more objective outcome measures to provide robust evidence of the effectiveness of LnLs on incorporating evidence-based teaching within the program.

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Effect of Water Temperature on Mammalian Diving Reflex

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The mammalian diving reflex (MDR) is a physiological response activated by facial submersion in water, inducing bradycardia and peripheral vasoconstriction to conserve oxygen and optimize survival. Although this reflex is well-documented, the influence of water temperature on MDR magnitude remains controversial. This study examined how varying water temperatures (0 °C to 30 °C) affect physiological markers of MDR, including heart rate and peripheral oxygen saturation (SpO_2). A within-subject repeated-measures design was employed with undergraduate participants (age 20, n = 9) undergoing breath-holding and face submersion in water at five different temperatures (0 °C, 5 °C, 10 °C, 20 °C, 30 °C) and a control trial without submersion. Heart rate was measured using a pulse-transducer with ADInstruments LabChart, and SpO_2 was measured using a finger-tip pulse oximeter. Statistical analyses included one-way ANOVA, Tukey-Kramer tests, and linear regression. Cold water trials (0 °C & 5 °C) produced significantly greater percent decreases in heart rate compared with warm water (20 °C & 30 °C) and control trials, with the largest decrease observed at 0 °C and progressively smaller reductions as temperature increased. In contrast, the maximal percentage decrease in SpO_2, voluntary apnea duration, and the latency to maximal drop in heart rate showed no significant differences across different temperature groups. Colder water temperatures elicited a more pronounced MDR, as evidenced by greater heart rate reductions. These findings suggest potential clinical relevance for temperature-induced vagal activation as a noninvasive alternative in managing supraventricular tachycardia. However, further studies with larger sample sizes and more physiological parameters are needed to refine activation protocols and confirm temperature dependence of MDR.

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The First Interaction Matters: Improving Intake Assessments in a Community Exercise Program for Adults With Spinal Cord Injury, Multiple Sclerosis, and Post-Polio Syndrome

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This project identified evidence-informed intake assessment tools that are feasible for use at the Yuel Family Physical Activity Research Centre (PARC), a fitness facility for people with spinal cord injury (SCI), multiple sclerosis (MS), and post-polio syndrome. There is considerable evidence that physical activity (PA) is an effective way to improve cardiovascular health, muscular strength, and functional capacity. Yet, many individuals with SCI, MS and post-Polio face barriers to exercise and/or are not sufficiently active to experience the benefits. Intake assessments are often the first structured interaction individuals have with an exercise facility, and research suggests they can strongly influence ongoing participation in exercise programs. We used an environmental scan to map current practices and gaps in intake assessments across (1) peer-reviewed literature, (2) existing PARC intake assessment, policies and training materials, (3) Intake protocols from two comparable exercise programs. The environmental scan identified sitting balance, upper-limb strength, and cardiorespiratory fitness as key domains for assessment. We then conducted two focus groups, one with PARC members and one with employees, to assess the feasibility and implementation of the environmental scan. PARC members agreed with the environmental scan results, but also wanted to emphasize community building as part of an intake protocol. Thus, the findings indicated that the environmental scan results are meaningful and should be implemented. Still, the exercise assessment should be an optional part of an intake assessment, with community building and overall comfort in the facility being the most important outcomes of an intake assessment at PARC.

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Scheduling Effect on Efficacy of Combinatorial Drug Treatment Utilizing Olaparib PARP Inhibitor against BRCA-deficient cancer cells

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Triple Negative Breast Cancer (TNBC) poses major treatment challenges due to limited targeted therapies. Recent advances suggest that drug combinations consisting of platinum-based agents and PARP inhibitors exhibit synergistic effects in BRCA-deficient TNBC tumor cells. The PARTNER clinical trial, including recent randomized Phase II and III studies, demonstrated significant improvements in overall survival (OS) among BRCA-deficient cohorts using a combination of Carboplatin-Paclitaxel with Olaparib administered under a unique Gap-Holiday treatment schedule, achieving a 100% OS rate (n = 39). In contrast, the BrighTNess trial, which lacked scheduled treatment gaps and used Velaparib, showed no survival benefit, underscoring the critical importance of both drug selection and treatment timing. This study investigates whether scheduled gaps and holiday periods in treatment scheduling with the two-drug regimen of Cisplatin and Olaparib influence drug potency against HCT116 and RPE-1 wild-type and BRCA-knockout tumor cell lines. The inclusion of a 48h gap period in the drug regimen shows comparable cell killing effect to Cisplatin-Olaparib concurrent regimen with longer gap periods resulting in reduced cell death. The PARTNER trial bone marrow cell culture results show a similar gap effect. Treatment holiday conditions enhance drug potency against BRCA-deficient cells within a defined temporal window, promoting cell death and growth arrest with increasing holiday duration and reduced drug exposure, comparable to continuous treatment. These findings may guide the optimization of treatment schedules to improve PARP inhibitor combination therapy outcomes and support the use of these in vitro cell models to study combinatorial treatment scheduling.

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GIS-Based Multi-Criteria Site Selection for Tiny Home Parklets in Oakland, California

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Housing affordability is a crisis faced worldwide; it is prominent across various North American cities, from Vancouver, Canada, to Oakland, USA. Tiny Home Parklets are a potential innovative solution for this crisis. They are compact residential units that could be placed on government-owned, underutilized urban land. Neighborship, a non-profit organization in Oakland, approached the UBC Kalyan Lab with the goal of identifying optimal locations for tiny home placement using a data-driven site selection framework. Early on, a key challenge we identified was the significant lack of available municipal data, since most governments do not systematically and continuously collect parking and localized infrastructure data. To address this, we developed unique solutions, such as webscraping and parsing OpenStreetMap (OSM) and SpotAngels, yielding 5,142 candidate parking sites across Oakland. Following literature reviews of established site selection methodologies, we concluded upon two multi-criteria decision-making (MCDM) approaches: Analytical Hierarchy Process (AHP) and linear weighting across eleven criteria: transit proximity, affordable housing adjacency, water infrastructure, urban planning priority designation, homeless services access, wildfire risk, and sewer infrastructure. A central goal of this project is to gather and incorporate community perspectives. Thus, we created a web platform developed with Flask and React, enabling Oakland residents to weigh and prioritize suitability criteria interactively. We are currently in the process of actively collecting user data. We anticipate that this research will result in producing a policy report to help inform the Oakland municipal government of actionable items to support those facing housing affordability challenges.

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Light Work: Heptazines Turning Sunshine Into Reaction Power

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In 2023, 82% of global energy sources depended on non-renewable forms of energy that contribute to anthropogenic climate change. Through the development of renewable energy sources, such as those based on solar energy, we can achieve a path to sustainability and the mitigation of climate change. Carbon nitride is a photocatalytic material that utilizes light energy to break and form chemical bonds. However, it is a heterogeneous material and difficult to study and modify in predictable ways. To solve this problem we made small soluble heptazine derivatives, derived from trichloroheptazine, to study how a material's structure and optical properties are related. Over this 16-week internship, several new heptazine (C_6H_7 ring system) derivatives were successfully synthesized, and characterized by ^{1}H NMR and X-ray crystallography. The syntheses involved are long and purifications challenging. Samples are currently being prepared for time-dependent spectroscopy, and will be evaluated in photocatalytic reactions in the near future.

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Sociodemographic Influences on Program Adherence in Young Adults Following Traumatic Knee Injury: Secondary Analysis from the Stop OsteoARthritis (SOAR) Randomized Delayed-Controlled Trial

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Adherence to exercise therapy and physical activity is essential for restoring joint function and reducing long-term osteoarthritis risk after a traumatic knee injury. How adherence varies across sociodemographic characteristics after knee injury is unknown. The study describes exercise and physical activity goal adherence in young adults 9-36 months post-knee injury considering gender, ethnicity, education, household income, employment status, and pre-injury activity level. This secondary analysis used data from the Stop OsteoARthritis (SOAR) randomized delayed-controlled trial, which assessed a multi-component virtual program including education, behaviour change strategies, tailored exercise, self-monitoring, and physiotherapist support. Sociodemographic variables were self-reported at baseline. Adherence was described as the percentage (mean proportion, 95%CI) of weekly exercise and physical activity goals fully completed over an 8-week intervention. Forty-eight participants (median (range) age; 27 years (22–36) with similar gender (60% women, 37% men, 6% gender diverse) and ethnicity (2% Black, 49% Chinese, 6% Latin American, 4% South Asian, 11% West Asian, 43% White), but higher education and income to the Canadian population (2021 Census) were included. Mean fully completed exercise and physical activity goal adherence was 60% (95% CI 54–66), and was similar regardless of gender, ethnicity, education, household income, employment status and pre-injury activity levels. Findings suggest that the SOAR program is generally associated with high adherence levels compared to other musculoskeletal exercise interventions across sociodemographic groups, and the importance of inclusive recruitment and accessible intervention designs to support equity in musculoskeletal rehabilitation research. These findings support designing rehabilitation programs that promote equitable engagement across diverse populations.

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An iPSC-based 3D model of synaptic pruning by microglia with GRN haploinsufficiency

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Heterozygous loss-of-function mutations in progranulin (GRN) cause frontotemporal dementia (FTD-GRN) via haploinsufficiency. Converging experimental and clinical evidence implicates microglial dysfunction and complement signaling in early synaptic pathology; however, whether GRN haploinsufficiency in human microglia is sufficient to drive complement-dependent synaptic elimination within a human 3D neural environment remains unresolved. To address this, we establish an isogenic human induced pluripotent stem cell (iPSC)-based model combining 3D neurospheres with microglia carrying GRN haploinsufficiency. Following microglial integration, we characterize microglial state and function across genotypes and assess their impact on synaptic integrity. We test the hypothesis that GRN haploinsufficiency biases microglia toward excessive complement-mediated synaptic pruning. Specifically, we examine whether C1q-initiated C3 deposition on synapses promotes Complement Receptor 3 (CR3)-dependent microglial engulfment, resulting in reduced synapse density. Synaptic changes are quantified using immunofluorescence-based measurements of excitatory and inhibitory synaptic puncta (e.g., VGLUT1/PSD-95 and VGAT/GPHN) and complement localization, alongside multielectrode array recordings of neuronal network activity. To establish causality, complement signaling is perturbed at distinct pathway levels through targeted blockade of C1q, C3, or CR3, and the resulting effects on synaptic density, complement deposition, and microglial engulfment are evaluated. Together, this system defines a human, cell-type-resolved approach to interrogate microglia–synapse interactions in FTD-GRN and to test whether complement-dependent pruning contributes to early synaptic dysfunction.

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Prophylactic Salbutamol Use for Pediatric Exercise-Induced Bronchoconstriction

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Exercise-induced bronchoconstriction (EIB) is a transient narrowing of the lower airways during or after physical activity that limits pulmonary airflow. Diagnosis is typically made using an exercise challenge test, with a post-exercise fall in forced expiratory volume in one second (FEV_1) of 10–15%. EIB affects approximately 9% of youth and up to 46% of children with asthma. If untreated, EIB can reduce participation in physical activity and negatively impact physical and mental health. Salbutamol, a short-acting β_2-agonist, induces bronchodilation via β_2-adrenoceptor stimulation and is commonly used for EIB prevention. The aim of this study is to evaluate existing evidence for efficacy and safety of salbutamol in children, to inform an evidence-based recommendation for use in prevention of pediatric exercise-induced bronchoconstriction. Literature searches were conducted using PubMed and Google Scholar, with keywords such as "salbutamol," "exercise-induced bronchoconstriction," and "pediatric." Relevant studies were identified through screening of titles, abstracts, and reference lists. We extracted information on study methodology, participants' age, time of drug administration before exercise, and post-exercise change in FEV_1. Eleven randomized controlled trials were included, with salbutamol administered 15–30 minutes prior to exercise. In seven pediatric trials, mean post-exercise FEV_1 changes ranged from +1.9% to −18%. Four adult trials reported changes from −4% to −15.4%. Overall, evidence supports the short-term efficacy of salbutamol for EIB prevention in children and adolescents. Treatment was generally well tolerated, with a favorable safety profile when used less than once daily on average.

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A Vector-Based Approach to Surveillance of Antimalarial Drug Resistance

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Malaria, a disease caused by mosquito borne parasites in the *Plasmodium* genus, is the leading cause of death in many developing countries, with an estimated 263 million cases worldwide in 2023. A growing obstacle to malaria eradication is antimalarial resistance, the phenomenon of the parasites evolving the ability to survive drug treatment through DNA mutations. While current methods for monitoring this exist, such as Therapeutic Efficacy Studies, these techniques are far from perfect; they are expensive, limited to specific sentinel sites, and subject to clinical immunity biases. A promising alternative surveillance method is to directly examine the mutations conferring resistance in the parasites instead of in patients. We hypothesize that detecting these resistance mutations directly in vector mosquitoes carrying malaria, rather than through clinical testing, could allow for less biased and more cost effective antimalarial resistance surveillance than the current standard. We propose a study utilizing human-baited double net traps at sentinel sites to capture local mosquitos. DNA will be extracted from the mosquitos and screened for *P. falciparum* positivity via qPCR. Positive samples will have common *P. falciparum* resistance mutations enriched through amplicon sequencing using the MAD4HatTeR enrichment panel which will then be DNA sequenced on an Illumina system. Bioinformatic analyses will be performed to quantify prevalence of different mutations which may predict local antimalarial resistance patterns to inform clinical treatment.

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Persistent Postconcussive Syndrome: Identifying Clinical and Sociodemographic Drivers in the *All of Us* Research Program

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Traumatic brain injuries (TBI) impact around 70 million individuals worldwide every year, yet the trajectory of TBI recovery is extremely variable among cases. TBI symptoms typically last 1 to 3 weeks, however if they continue past this time point the individual is thought to have persistent postconcussion syndrome (PPCS). PPCS is a relatively new condition and is poorly understood, with no universal clinical definition or treatment. We conducted a multivariable logistic regression analysis using data from the NIH All of Us Research Program to identify potential clinical and sociodemographic predictors of PPCS among individuals with documented TBIs. Among 3,466 participants with at least 1 documented TBI, the prevalence of PPCS was 20.2%. The number of TBIs emerged as the strongest predictor based on this cohort, with each additional TBI being associated with a 2.21-fold increase in the odds of developing PPCS. In contrast, most socioeconomic variables were found to not be independently associated with PPCS. Overall, clinical and sociodemographic factors demonstrated limited predictive performance for prolonged TBI recovery, underscoring the need to integrate biological and genetic risk factors into future risk stratification models.

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Utilization of VISTA Associated Chimeric Switch Receptors to Combat the Effects of the Acidic Tumour Environment in CAR T-Cell Therapy

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V-domain Immunoglobulin suppressor of T-cell activation, also known as VISTA, is an inhibitory immune checkpoint molecule that plays a vital role in regulating T-cell responses within the tumour microenvironment. Unlike more widely targeted checkpoints, such as PD-1, VISTA is often highly expressed on myeloid cells and, in some tumours, on cancer cells themselves, where it contributes to T-cell dysfunction and immune evasion. Furthermore, increased VISTA expression has been observed in patients who fail to respond to existing checkpoint blockade therapies, suggesting that it may act as an alternative or compensatory resistance mechanism. VISTA activity has been observed to increase under acidic conditions in tumour microenvironments, indicating that this pH-dependent activity brings potential to utilize VISTA regulation to target tumours that are non-responsive to other immune checkpoint therapies, as well as in patients who initially respond but later relapse with increased VISTA expression. This is also true for tumours lacking other checkpoint ligands while remaining VISTA-positive. Together, these findings indicate that VISTA-mediated suppression in acidic tumour microenvironment limits the effectiveness of current CAR T-cell-based immunotherapies. Based on this rationale, we hypothesize that engineering a chimeric switch receptor that converts VISTA-mediated inhibitory signals into activating signals within CAR T-cells, specifically under the acidic conditions of the tumour microenvironment, could restore or enhance anti-tumour immunity. The reprogramming of VISTA-mediated inhibitory signals regarding pH-dependent activation would ultimately enable effective immune responses in patients who are non-responsive or resistant to existing checkpoint inhibitor therapies.

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Exploring IRAK Kinases and BCL-10 as Novel Therapeutic Targets in Diffuse Large B-Cell Lymphoma

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Diffuse large B cell lymphoma (DLBCL) is a cancer of B cells, varying in its biology and clinical outcomes. Recent studies to genetically classify DLBCL identified a subtype characterized by mutations in the MYD88 and CD79B proteins, named “MCD”, which has a lower overall survival rate compared to other subtypes. Therefore, refining treatment options for MCD DLBCL is highly desirable. Mutations found in MYD88 and CD79B allow for constant activation of the toll-like receptor (TLR) and B-cell receptor (BCR) pathways, promoting cell proliferation. IRAK kinases (1 and 4) and BCL-10 are proteins found downstream of MYD88 and CD97B and serve to propagate activation signals in the TLR and BCR pathways. However, the therapeutic potential of targeting both IRAK kinases and BCL-10 in MCD DLBCL is not well explored. We hypothesize that inhibition of IRAK kinases and BCL-10 activity will result in decreased proliferation and viability of MCD DLBCL cell lines. We will knock out IRAK kinases and BCL-10 in MCD cell lines, as well as treat other MCD cell lines with inhibitors of the aforementioned proteins. Proliferative markers (Ki67) will be measured via flow cytometry, and cell viability will be assessed by the MTT assay. These results are expected to identify the IRAK kinases and BCL-10 as novel therapeutic targets for the treatment of MCD DLBCL.

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How can students perform effective literature searches? A study on student learning aids in the era of Generative Artificial Intelligence

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Literature searching plays a fundamental role in research, yet much of the academic curriculum focuses solely on reading journal articles. Skills required to navigate a literature search in its entirety, from searching a database to citing the source, are rarely emphasized. Furthermore, the exponential growth of Generative AI and its use in the classroom puts students' ability to perform independently at risk, especially as guidelines are loosely defined by the institution. This paper investigates the needs of students in performing effective literature studies and how Generative AI plays a role in the process. Upper-year students in the UBC Bachelor of Pharmaceutical Sciences program were surveyed on their experiences and confidence in literature searching and Generative AI use. Students reported moderate to high confidence in performing tasks including generating manual citations and applying search terms and operators. In addition, many respondents reported using Generative AI for literature searching, with a moderate number also reported to cite their use of AI and verify the validity of its outputs. These results indicate that more in-depth course material concerning the many aspects of literature searching should be emphasized in the undergraduate curriculum along with more structured guidelines for Generative AI use in the classroom. Strengthening these skills will help set students in the Pharmaceutical Sciences program up for success in research-based environments where independent literature searching is essential. Expanding this work to other faculties and disciplines could also support broader improvements in how literature searching and Generative AI use are taught in higher education.

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Assessing the Impact of Defect Distribution Index (DDI) on Trikafta Treatment Response in Patients with Cystic Fibrosis

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Hyperpolarized 129Xe MRI (XeMRI) is a novel technique for assessing pulmonary ventilation in respiratory diseases, such as cystic fibrosis (CF). XeMRI outcomes include the ventilation defect percent (VDP), which is the proportion of unventilated lung volume relative to the thoracic cavity, and the defect distribution index (DDI), which characterizes the spatial distribution of ventilation defects. While VDP has received considerable attention, the impact of DDI on treatment response remains unclear. We hypothesize that treatment response in CF is correlated with baseline DDI. To assess this, we examined 38 individuals with CF (11F/27M; median age 19.5 years [Q3–Q1: 40–12]) who underwent XeMRI and pulmonary function testing, including spirometry and multiple breath washout, at baseline and after CFTR modulator treatment (median interval of 37 days). Lung outcomes including changes in VDP, forced expiratory volume in one second (FEV1; a measure of airflow efficiency), and lung clearance index (LCI; a measure of ventilation inhomogeneity) were correlated with baseline DDI using Spearman's rank correlation tests. ΔVDP showed a significant correlation with DDI (p = .0199), whereas ΔLCI approached significance (p = .0502) and ΔFEV1 did not reach significance (p = .0842). These findings contribute to defining the utility of DDI as a spatial imaging biomarker, suggesting that DDI can potentially predict short-term treatment response to CFTR modulators measured by VDP and perhaps LCI, but not so much by FEV1. Future research is needed to explore whether demographic factors contribute to the observed correlations, and whether the relationships persist long-term. Ultimately, DDI may help guide personalized therapeutic approaches in CF.

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From Concept to Cure: Scientific and Ethical Barriers to Clinical Pig-to-Human Liver Xenotransplantation

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Liver xenotransplantation—the transplantation of organs between species—has emerged as a viable option to address the severe shortage of donor livers. The global prevalence of end-stage liver disease is increasing, and the scarcity of appropriate human donor organs leads to significant morbidity and mortality globally. Despite considerable progress in transplant medicine, the scarcity of organs persists as a critical unmet clinical requirement, highlighting the necessity of discovering alternate sources for transplantable livers. Recent advancements, including initial clinical trials of pig-to-human liver xenotransplantation, have shown enhanced graft function and short-term survival, underscoring the translational promise of this approach. Nonetheless, both ethical and biological obstacles persist in constraining its wider clinical implementation. One of the major biological barriers is hematologic incompatibility between species, particularly thrombocytopenia and dysregulation of coagulation pathways. These complications can trigger inflammatory immune responses, enhance macrophage infiltration into the xenograft, and elevate the risk of bleeding, ultimately resulting in graft necrosis and failure. Simultaneously, ethical concerns regarding animal welfare, genetic alteration, and clinical risk persist as vital issues that require meticulous attention. This review investigates the key biological mechanisms that contribute to graft failure in liver xenotransplantation, focusing on immunological-coagulation interactions and innate immune responses. Furthermore, it investigates major ethical issues in this field, such as patient consent, animal welfare, pathogen-free breeding facilities, and broader societal and cultural perspectives that may influence the responsible development and acceptance of xenotransplantation.

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Hormone-Driven Changes in Specific X-Chromosome Inactivation Chromatin Remodelers Contribute to Osteoporosis Risk After Menopause

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Osteoporosis, a systemic skeletal disorder characterized by increased bone fragility and fracture risk, is most commonly diagnosed in the elderly, especially in post menopausal females. Previous research has mainly focused on osteoporosis prevalence associated with aging and hormone level decline, but obvious gaps still remain between post menopausal osteoporosis risk and chromatin remodeler coding genes that escape from X-chromosome inactivation (XCI), the epigenetic silencing of one X chromosome in females. This project employs an interdisciplinary literature synthesis approach to investigate how shifts in chromatin remodeler activity following post menopause hormone decline influence XCI escape, and contribute to the female-biased susceptibility to post menopausal osteoporosis. Peer-reviewed studies across XCI escape, bone metabolism, and hormone regulation are comparatively examined for overlapping epigenetic factors to identify convergent mechanisms, emergent patterns, and conceptual relationships. Chromatin remodeler SWI/SNF subunits, such as BRG1 and BRD9, are implicated in XCI escape, hormone metabolism and skeletal health. Existing literature demonstrates emergent links across these fields, suggesting that hormone dependent chromatin remodeler activity can influence escape status of XCI genes, and increase susceptibility to post menopausal osteoporosis. Overall, this study identifies chromatin remodelers involved in bone metabolism that are likely correlated with hormone changes during menopause, leading to shifts in XCI escape status and increased osteoporosis susceptibility. This interdisciplinary relationship provides a conceptual framework, linking epigenetic regulation, XCI escape, hormone regulation, and bone health. The emerged interactions underscore an underexplored intersection in female skeletal health for future investigations.

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What story do teeth tell? Morphological evidence of temporomandibular joint degeneration and occlusal wear

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The temporomandibular joint (TMJ), consisting of the rounded head of the jaw (condyle) and the socket in the skull where it sits (fossa), is highly vulnerable to cartilage degeneration, or osteoarthritis (OA). Biomechanical research suggests tooth wear may increase joint loading, potentially contributing to OA, yet this relationship has rarely been examined in cadaveric models. To address this, we explored the correlation between TMJ OA severity and molar wear patterns. 42 TMJs from 38 adult cadavers between the ages of 55–105 were dissected. TMJ OA severity of the condyle and fossa was graded using a 5-point scale through image analysis. Molar wear was assessed using a 19-point visual index, as well as tooth height measurements of the molars. We found that almost all TMJs (41/42, 98%) displayed some degree of OA. Molar wear ratings strongly correlated with fossa OA severity (r_S = 0.731, p < .001), and moderately with condyle OA (r_S= 0.567, p < .01). Molar crown height showed a negative correlation with OA severity, although differences between OA grade groups were not significant. In late stages of OA, bony outgrowths known as osteophytes were frequently observed on condylar surfaces. Perforations of the articular disc consistently coincided with the most irregular or protruded regions of the underlying condyle. With the current diagnosis of TMJ OA relying on costly radiographic imaging, the strong association between molar wear and TMJ OA severity highlights the potential for occlusal wear to serve as a non-invasive, cost-effective clinical marker for TMJ OA and degeneration.

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Where am I? The role of motor prediction in hand localization

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During active (self-generated) movements, our sensorimotor system has access to two sources of information: proprioceptive sensory input (the awareness of limb position), and a motor prediction (a state estimate of the body given an intended movement). Prior work suggests that proprioception is more precise following active movements than passive (externally driven) movements. This increased precision is argued to be the result of integrating both proprioceptive sensory information and motor prediction information. However, other studies have found no difference, and a clear computational framework underlying hand localization remains unknown. Here, we aimed to better understand if proprioceptive uncertainty is influenced by motor prediction, and to define the computational framework underlying this behaviour. To this end, participants performed active reaching movements to a target, which generated motor predictions, and experimenter-guided passive movements, which did not. After each reach, participants reported via cursor where they believed their unseen hand was. Contrary to prior findings, we observed no significant difference in proprioceptive uncertainty between active and passive conditions. Instead, participants exhibited a consistent bias towards the target location, suggesting that localization judgements were not based on proprioception as the only sensory input. This target-related bias may partially explain the absence of differences between conditions. Modelling showed that participants integrate proprioceptive signals with prior expectations of motor output, biasing localization towards the target. Ultimately, these preliminary findings will inform our lab's work by clarifying the task-dependent nature of sensory uncertainty.

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Does Ageing Alter the Knee Extensor Occlusion Threshold During Dynamic Resistance Exercise?

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During resistance exercise, the number of repetitions that can be completed is determined by the load lifted. At light loads, blood flows freely to working muscle, allowing for continued delivery of oxygen to help sustain muscle contractions. As the load becomes heavier, muscles produce more force which increases intramuscular pressure. This causes compression of surrounding blood vessels, thereby restricting oxygen delivery. The lightest load that constricts muscle vasculature to the point of blockage is deemed the critical occluding tension (COT). While the COT has been identified in younger adults, it is unknown whether degenerative changes in muscle associated with ageing—such as reduced strength, size, and ability to utilize oxygen—alter this threshold. The present study aims to identify the COT and characterize the determinants of muscle endurance above and below the COT amongst older and younger individuals. Healthy older and younger adults will perform knee extensions to fatigue over a range of loads with and without external blood flow occlusion. Muscle oxygen saturation will be continuously monitored using near-infrared spectroscopy (NIRS) during exercise. Muscle size, aerobic fitness, leg strength, and muscle oxidative capacity using NIRS will be assessed for relationships with performance at each exercise condition. It is expected that the COT will occur at a lighter relative load in older adults due to lower muscle force production and thus compression of muscle vasculature. These findings will provide insight into age-related differences in muscle endurance and inform exercise prescription strategies aimed at optimizing physical function in older adults.

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Drivers of Orca Population Dynamics in the Salish Sea: A Multi-Factor Systems Model

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The Southern Resident Killer Whale (SRKW) population is a critical indicator of ocean health and a cultural cornerstone for many Indigenous communities in British Columbia. It now faces a severe extinction risk, with only 73 individuals remaining. This study investigates how interacting biological, ecological, and human-driven pressures influence the resilience and sustainability of SRKWs. We used a systems-thinking framework - an approach that examines how different factors connect and influence each other - to map how toxicant accumulation, underwater vessel noise, and declining Chinook salmon availability jointly contribute to population decline. Using this map, we identified high-impact intervention points and assessed the effectiveness of current protection initiatives. In particular, we examined implementation gaps in existing measures, including the reliance on voluntary compliance in vessel noise reduction programs, such as ECHO. Our findings suggest that reducing vessel noise is currently the most feasible near-term lever for improving foraging success, but progress is constrained by weak governance and limited mandatory enforcement. Furthermore, we identified an amplifying feedback loop in which salmon depletion exacerbates nutritional stress, leading to failed whale pregnancies and further population decline. This research reveals that the survival of the SRKW depends on transitioning from isolated, voluntary initiatives that address one extinction pressure to coordinated, cross-jurisdictional strategies that address the problem as a whole. By identifying specific intervention points and their trade-offs, this study provides a roadmap for policy-makers to ensure the long-term viability of these keystone predators and the marine ecosystems they support.

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Affordable Calibration of Robot Simulations With Open Source Video-Based System Identification

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Core to any robotic system is its controller, which determines the robot's "actions" - how motors move in response to commands. Think of the system converting joystick input to movement in remote control cars. Machine learning (ML) methods leverage computer simulations, "digital copies" of the robot, to build flexible controllers. The quality of produced controllers hinges on the simulations' fidelity - how accurately it reflects the real world. System Identification (SI) is a crucial process to raising this fidelity. SI proceeds by collecting data on the physical robot's "actions" in response to specific commands. This data is used to tune the simulation, so that it behaves like the real system. Customarily, "action" data is collected from the physical robot using expensive sensor components. In this project, we instead propose a low-cost SI pipeline, where free computer vision software (OpenCV) extracts such data from videos of the robot in motion. Our pipeline will (1) collect motion data using visual markers (AprilTags) and OpenCV, (2) reduce noise through Kalman filtering, and (3) tune the simulation by minimizing the Root Mean Squared Error (RMSE) between simulated and physical robot "action" under identical commands. We apply the pipeline to a 3D custom-printed bipedal robot. Success is evaluated by comparing performance of ML controllers produced using simulations tuned with/without SI. We hypothesize this SI pipeline tunes the simulation sufficiently accurately, enabling the production of successful ML controllers. This work supports resource-constrained teams combining AI and robotics by reducing the cost of the critical SI step.

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Beyond the Individual Self: Immigrant Meaning-Making and the Limits of Western Psychotherapy

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Many immigrants come from cultures that emphasize family, community, and spirituality in responding to major life stressors. In contrast, many dominant psychotherapy models were developed in Western contexts that prioritize independence, personal choice, and individual psychological change. This study examines how immigrants from collectivistic cultures living in Western societies make meaning of stress, loss, and transition, and what these patterns reveal about the cultural limits of Western psychotherapy. Meaning making refers to how individuals interpret difficult experiences and integrate them into their broader understanding of life, relationships, and beliefs. Using a literature-based qualitative approach, this project conducted a focused narrative review of peer-reviewed research on meaning in life, acculturative stress, migrant coping in Western societies, and cultural clinical psychology. The selected studies were analyzed conceptually to compare immigrants' meaning-making processes with core assumptions embedded in Western psychotherapy. Across the literature, immigrants from collectivistic backgrounds often understood distress and coping in relational and spiritual terms, drawing on family obligation, community connection, and faith-based frameworks. By contrast, many psychotherapy models positioned culture and spirituality as secondary rather than central to psychological life. This mismatch suggests that dominant Western psychotherapies may not fully reflect immigrants' lived experiences or culturally grounded ways of coping. The findings point to the need for psychotherapeutic approaches that begin from immigrants' own systems of meaning so that mental health care can become more culturally responsive and clinically relevant.

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Multi-Stage Screening of Instrumented Mouthguard Data in University Rugby

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Concussions are a major concern in contact sports like rugby, yet accurately measuring on-field head impacts remains challenging. Instrumented mouthguards (iMGs) can record head kinematics, however raw iMG data are heavily contaminated by spurious recordings that do not reflect true head acceleration events (HAEs). While a multi-stage screening process has been shown to improve iMG data quality in varsity ice hockey, its application to other high-contact field sports such as rugby remains understudied. This study investigates whether a 4-stage screening pipeline can reliably identify true HAEs while filtering spurious non-impact events in university women's rugby players. 22 players were equipped with custom-fitted iMGs containing accelerometers, gyroscopes, and proximity sensors during competitive games. iMG recordings were time-synchronized with video footage and processed through a pipeline consisting of: (1) independent collection of iMG and video recordings, (2) general screening to remove rapid-sequence triggers and events without video coverage, (3) time-matched cross-verification of video and iMG events, and (4) coupling verification using infrared proximity sensors to confirm mouthguard-teeth contact during impact. This pipeline successfully filtered 97.7% of raw recordings as spurious or poorly coupled, reducing 57,190 raw acceleration events to 1,288 well-coupled, verified HAEs. Verified impacts exhibited significantly lower Peak Linear Acceleration, Peak Angular Acceleration, and Peak Angular Velocity compared to unverified raw data. These findings demonstrate that unscreened iMG data substantially overestimate HAE magnitudes, and that this validated multi-stage framework can be adapted across high-contact field sports to generate high-quality head impact data and inform evidence-based safety protocols.

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Exploring Crosslinking Strategies for Alginate Membranes in Aqueous Redox Flow Batteries

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Renewable energy sources such as solar and wind have become cheaper, but their reliability remains dependent on weather conditions. To address this challenge, there is intensified interest in large-scale energy storage. Aqueous redox flow batteries (ARFBs) are well-suited for such applications as they decouple their energy and power capacities, making long-duration energy storage more cost-effective. Although membranes make up the majority of ARFB costs, they are essential for keeping electrolytes separated while allowing charge-balancing ions to pass through. The industry-standard, Nafion membranes, provide excellent chemical stability and ion conductivity, but their fluorinated nature is costly and raises sustainability concerns. Promising alternatives are found in biomaterial-based membranes such as alginates, sourced from brown seaweed, due to their abundance and chemical flexibility. Research of alginate applications to RFB membranes is limited to one study that identifies mechanical stability as a limitation. Therefore, this work proposes using established chemical crosslinking methods, which strengthen membranes through bonds between polymer chains, on alginates in ARFBs. Alginate films crosslinked with salts like BaCl2 will be evaluated for mechanical strength, chemical stability, swelling, ion conductivity, and ion selectivity. All compositions will be tested against Nafion ex-situ, and the best-performing membranes will undergo cell-cycling to assess efficiency and durability. We expect larger ions used in crosslinking to increase selectivity, mechanical strength, and chemical stability, while decreasing swelling and conductivity. Choice of crosslinking cation may impact long-term stability and side reactions. This research aims to advance the development of low-cost, eco-friendly ARFB membranes, offering sustainable alternatives to industry standards.

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Risk Factors for Vascular Injury during Anterior Lumbar Spinal Exposure: A Retrospective Cohort Study

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Anterior lumbar interbody fusion (ALIF) is a surgical technique that is commonly used in spine revision procedures, allowing for improved lordosis and disc height restoration. While this approach preserves the posterior musculature, safe access to the disc space requires mobilization of the common iliac arteries and veins. This retrospective study identifies the risk factors associated with vascular injury and postoperative complications in patients undergoing anterior lumbar spinal exposure. We hypothesize that patients with more comorbidities and those undergoing multilevel exposure will have an increased risk of vascular complications. Demographic, spine- and vascular-specific variables were collected, and statistical analyses were performed. Among 233 adult patients who underwent anterior lumbar spinal surgery at Vancouver General Hospital (VGH) between 2009 and 2024, vascular injury occurred in 20 (8.6%). Charlson Comorbidity Index (CCI, OR: 1.31, [1.01-1.70], p = .039) and smoking (OR: 3.11, [1.12–8.59], p = .029) were identified as independent predictors of vascular injury. Postoperative complications were more common in cases with multilevel exposure (OR: 2.67, [1.85–3.86], p < .001) and previous bone morphogenetic protein (BMP) application (OR: 4.29, [1.55–11.88], p = .005). Higher CCI (OR: 1.28, [1.01–1.63], p = .043) and multilevel exposure (OR: 1.97, [1.32–2.96], p = .001) were associated with increased transfusion requirements. These results highlight the importance of analyzing predictors for preoperative risk stratification that considers CCI, smoking, and previous BMP application to guide surgical planning and improve patient outcomes.

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Older Canadian Women's Experiences of Playing Recreational Ice Hockey

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Sport participation provides social and physical benefits for older adults, yet previous sociocultural team sport research has primarily focused on men and younger athletes. Considering the aging population and growing popularity of women's hockey in Canada, this study examines how the intersections of age and gender impact the experiences of older women hockey players. The research question is: What meanings do older women ascribe to their experiences of playing recreational ice hockey? In-depth, semi-structured interviews were conducted with seven women hockey players aged 55–74. Data were analyzed thematically, resulting in the identification of three overarching themes. Theme 1: "It's a total escape", hockey as a source of freedom, reflects participants' perception of hockey as an escape from everyday life. Theme 2: "We're going to grow old disgracefully because we are not going quietly", hockey as resistance to societal norms, refers to participants' view that by competing in a sport traditionally associated with men and younger athletes, they challenge assumptions about who a hockey player is. Theme 3: "We are paving the way", older women as pioneers in hockey, encompasses participants' successful self-advocacy for age-specific women's recreational hockey leagues. This study contributes insight about older women's experiences in male-dominated team sport and reveals how they have self-organized to create hockey spaces not only for themselves, but for future generations of women hockey players. Findings can help recreation organizations implement age and gender inclusive programming to support lifelong sport participation amongst older women, particularly in ice hockey.

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Exam Accommodations and English as a Second Language (ESL) Students

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In Canada, English as a Second Language (ESL) students in the education system continue to increase. However, this group faces disproportionate linguistic complexity that functions as a barrier on exams, where limited proficiency lowers scores even when content understanding is stronger than results suggest. Although previous studies have explored accommodations, there remains limited knowledge on which test modifications educational institutions can implement to support ESL students while maintaining valid score interpretations. For this reason, this systematic review synthesises evidence on three commonly proposed exam changes: linguistic modification, extended time, and bilingual dictionaries, and their effects on the test performance of ESL students without compromising the validity of outcomes. From my findings, the most consistent evidence of accommodation benefit for ESL learners appeared under language modifications. In particular, elaboration, adding clarifying information while keeping the underlying content demand the same, supported better processing and comprehension. Thus, without this accommodation, construct language barriers continue to mask content knowledge, limiting ESL students' ability to demonstrate their learning in an examination. However, considerations must be made as modifications improved both ESL and non-ESL students' test scores. That suggests the change may be reducing language-related barriers more broadly, rather than providing a benefit unique to ESL students. Future research should test validity more directly by examining score comparability and fairness, including whether accommodations benefit ESL students specifically or improve access for all test-takers.

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Methylotrophic Methanogenesis in the Rumen: Understanding Pectin Metabolism in Response to 3-Nitrooxypropanol Supplementation in Cattle

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Methane produced by methanogens in the rumen is a major contributor to greenhouse gas emissions. Most mitigation strategies, including the feed additive 3-nitrooxypropanol (3-NOP), focus on inhibiting hydrogen-dependent methanogenesis. However, some methylotrophic methanogens use alternative pathways that rely on methanol and methylamines derived from dietary components such as pectin, choline, and betaine. Recent studies show that this pathway contributes more to methane emissions than previously thought, but how these pathways respond to 3-NOP supplementation remains poorly understood. This study examined the effect of 3-NOP on methylotrophic methanogenesis and pectin-derived methanol availability in dairy cattle fed a high-grain diet (control, n = 6; 3-NOP, n = 6). Metagenomic analyses were used to identify and quantify microbial genes involved in pectin degradation and methylotrophic methanogenesis. The abundance of methyl-coenzyme M reductase (MCR) subunits was significantly reduced under 3-NOP supplementation (~57–60% decrease; $p \leq .018$), indicating strong inhibition of methane production pathways. Its associated electron transfer and redox processes were also reduced. In contrast, select pectin degradation genes, including pectinerase and pectate lyase, showed increased abundance (up to 42%; $p \leq .034$), while others were unchanged. These results together suggest that 3-NOP suppresses core methanogenesis while potentially increasing methanol availability from pectin degradation, which may support residual methane production via methylotrophic pathways. By linking methanogenic and pectin-degrading processes, this study provides new insight into alternative methane production routes and highlights potential limitations of current mitigation strategies in ruminant systems.

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When the Air Turns Hostile: Cellular Effects of Pollen and Wildfire Smoke

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Climate-driven shifts are increasing exposure to respiratory allergens through longer, more intense pollen seasons and higher seasonal pollen counts. At the same time, rising temperatures have intensified wildfires, releasing airborne particles that aggravate respiratory disease. Although both allergens and wildfire smoke independently affect the lungs, their combined effects remain poorly understood. To investigate this, primary human lung epithelial cells from five healthy donors were differentiated at an air-liquid interface (ALI) to model the airway surface, confirming ciliary function and mucus production. Submerged cultures were first exposed to four common environmental allergens (*Cladosporium cladosporioides*, Birch Mix, Ragweed Mix, *Aspergillus fumigatus*), and inflammatory responses were measured by quantifying IL-8 and IL-33 expression using qPCR and ELISA. To model climate-relevant co-exposure, differentiated cultures were then treated with aged pine woodsmoke and/or Ragweed Mix. IL-8 secretion was measured 24 hours post-exposure, and transepithelial electrical resistance (TEER) was assessed to evaluate epithelial barrier integrity. Ragweed exposure produced a strong inflammatory response comparable to a positive control. While woodsmoke alone did not significantly increase IL-8 secretion, combined exposure synergistically enhanced IL-8 levels. Woodsmoke exposure also increased TEER, suggesting altered barrier function. By modeling combined climate-related exposures in human airway cells, this work provides new insight into how wildfire smoke and allergens may interact to amplify airway inflammation in the context of climate change.

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The Effects of Syncopation Weights, Duration, and Beats on Perceived Rhythmic Complexity

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Remember that moment in the Chrome dinosaur game when you jump at nothing? That unexpected space is like syncopation in music. Your brain locks onto a regular pulse, predicting the next beat, and syncopation disrupts this by placing events on weaker beats. The Longuet-Higgins and Lee (LHL) model measures syncopation by assigning weights from −4 (weakest) to 0 (strongest) to different beat positions. However, just as cactus size isn't the only factor affecting the game's difficulty, this weighting may oversimplify perception. We investigated overlooked factors: syncopation duration, multiple syncopations in a row, and specific beat locations. We hypothesized that longer syncopations increase complexity, listeners prioritize the strongest syncopation, and LHL weightings wouldn't align with complexity ratings. We generated 259 rhythmic patterns played at six tempos, totaling over 1,500 stimuli. 456 participants rated perceived complexity on a 6-point scale. Using linear mixed-effects models (LMM) and linear discriminant analysis (LDA), we identified the strongest predictors. Both methods indicate that tempo and the interonset interval between syncopated events drive perceived complexity. The LDA reveals ratings vary mainly along one discriminant dimension (90.6%), while the LMM identifies silence on the third beat as significant—a medium-strong position that the LHL model underweights. Syncopation weights are secondary to duration. Our findings reframe rhythmic complexity. It's not hidden in intricate weightings but in time itself: the gap and the silence. This offers musicians a new "knob" for tension and therapeutic tools for movement disorders. Ultimately, it sheds light on how we experience complexity in time.

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Impact of Peer Support Intervention on Return to Work and Productive Activities After Acquired Brain Injury

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Acquired brain injury (ABI) is a leading cause of disability worldwide, associated with persistent barriers to return to work (RTW) and engagement in productive activities such as volunteering and community participation. Fewer than 50% of individuals with moderate to severe ABI successfully return to work within two years post-injury due to cognitive impairment, fatigue, and poor mental health. Participation in paid and unpaid productive activities is critical for psychosocial well-being and quality of life. Although social support is a key facilitator of vocational recovery, most RTW interventions focus on individual rehabilitation strategies, overlooking socially driven approaches and productive engagement beyond paid employment. This study aims to explore the impact of a co-created peer-support intervention on RTW, engagement in productive activities, and mental health following ABI by evaluating the Peers Actively Involved in Rehabilitation (PAIR) program, a 12-week, one-to-one intervention delivered by trained mentors with lived experience of ABI. Eighty adults aged 19–75 years within 12 months of injury will be recruited from brain injury rehabilitation centres and community organizations across British Columbia. Primary outcomes include RTW status and engagement in productive activities, assessed post-intervention and at four-months using a study-specific questionnaire adapted from validated measures in prior ABI vocational research. RTW is defined as resumption of paid employment (full-time or part-time), while engagement in productive activities includes participation in unpaid roles. Secondary predictors include sex, injury characteristics, and mental health status. Findings will inform the development of socially driven rehabilitation strategies to support sustainable vocational and community participation following ABI.

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Beyond the ER: EMC5's Putative Role in Yeast Cell Wall Integrity (CWI)

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Glycosylphosphatidylinositol (GPI) anchored mannoproteins constitute the primary defense of yeast cells against extracellular threats. These bulky, glycosylated - or sugar-bound - proteins prevent the diffusion of harmful compounds such as Reactive Oxygen Species (ROS) like hydrogen peroxide (H_2O_2) which can damage DNA, proteins, and cellular machinery. When over-accumulated, ROS will induce cellular responses like apoptosis. While the biochemical synthesis of GPI is well-characterized, with enzymes like GPI18p - a mannosyltransferase - involved, the mechanisms governing the membrane integration of these enzymes are not elucidated upon in literature. The Endoplasmic Reticulum Membrane Complex (EMC) of *Saccharomyces cerevisiae* inserts transmembrane domains (TMD) of proteins for various pathways; we hypothesized that the EMC is essential for the accurate topogenesis and insertion of GPI18p. Specifically, we tested if the knockout of a subunit gene, EMC5, leads to misoriented GPI18p. Thereby, GPI-anchored mannoprotein synthesis would be perturbed, and ROS defence would diminish. Functional assays revealed that plasma membrane permeability differed between wild type (WT) and mutant (MT) *S. cerevisiae* cells when exposed to H_2O_2. Trypan Blue staining and Hemocytometry quantified a marked increase in cellular lysis, while fluorescence microscopy of Propidium Iodide and Concanavalin A-stained cells corroborated our hypotheses on increased permeability and decreased mannoprotein abundance, respectively. Ultimately, these findings identify EMC5p as a critical mediator of cell wall proteome assembly. By elucidating the EMC's role in the biogenesis of GPI-anchor pathway, this study highlights the importance of co-translational insertion complexes in maintaining cellular homeostasis and defending against environmental oxidative stress.

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Opening Rings, Closing the Loops: A Novel Aluminum Catalyst for the Polymerization of Cyclic Poly(lactide)

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Synthetic polymers are integral parts of our world today. However, their convenience, demand, ubiquity, and majority petrochemical basis have propagated the ongoing plastic problem, and thus environmentally friendlier alternatives are needed. Poly(lactide) (PLA) is a renewable, biocompostable, and biocompatible polymer that has potential to replace many commercial petrochemical polymers. While linear PLA has generally acceptable mechanical qualities, it has poor thermal resistance. The cyclic analogue however, cyclic PLA (c-PLA), provides superior crystallinity, thermal resistance, and mechanical strength. It furthermore combines biodegradability and better material characteristics, presenting a powerful approach to plastic alternatives with enhanced material properties. Thus, understanding c-PLA synthesis and catalysis is crucial, as cyclic polymer synthesis remains challenging. While c-PLA synthesis has been reported using indium catalysts, further understanding of the various factors that impact catalyst performance is needed. Aluminum is an abundant, green metal that is commonly used in catalysis, possessing higher Lewis acidity and a smaller ionic radius than indium. We aim to investigate and understand the effects of a different metal centre, with respect to Lewis acidity and ionic radius, on c-PLA synthesis using aluminum, with the expectation of also producing high molecular weight polymers. We will synthesize a novel aluminum catalyst and measure the initiation efficiency, monomer conversion, and polymer molecular weight. The catalyst will be characterized by nuclear magnetic resonance spectroscopy, X-ray crystallography, and elemental analysis, and the polymers will be analyzed via mass spectrometry and size exclusion chromatography.

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The development of a gnotobiotic animal behaviour facility

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The gut microbiota is increasingly recognized as having a pivotal role in many disorders. Gnotobiotic mice, which have a defined set of microbes and are raised in sterile isolators, provide a powerful model to study microbiota–host interactions. However, commonly used isolators are too small to carry out complex tasks, such as behavioural testing. Thus, our team has established a custom-built gnotobiotic isolator for behavioural testing. Evaluating potential changes in behaviour between mice in this isolator and mice in a conventional open-air facility is important for future experiments aiming to link gut microbiota to behavioural impacts. As such, the objective of this study was to validate the behaviour isolator setup by evaluating differences in sociability and anxiety-like behaviour between the isolator and a conventional testing facility using wild-type (WT) mice. C57BL/6J WT mice underwent the three-chamber test (3CH), elevated plus maze (EPM), and open field test (OFT) in the isolator or a conventional testing facility. Significance was assessed using two-way ANOVA. There were no significant main effects of testing location or sex for the EPM. There was a significant effect of testing location for the OFT, suggesting that the isolator mice displayed more anxiety-like behaviour. In the 3CH, both groups had a similar preference for the stimulus mouse, but isolator mice showed less total exploration. Overall, these findings demonstrate that the three behaviours tested can be conducted in a gnotobiotic isolator and will help establish a foundation for future gut microbiota research.

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Metabolic Effects of Caffeine on *Saccharomyces cerevisiae*: A study of CO_2 Production

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Caffeine is a widely consumed neuro-stimulant that blocks adenosine receptors and is commonly found in coffee, tea, hot chocolate, cola, energy drinks, medications, and supplements. Typically utilized to increase energy, alertness, or physical performance, mammals metabolize caffeine through the liver enzyme cytochrome P-450. Excessive caffeine intake saturates this enzyme, increasing the risk of arrhythmias, hypertension, anxiety, insomnia, and, in severe cases, sudden cardiac arrest. *Saccharomyces cerevisiae*, or baker's yeast, shares fundamental processes with human cells, such as DNA replication, transcription, and cell cycle regulation. This experiment investigates caffeine's effects on *S. cerevisiae*, which lacks a dedicated caffeine detoxification pathway, to better understand how caffeine impacts eukaryotic cells in the absence of metabolic clearance and proper nervous system. The hypothesis predicts that increased caffeine exposure will decrease yeast cellular respiration rates. A U-tube manometer was used to measure carbon dioxide displacement during fermentation when 10.00 ± 0.01 g of *S. cerevisiae* was mixed with different amounts of caffeine. After 98 sub-trials, results demonstrated that increasing caffeine amounts leads to a decline in carbon dioxide production, suggesting inhibitory effects on respiration. Analysis revealed a gradual decrease in carbon dioxide production with no clear threshold dosage. These findings provide insight into the metabolic effect of caffeine and its potential implications for biological research.

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Automatic Identification of On-Street Parking Land

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The growing desire for modern cities to transition into smarter, technology-integrated development, coupled with the problem of increasing population density, necessitates a more efficient system for managing public land, including on-street parking land. Neighborship, a community organization in Oakland, CA, focuses on how Tiny Urban Structures (TUS) can transform urban spaces to provide goods and services to communities, such as micro-housing, libraries, and community centers. On-street parking spots would be ideal locations for TUS, but the lack of tested, scalable methods for cataloging locations of on-street parking land leaves TUS difficult to implement at scale. In partnership with Neighborship, this study seeks to develop a method for automatically cataloguing on-street parking through the automatic segmentation of viable spots from Street View Imagery (SVI). Through deep learning of freely available SVI datasets, this method could be performant, reliable, and scalable enough for city-wide adoption. Specifically, we are optimizing the Meta SAM2 model to identify and label parking space boundaries in Oakland, CA, and transform these boundaries into geographic maps for city management, validated by testing the model for accuracy, then analyzing the overall process for efficiency and scalability. We expect to be able to produce a reliable method for mapping on-street parking in cities with a segmentation model of Oakland. This development will enable deep-learning and data-driven models of on-street parking spaces, advancing the implementation of TUS, the development of parking management systems, and overall, supporting the movement towards smart, efficient cities.

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The mountain heather hybrid *Phyllodoce* × *intermedia* originates from convergent bidirectional hybridization between *P. empetriformis* and *P. glanduliflora* in British Columbia

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Hybridization between plant species is common, yet each case is unique in its influence on evolutionary history and adaptation. Here I examined the origins of *Phyllodoce* × *intermedia*, a species of mountain heather that is thought to be a hybrid between the subalpine heather *P. empetriformis*, and the alpine heather *P. glanduliflora*, both native to British Columbia, Canada. I collected leaf tissue samples from field-collected and herbarium specimens of hybrid individuals and the putative parental species, and extracted their genomic DNAs. I then amplified and sequenced two genetic barcodes that are commonly used to identify plant species: the plastid gene *rbcL*, and the nuclear ribosomal ITS region. I performed maximum likelihood (ML) phylogenetic analysis for both genetic barcodes to determine the evolutionary relationships among the three species. The *rbcL*-based tree inference recovered one discrete clade each for *P. glanduliflora* and *P. empetriformis* samples, with 99% and 100% bootstrap support, respectively. Each clade contained only members of that species but with *P.* × *intermedia* samples interspersed among them. Assuming strict maternal inheritance of chloroplast DNA, these findings are consistent with separate hybrid origins of *P.* × *intermedia* in the two clades. Hybridization has therefore occurred at least twice between *P. empetriformis* and *P. glanduliflora*, with each species acting as the maternal parent at least once. Recurrent hybridization may facilitate introgression between the two parent species, which is relevant for conservation decisions because of anticipated shrinkage of mountain heather habitat in the Pacific Northwest.

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Shifting Values and Trialed Tools: Mapping Student Implementation of GenAI

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Though past studies have explored the impact of Chat-GPT on university students, and have found that undergraduate students generally perceive the technology positively, these studies do not consider the role of other types of AI systems in education (video generation, image generation, sound generation, etc.). Scholarship around what draws students to specific tools is also limited (their functionality, their ethics, their price, etc), leading to a gap in the literature. Our study used naturalistic observation, trialed applications, and survey data to analyze how students in MDIA 470 select and implement Generative AI tools other than ChatGPT across a project life cycle. Students began the course with a neutral perception of AI tools, undermining past studies into perceptions of Generative AI. By continuously interviewing, observing, and surveying students, we discovered that students grew to perceive AI as a way to augment their academic work rather than replace their role in the creative process. Despite ranking ethics as the first priority during tool selection, students often prioritized the efficiency of the tool over the ethics during all stages of a project, causing their actions to conflict with their usage testimonials. This indicates a shifting of values throughout the project lifecycle, as unethical tools were acceptable for brainstorming and ideation, but when creating the final product the ethics were supposedly more important than the efficiency, emphasizing the need for further study into how students' values impact their AI usage, and how this can be leveraged when making AI policies in education.

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Mosaic—Multi-method Open chromatin Solver for ATAC-seq Inference of Composition

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Despite its promise to increase experimental efficiency and stability, cell-type deconvolution with ATAC-seq remains underdeveloped, lacking the robust methodological toolkit currently available to transcriptomic data. While supervised deconvolution has become standard for bulk RNA-seq—successfully leveraging single-cell references—its extension to ATAC-seq is fragmented and poorly understood. Existing supervised deconvolution methods supporting ATAC-seq are split into two heavily diverging extremes. Feature-engineered regression models such as DeconPeaker offer computational efficiency and accessibility but struggle with the sparsity, noise, and high dimensionality of chromatin data. At the opposite end, deep learning architectures like DECA achieve strong performance with large Vision Transformer models, but at the cost of substantial computational demand and dependence on large, domain-specific training datasets—constraints that limit its widespread accessibility. Here, we explore the middle ground between these two approaches, attempting to answer the question of whether increased model complexity corresponds to more reliable proportion estimates. This study benchmarks six models: Non-Negative Least Squares (NNLS), Weighted NNLS (Adapted from MuSiC), Elastic Net, Support Vector Regression (SVR), Random Forest Regression, and XGBoost. Our analysis aims to highlight a set of modeling trade-offs that enable accurate, computationally tractable ATAC-seq deconvolution. Furthermore, we implement our findings in a publicly available pipeline, addressing the current need for ATAC-seq methods that are both computationally practical and robust to chromatin data's unique challenges.

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Isotope ecology of the invasive freshwater jellyfish *Craspedacusta sowerbii*

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The freshwater jellyfish *Craspedacusta sowerbii* is considered invasive in Canada. *C. sowerbii* sporadically forms high-density blooms, during which they may exert significant pressure on their prey and competitors, with cascading effects for the entire ecosystem. However, the diet of *C. sowerbii* and its overlap with competitors is difficult to determine. Analysis of their gut content is biased towards larger and harder prey because they are easier to identify, while lab-based predation experiments may not accurately reflect natural feeding preferences. Stable isotope analysis is a method for determining diets and reconstructing food webs that avoids these issues. It uses the ratios of heavy to light isotopes, atoms which differ only in their number of neutrons, because heavy isotopes concentrate higher up the food chain. The only stable isotope study with *C. sowerbii* found isotopic niche overlap with competitors, while gut content consistently identified mesozooplankton as the primary prey. This project analysed the carbon and nitrogen isotope ratios in *C. sowerbii*, its possible prey, and possible competitors to assess both niche overlap and diet. Results indicate that microzooplankton and particulate organic are the primary food sources of *C. sowerbii*, not mesozooplankton. Niche analysis suggests that in low-productivity lakes, resource limitation forces niche differentiation between *C. sowerbii* and its native competitors. This has implications for ecosystem management, as preventing lake eutrophication by limiting shoreline development and run-off could minimize the impacts of *C. sowerbii* invasion.

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Predicting temperate rainforest daytime ecosystem respiration using artificial neural networks

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Forest ecosystems sequester roughly one-third of anthropogenic carbon dioxide (CO_2) emissions. Thus, understanding forest carbon balance is vital for climate modelling. CO_2 exchange is governed by ecosystem respiration (R_e) and photosynthetic uptake. While net ecosystem carbon exchange can be measured directly, it is necessary to quantify these underlying biophysical mechanisms to understand how carbon storage may be affected by climate variability. Several methods have been developed to predict R_e based on temperature, though methods which incorporate additional meteorological and soil conditions remain underdeveloped. We test the hypothesis that data-driven machine learning methods provide more realistic estimates of R_e because additional climatic conditions can be incorporated. Using net CO_2 flux, soil, and meteorological data collected from a temperate rainforest on the east coast of Vancouver Island, British Columbia, we developed and trained two artificial neural network ensemble models to estimate daytime R_e based on nighttime and low-light daytime conditions. We then compared outputs to analogous temperature-based flux partitioning models and identified differences on seasonal cycles. Both data-driven methods displayed significant positive biases when predicting R_e under conditions for which they are trained, with mean bias errors of 0.584 and 0.565 µmol CO_2 m^{-2} s^{-1}, respectively. Both neural networks also failed to predict lower daytime R_e under low soil water content conditions compared to physics-based models, which does not support the hypothesis. This research points to the need for methodological refinement in providing a novel approach for quantifying terrestrial carbon cycles.

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Changes in Self Compassion and Fear of Compassion During Residential Eating Disorder Treatment

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Compassion is a powerful resource for improving wellbeing, allowing one to cope with life's challenges, and is considered a protective factor against eating disorder symptomatology. Compassion-related variables, such as self compassion (i.e., compassion towards oneself in difficult situations) and fear of compassion (i.e., reluctance to receive compassion from oneself and others) have received increasing attention in eating disorder populations, given their relevance in treatment engagement, motivation, and recovery trajectories. The present study aimed to examine the changes in self compassion and fear of compassion across residential eating disorder treatment in Vancouver. All individuals with eating disorders enrolled in the residential program were invited to participate in an online survey package, including two surveys asking questions about the aforementioned compassion variables. A total of 34 participants completed admission and discharge measures to examine this change. There was no statistically significant change between admission and discharge for either variable; however, the means trended in the expected direction (increases in self compassion; decreases in fear of compassion). This study was limited by sample size. Results suggest that residential treatment is more focused on symptom stabilisation over targeting deeper compassion behaviours. Findings aim to deepen understanding of compassion-related processes in eating disorder recovery and inform residential care processes.

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The Prospective Relationships Between Teamwork, Social Identity, and Athlete Thriving in Adult Team Sport Athletes

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While teamwork, social identity, and athlete thriving has been demonstrated to be key variables in the realm of team dynamics, their specific longitudinal relationships have not been investigated. As such, the purpose of this study was to examine the longitudinal bidirectional relationships between aspects of teamwork and social identity, and their potential prospective relationships on holistic athlete thriving. 149 adult team sport athletes completed a series of validated surveys at two timepoints, separated by a month, to determine these relationships. Results suggest that preparation, execution, and evaluation significantly predicted social identity a month later ($p < .001$), and social identity significantly predicted all five aspects of teamwork a month later ($p < .001$). Execution, evaluation, and adjustments, as well as overall social identity, significantly predicted athlete thriving over time ($p < .001$). Large effect sizes were found for the correlations between evaluation and social identity, as well as social identity and preparation, execution, adjustments, and management of team maintenance. Medium effect sizes were found for social identity to evaluations and athlete thriving, and evaluations and adjustments to athlete thriving. Small effect sizes were found for preparation and execution to social identity, as well as execution to athlete thriving. By integrating these constructs, this research aims to deepen our understanding of the dynamic interaction between social identity and teamwork and their prospective contributions to athlete thriving. The findings are expected to inform insights and training for enhancing team dynamics, as well as support athlete well-being.

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Reading the connection: Can third-party observers accurately predict liking after watching short, platonic initial interactions over Zoom?

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Determining whether others like us is a fundamental part of forming social relationships. However, people in initial interactions tend to be negatively biased in their judgments, underestimating how much others like them—a phenomenon termed the liking gap. If people commonly underestimate how much others like them, they may not seek out new relationships. Meanwhile, third-party observers predominantly display above-chance detection accuracy, suggesting that others may have better insight into who likes us than we do. This study, using the Truth and Bias Model, examined whether third-party observers exhibit tracking accuracy and directional bias in initial liking judgments and how these compare with those of interacting partners. Specifically, two data sources were analyzed: one comprising interaction partners (n = 315), who rated their liking of one another, and the other comprising research assistants (n = 25), who rated how much the interaction partners appeared to like one another following round-robin Zoom-based interactions. We found that both interaction partners and third-party observers displayed significant tracking accuracy and a negative directional bias. However, third-party observers demonstrated significantly higher tracking accuracy and a significantly weaker directional bias. This indicates that third-party observers demonstrate a smaller negative liking gap and may be better able to discern how much people like each interaction partner relative to others. These results suggest that individuals may receive more accurate and less biased judgments from others about how much people like them, which may increase the likelihood of forming new social relationships by reducing some of the uncertainty.

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Addressing the Gap Between Undergraduate Regulatory Education and Professional Roles: An Industry-Informed Needs Assessment

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The PHAR 470 (Pharmaceutical Cases II) course in the Pharmaceutical Sciences curriculum at The University of British Columbia challenges students to apply advanced pharmaceutical knowledge to complex real-world cases. It is the first course in the program that explicitly addresses the regulatory considerations in the drug development pipeline, positioning it as a critical component in preparing students for future careers in regulatory sciences. However, entry-level regulatory affairs job postings frequently employ terminology that is not formally addressed in undergraduate curricula and call upon skills and certifications that students rarely possess prior to graduation, highlighting a persistent gap between academic training and industry expectations. This study implements a mixed-methods needs assessment to inform revisions to PHAR 470 course content. Primary data will be collected through online and in-person interviews with regulatory affairs professionals and will be complemented by secondary data obtained through systematic reviews of entry-level regulatory job postings and comparative analyses of similar higher-education coursework. The study is expected to identify and prioritize key competency gaps in regulatory documentation, familiarity with regulatory authorities, awareness of Good Practice (GxP) frameworks, and scientific communication skills. These insights are expected to directly inform targeted revisions to PHAR 470 learning outcomes, including updated learning activities, assessment strategies, and grading criteria. The project aims to enhance undergraduate preparedness for regulatory-facing roles while establishing a transferable framework for industry-informed curriculum development.

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Unifying Levels of Graph Anomaly Detection in Provenance Threat Detection Systems

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Computer systems maintain historical logs of events that have occurred. These logs can be visualized in the form of complex and dynamic graphs called provenance graphs. From the perspective of cybersecurity, the analysis of these provenance graphs can support threat detection in a computer system. A general technique to identify abnormal behaviour in graph data is referred to as Graph Anomaly Detection (GAD). Historically, most GAD techniques have focused on identifying anomalies at a single level such as nodes, edges, or graphs. In comparison, a new technique, unified multi-level GAD, combines and exchanges the information at each graph level to detect anomalies at all levels. Given that this technique has not been applied on provenance graphs, our study aims to design and assess a unified multi-level GAD system for provenance graphs. We will use standard benchmark provenance graph datasets and an established evaluation methodology to compare this system with other state-of-the-art approaches. A review of the technique has been conducted, the system is now in the design and implementation phase. We expect improved detection with this technique because existing single-level methods may miss anomalies at other levels. These results would encourage the broader adoption of multi-level methods in the provenance threat detection space. In practical applications, anomalies are not necessarily restricted to a single level, whereas most state-of-the-art detection techniques are. Therefore, it is expected that applying multi-level methods in the provenance threat detection space can be of high value if found effective.

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Differentiation of *Burkholderia* Species From Other Pathogens Causing Infections in People with Cystic Fibrosis Using Volatile Organic Compound Profiling

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Chronic bacterial lung infections remain the highest driver of morbidity for individuals with cystic fibrosis (CF), with the members of *Burkholderia* species being a high-risk group causing necrotizing pneumonia due to their virulence and intrinsic antibiotic resistance. Current culture-based diagnostics are slow, limiting timely treatment. In this study, we investigated whether volatile organic compound (VOC) profiles from bacterial culture headspace can discriminate *Burkholderia* from other major CF pathogens. Headspace samples from 235 standardized bacterial cultures, including 43 strains across seven *Burkholderia* species, were extracted using solid-phase microextraction and analyzed by two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GCxGC-TOFMS). The resulting peak tables were preprocessed and normalized, then used for supervised classification with a random forest model. The principal component analysis using 10 features selected by RF modelling of 60 samples demonstrated clear separation between *Burkholderia* (n = 43) and non-*Burkholderia* groups (n = 17), accounting for 75% total variance. Hierarchical clustering further confirms this with two well-defined, genus-specific clusters. These findings demonstrate that VOC profiles from bacterial cultures can effectively discriminate *Burkholderia* from other major CF pathogens. Some of the identified discriminating compounds may also be present in exhaled breath, offering a potential pathway toward noninvasive, breath-based biomarkers. Future work will focus on determining whether these culture-derived VOC signatures can be detected in clinical breath samples, with the longer-term goal of developing rapid diagnostic tools to improve infection detection and guide personalized therapy in CF care.

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Comparative Effects of Different Breathing Strategies on Pelvic Floor Muscle Activation

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The pelvic floor muscles (PFM) play a critical role in supporting pelvic organs against the fluctuations in intra-abdominal pressure (IAP) that occur in daily activities. During these pressure changes, the PFMs must generate precisely timed contractions to prevent displacement of the pelvic viscera. Disruption of this automatic response can contribute to conditions such as urinary incontinence or pelvic organ prolapse. As breathing is a primary driver of IAP fluctuations, understanding how breathing strategies influence PFM activity may provide insight into pelvic floor control. The purpose of this study was to determine whether different breathing strategies alter PFM activation magnitude and timing across the respiratory cycle. Eight healthy adults performed six breathing conditions: quiet breathing, rapid breathing, chest breathing, and abdominal breathing (hold and no-hold). We used surface electromyography to measure PFM and trunk muscle activity and pneumotachography to measure airflow. We observed higher, but non-significant mean PFM activation during the rapid breathing and abdominal hold conditions. Time-normalized ensemble analysis showed that PFM activity remained largely tonic across the respiratory cycle, with only modest phase-dependent modulation during rapid breathing and abdominal hold conditions. These findings suggest that breathing strategy alone may have a limited influence on superficial PFM activation magnitude in healthy adults, although certain breathing tasks may produce small, task-specific adjustments in the timing of pelvic floor activity in response to changes in IAP. Our results may help inform alternative, non-invasive strategies to support pelvic floor function in populations who may not respond to conventional PFM training.

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How Does Hearing Loss in Older Adults Increase Social Withdrawal and Depressive Symptoms?

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Hearing loss, one of the most prevalent chronic conditions in older adulthood, has been linked to social withdrawal and depressive symptoms within the literature. Understanding this is essential for informing interventions aimed at supporting older adults in maintaining socially engaged lives. This narrative review examines hearing loss as a contributor to social withdrawal and depressive symptoms, and investigates possible mediating, moderating, and intervention factors. Because hearing loss, social withdrawal, and depressive symptoms interact in complex ways and the research spans diverse methodologies, populations, and measures, a narrative review was used to synthesize findings and highlight key patterns. The findings in this review were compiled across six cross-sectional and longitudinal studies from large-population-based datasets (e.g., NHANES, Health and Retirement Study, SHARE) and smaller intervention studies. The samples included 60–90-year-old mixed-gender older adults residing in the United States and in Europe. Hearing loss was consistently associated with three themes: 1) reduced social participation, 2) greater social avoidance, and 3) higher depressive symptoms. The studies suggest that depressive symptoms act as a mediator that links hearing loss to subsequent social withdrawal. Meanwhile, social support moderates this link by buffering against emotional distress. Looking at the interventions, studies point to hearing aid use, early recognition and identification of hearing loss, and strong social support as effective methods in reducing depressive symptoms and improving social engagement. Future research should prioritize longitudinal and culturally diverse populations. They should also examine how technological and psychosocial interventions can be integrated to mitigate social withdrawal and depressive symptoms.

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Play the Part, Chart the Heart: A Naturalistic Exploration of Fantasy Play and Its Relationship to Cognitive Development

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Fantasy is often dismissed as escapism or childish indulgence, yet developmental psychology reveals that engaging with it is a sign of advanced thinking and emotional understanding. Imaginative play allows children to integrate thought, feeling, and action – bridging creative reasoning with real-world insight. Recognizing fantasy as a sign of maturity challenges assumptions that imagination is trivial or unscientific. With the *Day in the Life (DITL)* methodology – a naturalistic qualitative design was used to document a full day in the life of a preschool-aged child recognized by their community as "thriving." Continuous video recording captured spontaneous moments of imaginative play woven into daily routines and family interactions. Analysis focused on the mental processes involved when the child reimagined ordinary spaces, adopted new identities, and invented stories in collaboration with others. Across contexts, fantasy required complex coordination: the child flexibly shifted perspectives, applied narrative logic to manage emotion, and used play to navigate social relationships. These moments reflected abstract reasoning, planning, and self-awareness typically associated with more mature forms of thought. Far from signalling immaturity, fantasy revealed intelligence, empathy, and emotional regulation in action. Pretend play thus functioned as a sophisticated exercise in creative thought and emotional integration. Recognizing imagination as advanced development reframes play not as a break from learning but as its most natural and joyful expression: one that parents and educators should protect, celebrate, and cultivate.

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The Effectiveness of Resistance Training on Improving Balance and Fall Prevention in Older Adults

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Age-related falls are a leading cause of injury, hospitalization, and loss of independence among older adults. Therefore, resistance training has been considered a key intervention for fall prevention. There is considerable variability in program design and delivery, which limits clarity regarding the most effective training parameters. Addressing this gap is essential for informing evidence-based fall prevention strategies for older adults at elevated fall risk. This narrative review examined the effectiveness of resistance training, defined as multicomponent exercises that target strength, balance, and functionality, for improving balance and reducing fall risk in older populations. Studies were examined using databases such as PubMed and UBC Library, with keywords including “resistance training, “older adults, “balance," and “fall prevention.” Participants were aged 65 years or older, mostly community-dwelling, and often at elevated fall risk due to pre-frailty, osteoporosis, or prior falls. Across the studies, lower-limb resistance training exercises improved mobility, balance, and lower-limb strength. Common outcome measures included the Timed Up and Go test, knee extension strength, and self-reported physical function. Evidence for reduced fall rates were more variable. However, several studies reported significant reductions in subsequent falls. Multicomponent programs that were task-specific, progressive, and maintained over time appeared most effective. Overall, resistance training is a safe and effective method for improving balance and strength in older adults and may aid fall risk reduction. Further research with standardized outcome measures examining other factors associated with age-related falls, such as nutrition and neurological decline, may strengthen our understanding of minimizing age-related falls in older adults.

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ASCME Clinical Trial: High-Dose Lisdexamfetamine and Contingency Management for Methamphetamine Use Disorder

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Methamphetamine use disorder (MUD) has emerged as a major public health concern in Canada, yet no pharmacotherapies are currently approved for its treatment. Behavioural interventions, particularly contingency management (CM), demonstrate benefit but treatment outcomes remain suboptimal. The Addition of high-dose Stimulant and Contingency Management Evaluation (ASCME) trial addresses this gap by evaluating a combined pharmacological and psychosocial approach to MUD. ASCME is a multi-centre, randomized, placebo-controlled, four-arm clinical trial enrolling 440 adults with moderate to severe MUD across Canadian sites. Participants are randomized to 12 weeks of treatment as usual (TAU) with: (1) placebo, (2) placebo plus engagement-focused CM, (3) high-dose lisdexamfetamine (LDX: up to 250 mg/day), or (4) LDX plus CM. LDX administration is double-blinded while CM is delivered openly and incentivizes engagement in TAU. The primary outcome is reduction in days of self-reported methamphetamine use during the maintenance phase. Secondary outcomes include treatment retention, sustained abstinence, safety and tolerability, medication adherence, quality of life and participant satisfaction. The ASCME trial is the largest study to date examining high-dose psychostimulant therapy for MUD and the first to assess its additive and synergistic effects with contingency management using a four-arm design. Findings from this study will provide critical evidence to inform clinical practice, service delivery and policy decisions regarding integrated treatment strategies for methamphetamine use disorder.

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Comprehensive review of the mechanisms underlying Enhertu associated interstitial lung disease in patients with cancers

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Enhertu (trastuzumab deruxtecan; T-DXd) is a targeted chemotherapy containing a HER2 antibody-drug conjugate widely used to treat HER-2 positive cancers. Despite high efficacy, a serious and potentially fatal complication of this treatment is Interstitial Lung Disease (ILD), in which scarring stiffens the lungs, reducing pulmonary expansion and oxygen uptake. The biological mechanisms underlying T-DXd-induced ILD remain incompletely understood. This review aims to identify, summarize, and synthesize existing literature into a coherent pathway of the interplay between Enhertu and ILD to elucidate key mechanistic roles for prevention and treatment of this life-threatening complication. A systematic search using keyword combinations such as “Enhertu,” “trastuzumab deruxtecan,” and “interstitial lung disease” was conducted across major databases, including ScienceDirect and PubMed. Bioinformatic databases such as NCBI and STRING were used to identify and characterize key genes and proteins potentially involved in ILD pathogenesis. The review focused primarily on breast cancer, excluding other HER2-positive cancers, with no specific restrictions related to patient age or ancestry. Through unintentional internalization of T-DXd into neighboring lung sac cells (bystander effect), off-target cellular damage induces immune responses that degrade cellular structure, promoting cell proliferation and scar tissue formation. This pathway is exacerbated by gene products such as MMP7, SPP1, and CD44, whose interactions contribute to fibroblast activation, collagen deposition, and progressive tissue thickening. These processes result in permanent alveolar damage and respiratory impairment, with only preventative treatments that slow progression currently available. A clearer understanding of this pathway may inform strategies to mitigate the side effects of T-DXd.

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Improving Money Laundering Detection Using a Hybrid AI Model

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Money laundering remains a persistent challenge for financial institutions, many of which still rely on manual, rules-based transaction monitoring systems that generate large numbers of false positives and often miss complex patterns across accounts. This study examined whether a hybrid anti-money laundering detection model combining AI-assisted analysis with human oversight could outperform a rules-based manual-review baseline while also identifying the legal and ethical issues raised by its use. Utilizing synthetic banking transaction data with a set of known money laundering patterns from the AMLsim repository, we generated 5,000 simulated cases, including 25 suspicious money laundering transactions. We developed a Python-based model that integrates rule indicators, anomaly scoring, and network signals into a single risk score used to rank suspicious activity, while leaving final reporting decisions to human reviewers. Thus, creating a hybrid model. The use of synthetic data enabled a controlled comparison without exposing real customer data. We subsequently compared how this hybrid model performed compared to a rules-based model. Results showed that the hybrid model identified suspicious activity substantially earlier and more efficiently than the rules-based model: 50% of the first 10 alerts were true fraud, 87.5% of all fraud cases were identified within the first 25 alerts, and all fraud cases were identified within the first 200 alerts. By contrast, the rules-based produced false alarms in more than 95% of alerts. These findings suggest that hybrid human-AI systems can strengthen anti-money laundering screening while also raising important concerns about transparency, bias, privacy, vendor risk, and institutional accountability.

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Understanding Divorce Through Systems Theory and Conflict Theory: A Theoretical Analysis of Family Change

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Divorce remains a defining feature of contemporary family life. Sociologists recognize that divorce is a complex social process that reorganizes family structures and economic resources. Previous research highlights how divorce can disrupt children's academic outcomes and long-term attachment patterns, while for adults, it can involve psychological and economic adjustments as they navigate their new identities and living arrangements. My theoretical application examines divorce through two sociological lenses: systems theory and conflict theory which highlight interdependency and power dynamics. Systems theory provides the strongest explanation for understanding divorce as a process. While conflict theory contributes valuable insights, it is limited by its assumption that conflict is inevitable and that individuals are constantly competing over limited resources. By framing divorce not as an individual failure but as a systemic reorganization aimed at restoring balance, Systems theory provides a holistic lens to explore the concept of divorce within a family. Both theories move beyond the individual to offer a more comprehensive perspective on how family dynamics and social forces shape marital dissolution. By synthesizing existing research, this analysis highlights the broader social implications of divorce and emphasizes the importance of supportive, evidence-informed approaches to family change such as co-parenting communication counselling. This analysis demonstrates how theory-informed interventions can restore equilibrium in families experiencing divorce. It also highlights how systems theory can guide practical, evidence-informed approaches that ultimately promote healthier adjustment post-divorce.

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Reducing Relationship Self-Sabotage: A Cognitive-Behavioural Therapy Approach

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Self-sabotage is a maladaptive behavioural response that functions to avoid failure and protect the self. In romantic relationships, self-sabotaging behaviour takes the shape of withdrawing efforts to justify failure; however, the implications are catastrophic for relationships. In our presentation, we examined a case study of a relationship dilemma submitted on Reddit. Our analysis focused on the relationship problems of a 26-year-old male Redditor, whose feelings of fear and anxiety caused him to self-sabotage potential relationships. Our aim is to understand individual stories and provide scientific advice to solve the relationship dilemma. While this advice is individualized we hope our analysis will prove helpful to the general population of self-saboteurs. We consulted AI technology, peer-reviewed literature, and course concepts to present holistic relationship advice. We consulted the literature on attachment styles and their relationship to triggering self-sabotaging behaviours. To combat self-sabotaging behaviour, we encourage the use of cognitive behavioural therapy (CBT). Preliminary synthesis of literature suggests that individuals who engage in CBT can learn to replace self-sabotaging responses with healthier coping strategies, empowering individuals to form healthier attachments and pursue romantic relationships. However, research also shows that CBT may initially heighten distress as clients confront deeply rooted fears. Despite the short-term difficulties, our findings support CBT as a promising and evidence-based intervention for adults seeking to overcome relationship self-sabotage. Our presentation contributes to emerging conversations on how psychological treatment can enhance relationship development by focusing on the cognitive and attachment-based mechanisms underlying avoidance.

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Perinatal Mental Health in Immigrant and Racialized Women: A Scoping Review of Barriers and Holistic Supports

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Perinatal mental health refers to the psychological well-being of women during pregnancy and the first year postpartum. Mental health challenges during this period are a significant public health concern, affecting a significant proportion of women globally. These conditions can impair maternal functioning and increase the risk of maternal mortality when left untreated. Immigrant and racialized women face higher rates of perinatal mental health challenges due to socio-structural inequities. This scoping review identifies key barriers and holistic supports influencing perinatal mental health for immigrant and racialized women in Canada and the United States. The review uses the Joanna Briggs Institute guidelines and the Population-Concept-Context framework to determine eligibility. Searches were done in Ovid MEDLINE, CINAHL, and PsycINFO. Studies were screened in Covidence, and data were extracted and analyzed to find common patterns in barriers and supports. Preliminary findings show that socio-structural barriers such as language challenges, financial constraints, and limited access to culturally appropriate care increase the risk of depression and stress. In contrast, holistic supports like peer programs and mindfulness-based interventions help improve mental well-being and access to care. The review aims to highlight the need for policies and healthcare interventions that address structural inequities and integrate culturally responsive, community-based supports to improve perinatal mental health outcomes for immigrant and racialized women.

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Recycling Under Pressure: A Proposed Role for New1 in Ribosome Regulation During Osmotic Stress

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Translation termination and ribosome recycling are essential steps in protein synthesis that ensure ribosomes are efficiently released and reused for subsequent rounds of translation. Disruptions in these processes lead to ribosome stalling, reduced protein production, and impaired cellular growth. Given their fundamental role in cellular viability, understanding the mechanisms that regulate translation termination and ribosome recycling is essential. Bioinformatic analysis of osmotic stress data in *Saccharomyces cerevisiae* showed significant downregulation of New1, suggesting a potential role in translational regulation. The protein New1 supports ribosome recycling in *Saccharomyces cerevisiae*, yet the specific domain responsible remains unknown. This proposal aims to identify the role of New1's Chromo domain in ribosome recycling and translational regulation. We hypothesize that the Chromo domain binds messenger RNA (mRNA) and is required for efficient ribosome recycling. To test this, we designed experiments comparing wild-type New1 with a Chromo domain-lacking mutant. Protein–RNA interactions will be assessed using ultraviolet crosslinking to determine whether the Chromo domain contributes to mRNA binding. Ribosome recycling will be evaluated by chemically stalling translation and measuring ribosome occupancy on mRNA in both cells. Because ribosomes that are not efficiently recycled remain attached to mRNA, impaired recycling is expected to increase ribosome accumulation. We expect that loss of the Chromo domain will reduce RNA binding and increase ribosome occupancy, indicating elevated ribosome stalling and reduced translational efficiency. Elucidating the function of New1's Chromo domain will advance our understanding of translational control in yeast and may provide insight into conserved ribosome recycling mechanisms across eukaryotes.

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Colour Normalization of Hyperspectral Scanned H&E Stained Lung Tissue in Preparation for AI Segmentation

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Hyperspectral imaging has enabled diverse medical applications, including melanoma classification, cervical cancer detection, and diabetic complications. This research extends hyperspectral imaging to lung cancer as it is the most commonly diagnosed cancer and the leading cause of cancer death in Canada. AI based histological analysis is highly sensitive to hematoxylin and eosin (H&E) staining variability (from multiple institutions), illumination differences, and acquisition-dependent colour inconsistencies. To address the need for colour normalization across our 16-spectral datasets, different methods are explored. Macenko estimates stain vectors using singular value decomposition in RGB space and loses vital information when extended to hyperspectral slides. Conversely, Whitening and Colouring Transform destroys biological relevance by equalizing all signal variances. With a hybrid Spectral Unmixing-Macenko framework, 16 wavelength data across 100 normal tissue Regions of Interest (ROI's) are normalized to one reference. First, concentration is derived from generalized pure spectra and normalized. Then, differences in spectral information not captured by the two H&E stain vectors are preserved and added to the image constructed with the normalized concentrations. Four image sets are generated per slide: extracted H&E, pre-colour normalized, residual differences, and post-colour normalized. This approach calculates slide-specific concentration H&E weights from normal tissue and applies them to 300 cancer ROI's, improving interpretation of principal component analysis and AI segmentation. Enhancing discernment between nuclei and tissue improves sensitivity to subtle heterogeneity in stain absorption spectra, dependent on different proteins being bound by the stains, enabling more robust analysis of lung cancer histology across hyperspectral datasets.

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Mapping Particle Fates Around Black Holes: A Computational Phase-Space Analysis of Schwarzschild Geodesics

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Black holes represent the most extreme gravitational environments predicted by Einstein's general relativity, where the familiar concept of gravitational force is replaced by the curvature of space and time. Particles near black holes follow paths called geodesics—but the equations governing these paths are too complex to solve analytically in most cases, making numerical methods essential for building physical intuition. We developed a computational framework in Julia to explore particle motion around a non-rotating black hole. By solving the geodesic equations using a high-order adaptive integrator with strict accuracy controls, we classify particle trajectories across 160,000 combinations of energy and angular momentum, producing a complete phase portrait of orbital outcomes—captured, bound, or escaped. Crucially, every numerical boundary in this portrait is validated against exact analytical predictions from general relativity, confirming physical accuracy throughout. Beyond classification, we generate three-dimensional visualizations of qualitatively distinct orbit types, including precessing rosette orbits, whirl-and-plunge captures near the stability boundary, and trajectories oscillating above and below the orbital plane. While the underlying physics is established, our contribution is a validated, reproducible framework that unifies systematic phase-space classification, analytical benchmarking against exact general relativistic predictions, and three-dimensional visualization in one place—bridging the gap between abstract relativistic mathematics and physical intuition.

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The Effect of Light and Temperature Shifts on Anthocyanin Production in *Rubus idaeus*

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Climate change will lead to dramatic shifts in light intensity and temperature, thereby affecting the agricultural growing conditions of fruit crops including red raspberry (*Rubus idaeus* L.). Anthocyanins are the pigments underlying raspberry color and important antioxidant compounds, whose concentration can be altered by light and temperature. Understanding how light intensity and temperature affect anthocyanin concentrations can help find the most favourable environment to enhance anthocyanin synthesis and accumulation. Previous studies have investigated anthocyanin degradation in laboratory settings, however, fewer studies have analysed correlations between agricultural techniques and anthocyanin concentrations, especially considering light and temperature combined. This investigation's goal is to discover the ideal growing conditions for raspberries, emphasizing ways farmers can increase their berries' anthocyanin content. This experiment will use the red raspberry cultivar 'Heritage'. Data collection, in a greenhouse setting, will include two independent variables (light and temperature shifts), and three ranges per independent variable to reflect outdoor environments. This includes a light range of 300, 600, and 900 µmol m^{-2} s^{-1}; and temperatures of 12 °C, 22 °C, and 32 °C. Ripe berries will be harvested for anthocyanin extraction by dissolution in methanol and centrifugation. The pH differential method will determine anthocyanin concentrations as cyanidin-3-glucoside equivalents. Following, the data will be analysed through two-way ANOVA to measure the effects of light and temperature, alongside their interaction. This research will formulate the optimal temperature and light conditions for red raspberry 'Heritage' towards obtaining the greatest anthocyanin concentration, guiding growers to enhance anthocyanin levels within raspberries.

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Investigating Melatonin as a Treatment Pathway for Multiple Sclerosis

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Multiple sclerosis (MS) is a chronic inflammatory autoimmune disease affecting the central nervous system and is a leading cause of neurological disability. It is characterized by neurodegeneration, inflammation, and loss of myelin sheath, the protective layer of axons in the nervous system. Over time, chronic inflammation can lead to damaged areas called lesions. This tissue damage can cause scarring and disrupt neural signaling. Brain-Derived Neurotrophic Factor (BDNF) is a protein promoting neuronal survival and remyelination following myelin injury. Increasing the regulation of BDNF is a promising therapeutic avenue for MS. This study examines the hormone melatonin as a potential treatment for MS. Firstly, melatonin has been shown to increase the transcription of BDNF. Second, melatonin has anti-inflammatory properties and may reduce the clinical severity of MS. This makes it a promising therapeutic avenue. There has been limited scholarship on the effects of melatonin upregulating BDNF levels in MS patients. This study investigates melatonin's effect in enhancing BDNF-mediated neuroprotection in MS, and whether these changes are reflected in lesion-associated BDNF expression and clinical severity. Methods include oral melatonin administration in both humans and a mouse model of MS, followed by quantification of BDNF levels and clinical severity. A combined human/mouse model provides a fuller picture uninvestigated in the current literature. By understanding these effects, melatonin can be explored as a potential treatment for MS.

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Analyzing Antibiotic Susceptibility for Efficacy in Treating Pneumonia

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The increasing global prevalence of antimicrobial resistance (AMR) is making the treatment of bacterial infections with existing drugs progressively more challenging. Pneumonia, an illness with a high mortality rate and rapid progression, requires prompt antibiotic treatment: identifying susceptibility patterns is critical to ensuring patients are quickly prescribed drugs that are effective against the causative organism. This study analyzed antimicrobial susceptibility profiles of *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*, five of the most common pneumonia-causing organisms, across a broad range of antibiotics, antibiotic classes, and combination regimens. Data was obtained from the Antimicrobial Resistance Microbiology Dataset compiled by Nateghi Haredasht et al., consisting of de-identified electronic health records from over 200,000 patients treated by Stanford Health Care between 2007-2024. A binomial logistic regression model was fitted to binary susceptible vs resistant outcomes for the five species, including subspecies where there were more than 20 observations per antibiotic. Estimated marginal means were then calculated using the *emmeans* package in R to derive predicted probabilities of susceptibility for each antibiotic. A second regression model evaluated susceptibility by antibiotic class, and pairwise comparisons identified classes to which species were significantly more susceptible or resistant. These findings highlight class-dependent susceptibility patterns, and significant differences between antibiotic class efficacy on specific species. More informed antibiotic selection has the potential to enhance patient outcomes, shorten treatment and recovery periods, and support ongoing efforts to mitigate the progression of antimicrobial resistance.

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Cellular Senescence in Ovarian Aging: Drivers, Functional Impacts & Emerging Therapeutics

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The female reproductive system is one of the earliest organ systems to exhibit age-related decline, with ovarian function decreasing in the mid-thirties and ending at menopause. This decline is clinically significant, as loss of ovarian hormones is associated with increased risks of metabolic disease, osteoporosis, cardiovascular disease, and neurodegeneration. Despite its broad health implications, the cellular mechanisms driving ovarian aging remain incompletely understood. Emerging evidence suggests that cellular senescence, a state in which cells permanently stop dividing and release pro-inflammatory factors, plays a central role in ovarian decline. This review addresses how cellular senescence contributes to ovarian aging, identifies its key molecular drivers, and evaluates the therapeutic potential of targeting senescent cells. Findings were synthesized from eight peer-reviewed studies, including mechanistic reviews, biomarker frameworks, single-cell analyses, and clinical perspectives. Across these studies, senescence was consistently observed in multiple ovarian cell types, including oocytes, granulosa cells, stromal cells, and immune cells. Major drivers of senescence included DNA damage, telomere shortening, oxidative stress and mitochondrial dysfunction, leading to impaired follicle development, reduced hormone production, chronic inflammation and tissue fibrosis. Preclinical evidence suggests that emerging interventions, such as senolytic drugs, senomorphics, NAD^+ boosters, and stem cell therapies may mitigate aspects of ovarian aging, although clinical translation remains limited. Overall, this review identifies cellular senescence as a unifying mechanism of ovarian aging and emphasizes its relevance for developing future strategies to preserve reproductive health and extend healthspan in aging individuals with a uterus.

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Why Suppression Isn't Enough: BC Wildfires Through a Systems Thinking Lens

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British Columbia (BC), is experiencing increasingly severe and frequent wildfires that continue to reduce forested land area and damage ecosystems. These fires not only reshape the environment but also have an effect on people living in fire-prone regions. Less is known about how public misunderstandings about Indigenous-led cultural burning, weak cross-government collaboration, and a continued preference for emergency response over prevention could contribute to a growing and unsustainable wildfire risk. By applying a systems thinking lens, this study reframes wildfires from isolated disasters to outcomes of interconnected systems. This approach exposes limitations of short-term suppression that have reinforced hazardous fuel accumulation and limited the effectiveness of current mitigation strategies. The existing BC wildfire risk and management landscape was examined through a review of current literature and policy. This informed the curation of a stock and flow diagram illustrating the impacts of wildfires on the population and environment, as well as the existing measures used to address them. As a result, systemic gaps and potential levers of change emerged. We found that BC wildfire impacts are sustained by reinforcing feedbacks between environmental degradation, repeated displacement, health impacts, and governance fragmentation. We expect that prioritizing prevention-focused funding, Indigenous-led fire stewardship, public education, and centralized displacement and health tracking would weaken these feedbacks and reduce long-term risk. This study demonstrates the value of systems thinking in wildfire governance by identifying leverage points that address root causes rather than short-term symptoms, supporting more equitable and sustainable wildfire management.

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Brief Dry-Heat Exposure Rapidly Degrades Dried Salmon Genomic DNA and Reduces PCR Yield

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Heat exposure can damage DNA and reduce the reliability of genetic testing in dried biological samples, including laboratory materials or evidence exposed to fire. This study examined how brief dry heat affects both overall DNA integrity and the fraction of DNA that remains suitable for analysis. Using dried salmon genomic DNA as a model system, we tested whether increasing temperature alters DNA structure and analytical success. Equal DNA samples were dried onto glass vials and heated for five minutes at temperatures ranging from room temperature to 200°C. After rehydration, DNA quality was evaluated in two ways: a DNA amplification test to determine whether specific regions remained intact, and size-based separation of DNA fragments to assess structural damage. Image analysis was used to quantify changes in DNA signal intensity across temperatures. DNA amplification remained strong at low temperatures but declined sharply above 125–150°C and was absent at higher temperatures. Measurements of whole DNA structure showed earlier and more extensive degradation, with long DNA molecules fragmenting as temperature increased. Band intensity decreased significantly with temperature for both measurements, with genomic DNA showing a steeper decline and a stronger relationship with temperature ($R^2 = 0.95$) than amplified DNA products ($R^2 = 0.71$). These findings demonstrate that dry heat progressively fragments DNA and reduces the fraction that can be reliably analyzed. Detectable amplification does not necessarily indicate intact original DNA, highlighting risks of over-interpreting genetic results from heat-exposed samples.

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Personalized Dietary Intervention to Improve Sarcopenia and Nutrition in Gastroenteropancreatic Neuroendocrine Neoplasms (GEP-NENs): A Pilot Study

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Gastroenteropancreatic neuroendocrine neoplasms (GEP-NENs) are a diverse group of tumours arising from specialized cells that produce hormones and signalling molecules. The pathophysiology of GEP-NENs can reduce vitamin synthesis and absorption while affecting dietary habits, weight change, and appetite. Sarcopenia, the loss of skeletal muscle mass and strength, is common in this population, affecting up to 61% of patients. Personalized dietary intervention (tailored and adaptive to an individual's baseline intake, symptoms, and preferences) has been proposed to mitigate muscle loss in cancer, however limited interventional diet studies for GEP-NENs exist to date. We hypothesize that a personalized diet will improve muscle mass, gut microbial diversity, and quality-of-life measurements compared to standard care. Our one-year randomized pilot study will enroll 50 GEP-NEN patients with low-grade tumours on stable hormone-control therapy. To establish baseline metrics, we will use the Malnutrition Universal Screening Tool (MUST) and CT scans to measure initial muscle and nutrition levels, alongside blood and stool samples to assess nutrient deficiencies and gut microbial diversity. Patients in the intervention group will receive biweekly nutrition guidance from a dietician to implement a personalized diet, while control patients will receive standard cancer nutrition guidance. The primary endpoint will be the change in Skeletal Muscle Index (SMI), an objective measure of muscle mass. Secondary endpoints include changes in microbial diversity, vitamin levels and quality-of-life scores. We expect that patients following the interventional diet will demonstrate improved outcomes in all endpoints. This study will provide a framework for integrating nutrition into multidisciplinary GEP-NEN management.

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Neonatal NSG mice as suitable models for studying B-cell acute lymphoblastic leukemia development (B-ALL)

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B-cell acute lymphoblastic leukemia (B-ALL) is the most common type of childhood cancer and is characterized by rapid division of abnormal B-cells that impede normal immune function. Although 90% of patients are cured by chemotherapy, the leading cause of mortality in affected children is relapse, calling for the development of targeted immunotherapies. However, current research has focused on leukemia, rendering the early development of preleukemia into leukemia under-studied. Here, we present neonatal NSG mice as suitable in vivo models to study leukemogenesis, as their immune microenvironment is appreciably receptive to B-cells. Pre-B and preleukemic cells isolated from the spleen and bone marrow of preleukemic Eμ-Ret mice were enriched via pro-B cell magnet sorting and injected intravenously into the temporal vein of 1-2 day old NSG pups. The mice were sacrificed at different time points post-injection and B-cells in their spleen and bone marrow were stained and inspected via flow cytometry. At 50 days post-injection, the spleen:body mass ratio of mice increased 6-fold, consistent with the percentage of preleukemic CD19+BP1+ B-cells increasing from 16.5% to 98.1% at which point they became leukemic, indicated by the loss of intermediate CD19+ and BP1 low B-cells (normal B cells). This signifies the successful differentiation of preleukemic B cells into leukemic blasts within a 1.5 month time window, making NSG pups an efficient model for studying leukemogenesis. Further investigation into human B-cell engraftment is needed, paving the path for developing therapeutics that control preleukemic cell development in patients with B-ALL.

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Study of Hyperpolarised Imaging Following CFTR Modulator Therapy change in Cystic Fibrosis (SHIFT-CF)

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Cystic fibrosis (CF) is the most common, fatal, genetic disease affecting over 4,500 Canadians. It is caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene, disrupting ion and water transport across membranes. This dysfunction leads to thickened mucus and results in persistent coughing, recurrent infections, breathing difficulties, elevated salt levels in sweat, digestive complications, and progressive lung damage. A medication approved in 2021, elexacaftor-tezacaftor-ivacaftor (ETI), has transformed CF treatment and dramatically improved CF prognosis. Recently, a modified version of ETI, vanzacaftor-tezacaftor-deutivacaftor (VTD), was developed and is believed to recover CFTR function more effectively. However, previous tools detected no differences in lung function between ETI and VTD therapy. Multiple breath washout (MBW) and 129-Xenon magnetic resonance imaging (XeMRI) are emerging tools that measure lung function better and are more sensitive than standard clinical measures in CF. We hypothesize that XeMRI and MBW will detect treatment responses in individuals transitioning from ETI to VTD that may have been missed by traditional testing. The Study of Hyperpolarised Imaging Following CFTR Modulator Therapy change in Cystic Fibrosis (SHIFT-CF), a prospective multicentre observational cohort study, will evaluate the effects of VTD on lung function using XeMRI and MBW. Using these advanced lung assessment techniques to detect important pulmonary changes, we aim to determine potential benefits of transitioning to VTD. In the future, these findings may support clinical and patient decision making to start VTD therapy, and provide new ways to monitor treatment response and progression of CF lung disease.

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The Gut-Brain Axis and Neurodegeneration: A Review on the Roles of Microbial Metabolites and Immune Signalling

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The gut-brain axis represents a bidirectional network linking the intestinal microbiota to the central nervous system (CNS) through neural and immunological pathways. Gut dysbiosis, an imbalance in microbial population diversity, can increase intestinal permeability, allowing microbial metabolites to enter circulation and potentially contribute to neurodegenerative conditions such as Alzheimer's, Parkinson's, and Multiple Sclerosis (MS). Existing studies on MS have examined isolated factors such as immune signalling or microbial metabolites, but the interactions between these components in MS development remain unclear. Therefore, this review examines current literature regarding interactions between gut metabolites and the CNS to propose a mechanistic pathway that leads to MS development via immune signaling. Short-chain fatty acids (SCFAs), produced by fibre-fermenting bacteria, reduce neuroinflammation by decreasing expression of immune signalling molecules and strengthening intestinal integrity. Conversely, lipopolysaccharides (LPS), structural glycolipids found on the plasma membrane of gram-negative bacteria, once in the bloodstream, were positively correlated with MS prognoses. LPS-driven Toll-like receptor 4 (TLR4) signaling promotes systemic inflammation that can increase blood-brain barrier permeability and promote microglial hyperactivation, a hallmark of MS. On the contrary, SCFAs can counteract these effects by enhancing intestinal integrity. Therefore, maintaining low levels of LPS while enhancing SCFAs production appears crucial within the gut-brain axis for limiting neuroinflammation and MS development. Additionally, dietary interventions can influence MS progression by altering the gut microbiome and reducing neuroinflammation. Ultimately, there is a large body of evidence that suggests changes in gut microbial composition may play a central role in modulating the development of Multiple Sclerosis.

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Academic and journalistic representations of First Nations' sovereignty in pipeline development in British Columbia

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This study explores how Tsleil-Waututh and Wet'suwet'en sovereignty in pipeline development is represented in academic literature and popular media, focusing on differing Western and Indigenous understandings of land and governance. A narrative literature review was conducted on peer-reviewed academic articles and news reports examining the Coastal GasLink (CGL) project on Wet'suwet'en territory and the Trans Mountain Expansion (TMX) on Tsleil-Waututh land. Sources were analyzed using themes to identify recurring patterns across disciplines and media contexts. Across the literature, three primary themes emerged: 'Informed First Nations Consent,' 'Intergenerational responsibilities,' and 'reciprocal versus extractive lenses.' First, many sources highlight limitations in the current consultation process, particularly concerns about informed consent and the restricted decision-making authority of Indigenous leaders within the Canadian legal system. Second, existing federal government-conducted impact assessments are frequently critiqued for underestimating cumulative health risks, disruptions to traditional practices, and long-term environmental consequences following an oil spill. These concerns connect directly to the intergenerational responsibilities Tsleil-Waututh people hold toward the land across the past, present, and future. Lastly, Canadian legal governance of energy is divided between the federal and provincial governments and prioritizes profit distribution and economic growth. In contrast, Wet'suwet'en law is grounded in the connection to the land, kinship, and intergenerational lineage. Overall, the literature suggests that the current consultation process alone is critically insufficient. Structural changes—including Indigenous-led impact assessments and shared decision-making authority—are necessary to meaningfully recognize Indigenous sovereignty in pipeline development and energy governance.

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Paths to Belonging: Multiculturalism and Canadian Political Identity Among Middle-Aged Punjabi Immigrants in the Lower Mainland

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Canada officially embraces multicultural policy, creating a nation where people from different backgrounds are encouraged to maintain their cultures while participating fully in society, and where political and national identity is tied closely to multiculturalism. However, less is known about how immigrant communities understand this political identity within the broader context of Canadian society and its multicultural framework. This study examines how Punjabi immigrants aged 50–70 living in British Columbia's Lower Mainland conceptualize their political identity, exploring multiculturalism and what it means to be Canadian. Using semi-structured interviews, this research explores participants' immigration experiences, family and community networks, work histories, and views on Canadian identity. Participants were asked open-ended questions about why they immigrated, their experiences after arrival, their social connections, and whether they see themselves as Canadian. Based on existing literature, this study was conducted with two hypotheses. First, immigrants with strong social connections, such as family ties and participation in Punjabi cultural and religious institutions, are more likely to feel Canadian, as these networks recreate a sense of home and belonging. Second, immigrants who emphasize hard work and economic contribution use these to justify their belonging in Canadian society. However, the findings do not fully support these expectations. While participants valued social, familial, and community networks, economic contribution was not framed as a marker of Canadian identity or belonging. Instead, participants emphasized gratitude toward Canada and viewed economic participation less as a justification for belonging and more as a responsibility owed to the country.

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Baker's Yeast: A Scientist's Battery – Creating a Mathematical Model for *Saccharomyces cerevisiae* Microbial Fuel Cells

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Microbial fuel cells (MFCs) are a promising technology offering a low-cost, sustainable option for generating renewable energy from organic matter and efficient wastewater treatment. While MFCs have been well studied, those powered by Saccharomyces cerevisiae, commonly known as baker's yeast, remain less explored, especially regarding accurate predictive modelling of their electrical output. This study investigated the voltage produced by MFCs comprised of baker's yeast, sugar, and graphite rods and developed a mathematical model of the voltage over time. The voltage output of an MFC was recorded over time using various concentrations of yeast and sugar. To interpret the behaviour of the system, several mathematical models were combined, including Monod kinetics and ordinary differential equations (ODEs) for yeast growth and sugar depletion. A Monte Carlo simulation was used to estimate the uncertainty and to account for biological variability and electrical noise in the system. The combined experimental and modelling results confirmed that yeast MFCs can reliably sustain a low voltage and that the voltage over time produced by them can be effectively modelled using a system of biological and electrochemical equations. This approach provides insight into the properties and viability of yeast-based MFCs.

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Robot-Assisted Versus Traditional Gait Rehabilitation effect on Perturbation-Based Locomotor Adaptation in SCI Patients

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Gait impairments after motor-incomplete spinal cord injury (SCI) severely limit mobility, independence, and quality of life. Traditional gait rehabilitation (TGR) uses therapist-guided, body-weight-supported treadmill training where clinicians manually assist the hips, knees, and ankles to shape stepping, whereas robot-assisted gait training (RAGT) uses a robotic exoskeleton (Lokomat) to guide leg motion with harness support. Despite similar functional outcomes, it remains unclear whether TGR and RAGT differentially improve locomotor adaptation, defined as the nervous system's ability to recalibrate walking coordination when conditions change. This single-blind randomized controlled trial will recruit 70 adults (age 19+) with motor-incomplete SCI (AIS B-D, indicating an incomplete injury) with stable cardiovascular health and capacity to provide informed consent. Exclusion criteria include AIS A injury, lower-limb contractures, severe osteoporosis, active pressure injuries, pre-existing gait disorders, and concurrent enrollment in other rehabilitation programs. Participants will be randomized 1:1 to TGR or RAGT, completing 15 sessions over 5 weeks (3 sessions/week, 40 minutes/session across eight 5-minute bouts with 2-minute rest breaks). Locomotor adaptation will be assessed at baseline (T0) and post-intervention (T1) using split-belt treadmill walking, where two belts run at different speeds. Primary outcomes, step length asymmetry and double support time asymmetry, will be derived from ankle-marker motion capture analyzed in MATLAB by blinded assessors. We hypothesize TGR will produce greater reductions in both asymmetry measures than RAGT, driven by greater active voluntary engagement. Identifying which approach better supports adaptive walking coordination will inform more targeted rehabilitation to improve safe, independent community mobility after SCI.

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The effects of different tibial neurostimulation patterns on pelvic floor muscle excitability

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Overactive bladder is a type of lower urinary tract dysfunction that causes sudden and intense urges to urinate that are often difficult to control and lead to incontinence. Medications and catheterization are the main management strategies for this condition in neurogenic populations, however they come with adverse side effects. Posterior tibial nerve stimulation (PTNS), which applies mild electrical stimulation near the ankle, is a promising alternative treatment with no obvious side effects. Previous clinical studies on PTNS predominantly used protocols where stimulation is applied continuously. However, emerging evidence suggests that phasic inputs may better modulate spinal excitability. This study compared the effects of different stimulation patterns applied to both legs in healthy participants. Each participant completed three PTNS sessions (continuous, intermittent, and patterned) and PFM reflex responses were measured before and after each session. The continuous condition consisted of uninterrupted stimulation, while the intermittent and patterned conditions had repeating on-off stimulation. In the patterned condition, stimulation alternated between the left and right sides with a brief overlap between both sides. We hypothesized that patterned stimulation would produce the greatest facilitation due to enhanced sensory feedback similar to those produced during walking. Data from seven participants suggested that PTNS was associated with an unexpected decrease in the tibial-PFM reflex response, with no differences between conditions. Future research is warranted to further understand how PTNS affects bladder control.

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Using autoethnography to understand the lasting impacts of childhood bullying

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Childhood bullying and its impacts on health, wellbeing, and development have been extensively researched through interdisciplinary lenses. One of its types, appearance-related and weight-based bullying, is found to be predictive of poorer psychosocial and biological impacts, many of which extend into emerging and lasting adulthood. But how does that happen? Current research comments little on the underlying process and symptomatic re-appearance of childhood bullying in young adulthood, several years after the instance(s) of bullying. In my research, I evoke the powerful sociological tool of autoethnography to argue that autobiographical and retrospective narratives can be used to identify and analyze how the impacts of childhood bullying fare into adulthood. By using autoethnography, I leverage the artistic medium of personal storytelling by narrating my own experience of being bullied, and then thematically analyze it to demonstrate how a victim "embodies" experience in adult life. Through embodiment, I propose that being a bully victim fundamentally shapes one's approach to new adult life experiences, such as navigating different friendships and external appearance. New life events serve as "reminders" of this embodiment by linking unrelated experiences to past bullying encounters. Autoethnography proves to be an exciting and innovative scientific tool to contextualize and produce new key variables of interest for bullying scholarship.

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"Switchin' the Positions for You": Sexual Agency and the Modern Female Popstar

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The consistent portrayal of women as sexual objects in popular media of the 2000s has been identified in contemporary scholarship as evidence of how the objectifying male gaze strips women of full social subjecthood. Whereas such literature often concentrates on the impact of sexual objectification in the context of men as the sexualizing media actors, this paper interrogates the active participation of female pop stars in sexualizing themselves through their artistic output. Accordingly, it asks whether women's self-sexualization in media functions as a salient form of gender empowerment or merely a byproduct of the heteropatriarchal conditions that reduce women to sexual objects. Methodologically, I synthesize objectification theory and critiques of postfeminist media culture to examine women's agentic or non-agentic sexual expressions within 21st-century pop media. Drawing on theories of feminist media studies to rhetorically and aesthetically analyze the content of modern female pop music albums, I focus on the highly illustrative cases of Ariana Grande's *Positions* (2020) and Sabrina Carpenter's *Man's Best Friend* (2025). I find that female artists retain some degree of autonomy over their desires, yet their sexuality is primarily legible through norms shaped by the objectifying male gaze. Thus, I term their behaviour *pseudo-agentic*, denoting their ability to exert agency exclusively within the social demarcations of patriarchy. This research helps illuminate the extent of women's sexual agency in pop music, thereby complicating the role of media consumers as participants in the processes of objectification.

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How do hospital-school liaison programs, which integrate Individualized Education Plans (IEP) and tele-education, influence the academic progress and educational reintegration of hospitalized children aged 6-12 with dyslexia: a literature review

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Providing education in clinical settings is known as hospital pedagogy; however, sessions require specialized staff and scheduling around treatments, proving difficult. With growing times, effective pedagogy considers integrating tele-education to overcome physical barriers and tailoring to learning disabilities to maximize educational delivery. This review examines effective methods in integrating tele-education to adapt individualized educational plans in hospitals for children with dyslexia and developmental learning disorders. Using UBC's Library, PubMed, Scopus, and the Directory of Open Access Journals, a literature search was conducted using predefined inclusion criteria, and findings underwent a three-stage screening process to go from 471 to ten eligible studies. Inclusion criteria included: pediatric patients with condition(s) requiring customized learning; education plans accommodating hospital treatments; and published studies in English between January 2015 and January 2025. Overall, three patterns were identified. First, tailored and flexible instruction in hospital settings promotes academic continuity and self-regulated learning. Second, synchronized tele-education reduces social isolation and enhances engagement by improving communication. Finally, children with dyslexia require increased individualized support. These findings call for diagnostic-specific research on effective teaching methodologies for hospitalized children with dyslexia, focusing on long-term outcomes and quality of educational reintegration. This review bridges the gap between current hospital pedagogy and specialized dyslexic support, providing caregivers, policy makers, and hospital administrators with the knowledge to make informed decisions about academic continuity for hospitalized children with dyslexia.

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Long Distance Roundness Vowel Harmony in Àúga

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Ùkààn, an endangered Benue-Congo language spoken in south-western Nigeria, is underdocumented and underresearched, resulting in a lack of knowledge concerning its long-distance vowel harmony processes. Long-distance vowel harmony occurs when non-adjacent vowels match in phonological (meaning sound-based) features. This diverges from more commonly understood local harmony processes, where adjacent vowels match in a feature. In Ùkààn, the vowel in a noun's class marking prefix (CMP) and the vowel in the demonstrative suffix match in some phonological feature, ignoring the intermediate vowels of the root word. We aimed to capture the long-distance vowel harmony present in Àúga, one dialect of Ùkààn, using theoretical frameworks. Analyzing Àúga data collected by our supervisor, which consisted of 40 demonstrative phrases, we observed that the CMP acts as the trigger for roundness harmony in demonstrative suffixes, while the noun root remains unaffected. To model this, we applied the Tier-Based Strictly Local (TSL) framework, which accounts for long-distance dependencies by projecting only relevant roundness features onto a separate structural tier. The apparent long-distance harmony in Àúga is computationally handled as a local agreement constraint. This TSL account effectively explains why the harmony ignores intervening root vowels while maintaining strict directionality from the prefix to the demonstrative. These results provide a more in-depth and detailed understanding of the vowel harmony, noun classes, and long-distance dependencies demonstrated in the Àúga dialect of Ùkààn. By furthering knowledge on endangered languages that differ from well-documented languages, the world's linguistic diversity can be fully appreciated, understood, and protected.

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Investigating the Outcomes of Neonates with Moderate or Severe Hypoxic-Ischemic Encephalopathy Following Cessation of Intensive Care

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Hypoxic-Ischemic Encephalopathy (HIE) is a birth-related brain injury caused by perinatal oxygen deprivation, often requiring intensive medical support such as artificial nutrition, hydration, and mechanical ventilation. These interventions often involve invasive and potentially painful medical procedures. In cases of poor prognosis, care may shift toward comfort through cessation of intensive care; however, survival patterns and physiological trajectories following this transition remain poorly understood, limiting clinicians' ability to provide clear prognostic guidance to families during critical decision-making. We are conducting a retrospective study to examine clinical factors associated with survival outcomes and to characterize the trajectory of neonates with Moderate (Stage II) or Severe (Stage III) HIE following cessation of intensive care. Medical records from infants born between 2019 and 2024 and treated at BC Women's Hospital NICU are being reviewed, comprising a cohort of 220 late preterm and term infants, of whom approximately 71% had moderate or severe brain injury. Chart review is currently underway for the subgroup of infants who underwent cessation of mechanical ventilation, with data collection focusing on clinical characteristics including type of ventilatory support and comorbidities related to neonatal asphyxia. Regression analyses will be performed to evaluate associations between multisystem organ involvement and survival time following extubation. These findings will improve understanding of clinical trajectories after cessation of intensive care in neonates with HIE and support clinicians in providing evidence-based guidance to families, while also informing future prospective studies aimed at improving care and decision-making in this population.

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Below the Snow Line: An Exploratory Study of Immigrant Labour and Housing in Whistler

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Ski resort towns like Whistler rely heavily on seasonal migrant labour, yet workers' experiences are shaped by restrictive immigration pathways and an ongoing housing crisis. This thesis examines how seasonal labour and housing conditions affect migrant workers' economic security, with particular attention to how immigration pathways shape job mobility, housing access, and vulnerability. Drawing on semi-structured interviews with migrant workers and local experts, alongside supporting policy and housing data, the study finds that employment instability driven by seasonal demand produces fluctuating hours and income insecurity, often requiring workers to take on multiple jobs. At the same time, limited and costly housing options push workers into overcrowded living arrangements or employer-tied accommodation, which can reduce costs but deepen dependence on employers. This interdependence between work and housing reinforces precarity, as losing employment may also mean losing housing. Despite these challenges, many workers remain in Whistler, drawn by lifestyle factors and the perceived benefits of mobility. These findings highlight how labour, housing, and immigration systems are deeply interconnected in seasonal tourism economies and underscore the need for policy approaches that more effectively address these overlapping structural constraints.

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Labour Exploitation in On-Demand Grocery and Food Delivery Services: A Comparative Study of Developed and Developing Economies

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This paper explores how varying degrees of labour exploitation in the on-demand grocery delivery sector affect economic development in developed and developing countries. Digital platforms in developing countries, including Indonesia, India and the United Arab Emirates, are criticized for the precariousness of gig work, but similar conditions persist in high-income economies as well, such as the United States, Finland and Spain. To systematically compare these contexts, the study compiles a cross-country dataset covering six countries for the years 2019–2025. For each country-year pair, the analysis measures working hours per day for gig-economy drivers as a proxy for labour exploitation, and three macro-level outcomes: the Gini index of income inequality, GDP per capita, and the prevalence of modern slavery. To estimate how variation in working hours relates to these outcomes while accounting for unobserved heterogeneity across countries and global shocks, the study finds a trend over 6 years across developed and developing countries, holding other variables such as culture, geography, and institutions constant. The results show that, after controlling for other variables, longer working hours are not statistically associated with changes in income inequality, GDP per capita, or the prevalence of modern slavery. Instead, cross-country institutional differences dominate the variation in all three outcomes. These findings suggest that differences in gig-workers' daily hours alone cannot explain macroeconomic trends, but broader labour-market institutions, government regulatory strength, and law enforcement capacity likely play a much larger role in shaping inequality, economic performance, and worker vulnerability to exploitation.

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Affordable Folate and Iron Co-Fortified Margarine to Improve Bioaccessibility and Reduce Deficiency

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Folate and iron are two essential micronutrients that play critical roles in human metabolism and other fundamental physiological functions. However, people do not usually get enough of these nutrients in their diet due to their limited bioavailability and stability during food processing and gastrointestinal digestion, which also substantially constrain the effectiveness of existing fortification strategies. In addition, purchasing supplements and nutrient-dense food is expensive, which further increases the expenses for people with low socioeconomic status, compromising health quality with other costs. Therefore, there is an urgent need to develop a universal, affordable, and food-based fortification strategy that can simultaneously enhance folate and iron intake. Water-in-oil (W/O) emulsions have been shown to effectively protect sensitive water-soluble bioactives during digestion and improve their physicochemical stability. Margarine, a typical W/O emulsion, is one of the basic condiments for bread and is also commonly distributed through food banks. It is highly accessible and is generally consumed without heating, thereby minimizing the degradation of heat-sensitive nutrients such as folate. This research aims to develop a fortified margarine with folate and iron to help the general public meet dietary requirements and reduce the risk of micronutrient deficiency–related health consequences. We hypothesize that the continuous lipid phase in W/O emulsion can protect water-soluble folate and iron from the acidic and oxidative gastrointestinal environment, thereby enhancing their bioaccessibility.

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Differences in Treatment Response Between BRCA1-Mutated and Sporadic Basal-Like Breast Cancers

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Basal-like breast cancer (BLBC) is an aggressive subtype of breast cancer characterized by the tumour's phenotypic similarities to basal epithelial cells. These tumours lack expression of estrogen receptors and HER2, contributing to limited treatment options and a poor prognosis. Basal-like breast cancers can be divided into BRCA1-mutated and sporadic forms, which share phenotypic similarities, but demonstrate immunohistochemical and molecular genetic differences. BRCA1-mutated tumours arise from defective DNA repair and tumour suppression pathways as a result of a truncated BRCA1 protein. Sporadic basal-like tumours arise independently and occur in individuals without BRCA1 mutations or a family history of breast and ovarian cancer. Despite these molecular differences, breast cancer research largely focuses on their genotypic and molecular disparities, rather than the difference in treatment response. This review examines whether BRCA1-mutated and sporadic basal-like breast cancers respond differently to existing treatments, emphasizing the potential for more targeted treatment strategies. This is proposed to be done using in vivo mouse models that have been injected with tumour tissue from either a BRCA1-mutated BLBC patient or a sporadic BLBC patient. Mice would then be randomly treated with a chemotherapy designed to target BLBC tumours, Olaparib, or Cetuximab. The BRCA1-mutated BLBC mice being treated with Olaparib and sporadic BLBC mice being treated with Cetuximab would be expected to experience greater tumor regression when compared to the control group. A better understanding of the treatment options may improve prognosis and contribute to a reduced mortality rate in patients with basal-like breast cancer.

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Developing an In-house Luciferase-based Assay for Screening Retinoic Acid-Related Orphan Receptor (ROR) Modulating Factors

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The retinoic acid-related orphan receptors (ROR), RORα and RORγ, are critical transcription factors that modulate a variety of physiological processes, particularly within the immune system. They regulate the differentiation and function of T helper 17 (Th17) cells, which produce pro-inflammatory cytokines such as interleukin-17 (IL-17) for antimicrobial defence. Dysregulation of RORs can lead to pathogenic Th17 activity and contribute to driving autoimmune and inflammatory diseases. However, due to RORs' ligand-dependent transcriptional activation, many studies have identified inhibitors of RORs as a therapeutic approach to suppress pathogenic Th17 activity. Characterizing the kinetics of these compounds and also identifying ROR-modulating factors using commercially available assays is prohibitively expensive, creating a significant barrier for high-throughput screening and research. In this project, we aim to develop an in-house assay to identify and characterize ROR-modulating biomarkers and compounds. This involves developing and validating a luciferase-based reporter assay in a HEK293T cell line using modular cloning and the PiggyBac transposon system to analyze RORα and RORγ transcriptional activity. The developed assay can then be treated with patient sera and/or ROR inverse agonists to assess its ability to suppress RORα or RORγ activity. This cost-effective platform can enable high-throughput screening and differential diagnosis of Th17-associated diseases, allowing for early intervention and ultimately informing the development of more targeted therapies.

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Sex Differences in Muscle Strength Are Not Explained by Extracellular Matrix Characteristics

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It is well-established that males typically outperform females in absolute strength tasks due to differences in body composition (males have more muscle mass). Sex-related differences at the muscle's cellular level; however, are unclear. The extracellular matrix (ECM) of skeletal muscle maintains muscle health and responds to both resistance and aerobic exercise, thus, if sex-related differences exist, could contribute to differences in muscle performance. The present study; therefore, investigated muscle function and ECM characteristics to explore the ECM's role in sex-related differences in muscle performance. Healthy, recreationally active males (n = 21) and females (n = 21) were recruited. Participants completed fitness testing and had an ultrasound of their thigh muscle to measure muscle size. A subset of participants had a thigh muscle biopsy before and 72h after resistance exercise. Males had greater lower body strength, grip strength, aerobic fitness and larger thigh muscles than females. When muscle size was accounted for, males trended towards having more strength per unit of muscle. No sex-related differences were demonstrated in ECM characteristics including intramuscular collagen (the key component of the ECM), post-exercise enzyme content (TIMP1) or activity (MMP2, MMP9). Intramuscular collagen content also did not correlate with any fitness measures.Males trended towards having higher muscle quality than females which may reflect underlying sex-specific differences in muscle adaptation and responsiveness to exercise interventions. These differences; however, are not explained by differences in ECM characteristics as measured in this study. Further research is warranted to inform recommendations for sex-specific training and rehabilitation strategies.

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Mental Health Experiences Among People Living with Cancer on Instagram: A Thematic Analysis

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With rising survival, cancer care now extends into long-term survivorship, where psychological burden could be intensified while coping with the new normal. In parallel, social media captures time-stamped records of personal lived experience that may not be fully reflected in clinic visits. This study aimed to examine how cancer-related mental health experiences are expressed in Instagram posts using a qualitative thematic analysis. Through a systematic hashtag search, the first 2000 posts under #cancermentalhealth and #cancerandmentalhealth were sequentially screened (4000 posts in total). Public posts authored from a personal perspective, written in English, and explicitly referencing both cancer and mental health were included. Eligible captions were coded in NVivo 14 to identify mental health terms, coping resources and emotional expressions in posts and engagement in comments. 31 captions met inclusion criteria (14 posts from #cancermentalhealth and 17 posts from #cancerandmentalhealth). Among 43 mental health terms identified, trauma (21%) and fear (14%) were most frequently expressed. Among 39 coping resources, community support (18%) and family/friends (13%) were most commonly reported. Among 57 emotional expressions, gratitude (19%) and sadness (19%) were most frequently conveyed, showing that cancer experiences are emotionally complex. Thematic analysis revealed patterns of psychological distress and community-based coping within posts, while comments frequently reflected shared lived experiences, encouragement and spiritual support. Instagram provides real-time insight into the psychological burden of cancer survivorship and functions as informal peer-support space. These findings support the need for ethical, patient-centered integration of digital peer-support communities into supportive cancer care research and practice.

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Music and Exercise as combined Non-Pharmacological Interventions for People Living with Dementia: A Scoping Review Protocol

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Dementia is a progressive neurocognitive condition with limited pharmacological treatment options, prompting increasing interest in non-pharmacological interventions to support cognitive, physical, and psychosocial well-being. Music therapy and exercise are two widely studied interventions for people living with dementia, with systematic reviews demonstrating benefits for neuropsychiatric symptoms, quality of life, physical function, and mood. However, these interventions have largely been examined in isolation. Emerging evidence suggests that combining music and exercise may enhance motivation, adherence, and therapeutic effects; however, the nature, effectiveness, and evaluation of such combined interventions have not been comprehensively summarized.The objective of this scoping review is to map the existing literature on combined music therapy and exercise interventions for people living with dementia. Specifically, this review aims to identify the formats of music and exercise used, examine outcome measures, and summarize reported outcomes and effectiveness.This review will be conducted in accordance with the Joanna Briggs Institute methodology and reported following PRISMA-ScR guidelines. A comprehensive search will be conducted across databases including CINAHL, MEDLINE, Embase, Web of Science, Scopus, ProQuest, and Google Scholar. Eligible studies will include published and unpublished qualitative and quantitative research involving people with dementia receiving combined music and exercise interventions.Two independent reviewers will conduct screening and data extraction. Data will describe intervention characteristics, study design, evaluation methods, and outcomes. Results will be synthesized descriptively to identify patterns, gaps, and future research directions.This review will clarify how combined interventions have been designed, implemented, and evaluated, informing future non-pharmacological strategies for dementia care.

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Using Transposable Element Activities to Monitor Neural Stress and Vulnerability to Neurodegenerative Diseases

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Transposable elements (TEs) are DNA sequences that can replicate and copy and paste sequences into new genome locations. Such translocation activities are common sources of genome instability and typical gene activity disruption, leading to vulnerability of diseased states. TEs are regulated by multiple repressive mechanisms to prevent transpositional activities and insertions along the host genome. The deregulations of TEs commonly found in neurons such as L1 and HERV have thus been linked to genomic mutagenesis and interference with signalling pathways, resulting in neurological cell dysfunction and inflammation linked to Alzheimer's Disease, Parkinson's Disease, Frontotemporal Dementia, and Multiple Sclerosis. However, TEs of identical DNA sequence are spread in many loci along the host genome, resulting in ambiguous loci-specific cause-and-effect relationships to neurodegenerative diseases. Thus, the insertion of unique DNA sequences on the targeted TE sequences using prime-editing gene techniques will provide an identifiable marker to reduce sequence mapping ambiguity over identical sequencing while reducing cell cytotoxicity. The resulting labeled neurons will then undergo ATAC-sequencing which detects open and active genes, allowing for the exploration of site-specific activities of TEs and their impacts on the neighbouring genomic regions.The labelling of TEs can thus be used as a model for downstream studies with neural stress and instability that ultimately lead to the disease states. By understanding the effect of TEs on disease vulnerability, the progression towards and of neurodegenerative diseases such as Alzheimer's, Parkinson's, Dementia, and Multiple Sclerosis can be further characterised, allowing for early access to prevention and progression via treatment.

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Labeling "Jumping Genes" to Track Activity in Alzheimer's Disease

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Transposable elements (TEs), or "jumping genes", are repeated DNA sequences that copy and insert themselves in the genome, making up about 45% of human DNA. While most are inactive, some remain active in neurons. These are called Class I retrotransposons, major families include: LINE-1 (L1), SINEs (Alu), and Human Endogenous Retroviruses (HERVs). Because mature neurons cannot efficiently repair DNA damage, stress accumulates over time. In Alzheimer's disease, the accumulation of tau protein increases TE accessibility, which can make TEs more likely to become transcriptionally active. Active TEs can promote DNA rearrangements and immune responses, leading to inflammation and cellular stress. ATAC sequencing (ATAC-seq) detects TE-associated chromatin accessibility by measuring which parts of DNA are open around TE sequences. Because TE sequences are highly repetitive, ATAC-seq reads often cannot be traced back to a single copy. Hence, current studies measure overall TE accessibility rather than locus-specific accessibility. We aim to develop a targeted TE-labeling method to track activity at a specific LINE-1 locus (L1HS) in neurons using a modified gene-editing tool (prime editing) that inserts unique labels into selected TE sequences with reduced toxicity. TE-labeling allows us to explore whether L1HS becomes more accessible under neurodegenerative stress and how changes at this locus impact nearby DNA. Once validated at L1HS, the same strategy can be applied to additional TE loci. Ultimately, moving the field beyond correlation toward a stronger causal and mechanistic understanding of neurodegenerative disease progression. Thereby, accelerating TE research and supporting earlier diagnosis and treatment of Alzheimer's Disease.

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Tooth loss and cognition: the mechanistic pathways

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Globally, over 3.5 billion people experience oral diseases which have wide-ranging effects on health and quality of life. A growing body of clinical and experimental literature links tooth loss (edentulism) with cognitive decline. However, the specific biological pathway remains unclear. We hypothesize that edentulism induces cognitive impairment through a multifactorial brain-mouth pathway involving reduced sensory-motor stimulation, chronic neuroinflammation, and masticatory-related nutritional deficiencies. A literature review of 2,130 articles was screened to include peer-reviewed articles from 2000–2025 focused on mechanistic pathways. The review identified edentulism to induce dental deafferentation (reduced sensory input to the brain) which disrupts the release of hormones and proteins for neuron survival. Early tooth loss was also shown to act as a chronic stressor that promotes cognitive decline by elevating plasma corticosterone and microglial activation. However, the nutritional and dietary impact of edentulism appeared to play a weaker role in mediating cognition. Notably, these effects on cognition were significantly reduced in denture wearers compared to non-wearers. Results from this review highlight the main intersecting mechanistic pathways relating edentulism to cognitive decline and suggest that the cognitive impact of edentulism is partially reversible through prosthetic intervention. These findings underscore the need to integrate oral care into public health initiatives to emphasize the importance of functional dentition in overall health and quality of life. However, these mechanisms remain provisional due to limited integrative research in humans, and longitudinal studies are needed to clarify causal direction and rule out reverse causality between edentulism and cognition.

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Drug-Exercise Interactions in Metabolic Syndrome: Synergistic and Antagonistic Effects of Common Pharmacological Therapies

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Metabolic syndrome (MetS) is a condition affecting more than one-third of the global population and is characterized by a cluster of metabolic abnormalities that substantially increase the risk of type 2 diabetes and cardiovascular disease. Hallmark features of MetS include hyperglycemia, obesity, hypertension and dyslipidemia, which are commonly managed through pharmacological interventions such as metformin, glucagon-like peptide-1 (GLP-1) receptor agonists, sodium-glucose cotransporter-2 (SGLT2) inhibitors, and statins, respectively. Exercise is well established to improve metabolic health by enhancing glycemic control, body composition, and lipid profiles, and is widely prescribed as an adjunct therapy in MetS management. Despite this, emerging evidence indicates inconsistent outcomes of drug-exercise interactions. Some studies report synergistic benefits, whereas others suggest antagonistic effects, raising important questions regarding the efficacy of combined therapeutic strategies. Metformin and statins have been shown to attenuate several exercise-induced adaptations, whereas SGLT2 inhibitors and GLP-1 receptor agonists more consistently demonstrate additive effects. This literature review synthesizes evidence from animal models and human trials to compare metabolic outcomes and exercise adaptations. Potential mechanistic explanations underlying these divergent responses are examined, and key gaps requiring further investigation are identified. Ultimately, by clarifying drug-exercise interactions in MetS, this work aims to inform future research directions and address critical gaps in the existing knowledge base. This study has important implications for optimizing combined drug and exercise prescriptions in individuals with MetS and highlights the need for more personalized therapeutic strategies.

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Does Breaking Conscientiousness Into Smaller Parts Improve the Prediction of Grit?

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Trait-level information reflects broad personality tendencies, whereas facets capture more specific components of those traits. This study examined whether facet-level components of conscientiousness improve the prediction of grit compared to the overall trait. Using secondary data from Schmidt et al. (2020), we analyzed conscientiousness from the Big Five Inventory–2 (BFI-2) and grit from the Short Grit Scale (Duckworth & Quinn, 2009). We compared trait-level conscientiousness with its three facets (organization, productiveness, responsibility) across three outcomes: overall grit and two grit facets, consistency of interest and perseverance of effort. Predictive performance was evaluated using explained variance (R^2) and nested model comparisons. We found that facet-level conscientiousness consistently explained more variance than the trait-level model across all outcomes. The facet-level model showed higher predictive validity for overall grit (.580 vs .495), consistency of interest (.421 vs .358), and perseverance of effort (.579 vs .495). Among the facets, productiveness emerged as the strongest predictor of perseverance of effort. Together, these findings suggest that looking beyond broad personality traits to their more specific components can improve our ability to predict real-world perseverance. We also acknowledge contextual limitations to the generalizability of these findings and outline directions for future research.

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Neuron-Microglia Interactions in Progranulin Haploinsufficiency-Associated TDP-43 Pathology

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Frontotemporal dementia caused by GRN haploinsufficiency (FTD-GRN) is characterized by cytoplasmic accumulation and nuclear depletion of the RNA-binding protein TDP-43, yet the cellular mechanisms linking reduced progranulin (PGRN) to TDP-43 pathology remain incompletely understood. Notably, neuronal PGRN reduction alone does not consistently recapitulate robust TDP-43 aggregation in vivo, suggesting that non–cell-autonomous contributions, particularly from glia cells, may play an important role in disease pathogenesis. Here, we use human induced pluripotent stem cell (iPSC)-derived neuronal and microglial models to test how PGRN haploinsufficiency perturbs neuronal TDP-43 homeostasis and whether microglia modulate this process. Aim 1 evaluates neuron-intrinsic effects by quantifying TDP-43 subcellular localization and accumulation in GRN-haploinsufficient neurons using immunocytochemistry and biochemical fractionation. Aim 2 examines non-cell autonomous mechanisms by exposing wild-type neurons to conditioned media and/or direct co-culture with wild-type versus GRN-haploinsufficient microglia. Aim 3 extends these paradigms to a 3D iPSC-derived neurosphere model to assess whether microglial effects on neuronal proteostasis are enhanced in a tissue-like context. Together, these aims test the hypothesis that microglial lysosomal dysfunction, coupled with downstream inflammatory outputs such as complement pathway activation, contributes to neuronal cytoplasmic TDP-43 accumulation in FTD-GRN. Expected outcomes include increased cytoplasmic TDP-43 and impaired lysosomal function in PGRN-deficient neurons, with stronger TDP-43 mislocalization/accumulation in the presence of GRN-haploinsufficient microglia. By distinguishing neuron-intrinsic versus microglia-driven mechanisms in a human iPSC system, this work aims to clarify how glial dysfunction influences neuronal proteostasis in FTD-GRN and to nominate microglial lysosomal/inflammatory pathways as potential upstream therapeutic targets for TDP-43 proteinopathy.

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Investigating the Association Between Agricultural Crop Diversity and Child Dietary Diversity in Ethiopia

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Dietary diversity is a recognized measure of micronutrient adequacy, especially among children who reside in low-income households. Given Ethiopia's high incidence of malnutrition, it is essential to improve the current state of food insecurity through analysis of dietary diversity. While existing research has investigated the relationship between crop diversity and dietary diversity, findings have remained inconclusive. This study examines whether increased agricultural crop diversity is linked with improved dietary diversity among children aged 0–59 months in Ethiopia. Agricultural diversity was measured through the use of the Simpson Diversity Index (SDI). Ethiopia was divided into a 10 km by 10 km grid of cells, each being assigned an SDI score calculated from crop-specific harvest area data. Dietary diversity was assessed using the World Health Organization's Dietary Diversity (DD) standard, using data from 2,525 children in the 2016 Demographic and Health Survey (DHS). Household-level SDI scores were subsequently assigned based on the grid cell in which their corresponding DHS survey cluster was located, identified through cluster-level GPS coordinates. The association between crop and dietary diversity was estimated using ordinary least squares (OLS) regression, controlling for household wealth, maternal education, and child age. Preliminary findings suggest a weak positive correlation between crop diversity and dietary diversity, with socioeconomic factors arising as stronger indicators. Maternal education emerged as the strongest socioeconomic predictor of dietary diversity. These results contribute to a clearer understanding of previously inconsistent findings, with practical implications for future agricultural interventions and nutrition policies in Ethiopia.

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Navigating health online: Capital, habitus, and Chinese older adults' engagement with online health information

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The growing abundance of online health information allows individuals to access resources across diverse digital platforms. In China, a large proportion of older adults engage with online health information to explore health practices. However, few studies have examined which social factors interact to shape this patterned engagement and how attitudes toward online health information are structured. Synthesizing peer-reviewed articles published in English from 2020 to 2026, this literature review aims to understand how capital and habitus influence the access, evaluation, integration, and sharing of online health information among Chinese older adults. Based on Pierre Bourdieu's theory, capital exists in three forms: economic resources, cultural knowledge, and social connections. The unequal distribution of these resources contributes to individuals' differential opportunities and broader social inequalities. Furthermore, habitus refers to the dispositions that guide how individuals think and act. I argue that the available literature suggests that economic capital shapes entry into online health resources; cultural capital, expressed in digital health literacy, informs the evaluation of health information and its integration into behaviors; and social capital, embedded in support networks, motivates the acquisition and sharing of information while simultaneously being cultivated through such engagement. Different forms of capital also provide the conditions under which habitus develops, which in turn feeds back into older adults' experiences with health-related information. This review sheds light on the mechanisms underlying health inequalities and emphasizes the need for programs and policies to account for older adults' varying circumstances in order to maximize the benefits of online health resources.

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The Effect of Helper Lipids on PEG-Free LNP Formulations

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With the success of COVID-19 vaccines, lipid nanoparticles (LNPs) have emerged as a leading platform for nucleic acid delivery. All clinically approved LNPs contain ionizable lipids, phospholipids, cholesterol, and polyethylene glycol (PEG) lipids. Despite PEG's use, concerns remain about its potential to reduce cell uptake and elicit immune responses. Sugar-based surfactants offer a promising alternative, but LNP formulations incorporating these surfactants (sugar-LNPs) have yet to be optimized. This study investigated the effects of altering helper lipid (phospholipid and cholesterol) ratios on PEG-free mRNA LNPs. We hypothesized that adjusting these ratios would lead to improvements in particle size, mRNA encapsulation, expression of delivered mRNA, and LNP stability compared to the lab's current best formulation. LNPs were prepared using microfluidic mixing and characterized for size and uniformity (PDI). Empty sugar-LNPs were initially screened to identify optimal formulations, which were then used to package eGFP (fluorescent protein) mRNA and assess both encapsulation efficiency and mRNA expression in target (HEK293) cells. Stability was evaluated by monitoring the size of empty sugar-LNPs during storage at 4 °C. Initial screening showed that sugar-LNPs with higher helper lipid and lower cholesterol content produced smaller, more uniform particles. The mRNA-loaded sugar-LNPs maintained sizes of 50–200 nm, PDIs < 0.3, encapsulation efficiencies >70%, and higher mRNA expression compared to the lab's current best formulation. The sugar-LNPs also remained stable over 28 days of storage. This study demonstrates that adjusting helper lipid ratios influences both the characteristics and performance of PEG-free mRNA LNPs, while also identifying lead formulations for further investigation.

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Investigating MED15 as a Therapeutic Target in Pediatric Neuroblastoma

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Neuroblastoma (NB) is the most common solid tumour in infants and remains a principal cause of childhood cancer mortality, highlighting the need for new therapies. At the molecular level, transcription factors (TFs) and their co-regulators, such as Mediator, often drive dysregulated gene expression that promotes tumour growth. MED15, a subunit of the Mediator complex, is highly expressed and associated with poorer survival in several cancers. Our lab previously generated MED15 knockout (KO) models in lung adenocarcinoma cells and observed the downregulation of oxidative stress response and pro-inflammatory immune genes. This signifies a role for MED15 in these cancer cells; however, MED15's functions in NB are unknown. Therefore, this project aims to determine how MED15 influences oxidative stress and immune-response pathways in NB. We will use CRISPR-Cas9 gene editing to generate stable MED15KO clones in two NB cell lines (IMR-32 and SK-N-AS), and confirm homozygous mutant clones by PCR genotyping. Changes in the oxidative stress and immune gene/protein expression will be assessed using qRT-PCR (RNA) and Western blotting (protein). Based on our prior findings, we expect MED15KOs to show reduced oxidative stress and immune response genes/proteins. Many childhood cancers, including NB, remain deadly and need new treatments. This project has the potential to identify MED15 as a new therapeutic target in NB. Importantly, the MED15-TF interface is targetable with small molecules, making MED15 a potential therapeutic target in pediatric cancers.

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