eureka!

undergraduate research symposium

9:00 - 9:15 a.m. Welcome & Opening Remarks

9:15 a.m.
75 minutes

Student Research Talks #1

Development of a Sensorimotor Platform for Enhanced Locomotion Under Microgravity Conditions · John Christy Johnson · Medicine

TaikoNation: Patterning-focused Chart Generation for Rhythm Action Games · Emily Halina · Computing Science

What Nutritional Interventions Exist for Canadian Indigenous Adults? A Scoping Review · Jessica Zhang · Psychology

10:30 - 11:00 a.m. Undergraduate Networking Session

11:00 a.m.
60 minutes

Poster Presentation Session #1

Computer Science & Design

- **Development of an Indoor Map Application for the University of Alberta Hospital**
- **Existence of an Equilibrium in Mixed Rings of Coordinators and Anti-coordinators**
- **Educational Game Design for Naloxone Kit Training**

Biomedical

- **Mechanistic Studies of Hsp90 Chaperone Dynamics by NMR**
- **Developing Selective Inhibitors of Siglec-Sialic Acid Interactions by Targeting Sialyltransferases**
- **Engineering Increased Expression of Human IL10 in S. boulardii**

Psychology

- **In the Eye of the Beholder: Examining the Influence of Arousal on Emotion Perception**
- **Is Uncertainty a Threat or a Challenge? Effects on Group Identification**
- **The Mental Health Implications of Remote Learning**

12:00 - 1:00 p.m. Keynote Speaker: **Dr. Elisabeth Bik**
"The Dark Side of Science: Misconduct in Biomedical Research"

1:30 p.m.
75 minutes

Student Research Talks #2

White Matter Correlates of Dual Task Gait in Parkinson's Disease · Ipinuoluwakiye Fatokun · Neuroscience

Mechano-Hypoxia Conditioning of Engineered Human Meniscus Fibrocartilage · David X. Li · Civil Engineering

Expression Analysis of Lignin related genes in Picea glauca (White Spruce) · Mohana Talasila · Molecular, Cellular, and Developmental Biology

Determination of a Novel Model of the Cytoplasmic (CT) Domain of the HIV-1 Envelope Protein Provides Evidence that Challenges the Existing Model of the HIV-1 Matrix (MA) Shell · Riya Mangukia · Chemistry

3:00 p.m.
60 minutes

Poster Presentation Session #2

Biomedical

- **Inhibitory Effects of Ubiquitin Variants on the Salmonella Novel E3 Ligase, SspH1**
- **Making Sense of "Antisense Therapy" for Spinal Muscular Atrophy**
- **Defining the Role of Caspases in the Human Brain**

Public Health

- **Out of Reach: Barriers to Accessing Tele-healthcare Amidst the Pandemic**
- **Association Between Sex and Mental Health Sequelae After ICU Discharge: A Scoping Review Protocol**
- **Assessment of Adherence to Perioperative Anticoagulation Interruption Guidelines in Patients with Atrial Fibrillation and Previous Stroke**

Oncology

- **Understanding the Role of DDX1 Expression in Neuroblastoma Response to Treatment**
- **Effect of Irradiation on Cytosolic DNA Release in Colorectal Cancer Subtypes**
- **Butyrate and Propionate Induce Immune Activation and Apoptosis in DNA Repair Deficient Colorectal Cancer Cells**

4:00 - 4:30 p.m. Awards Ceremony & Closing Remarks

Click HERE to visit the Eureka Undergraduate Science Journal website and join the virtual symposium.

eureka!

Undergraduate Research Symposium



2021 Abstract Book

Development of a sensorimotor platform for enhanced locomotion under microgravity conditions

John Christy Johnson[1], Peter Anto Johnson[2], Austin Mardon[3]

[1]Department of Biomedical Engineering, University of Alberta, Edmonton

[2]Faculty of Medicine and Dentistry, University of Alberta, Edmonton

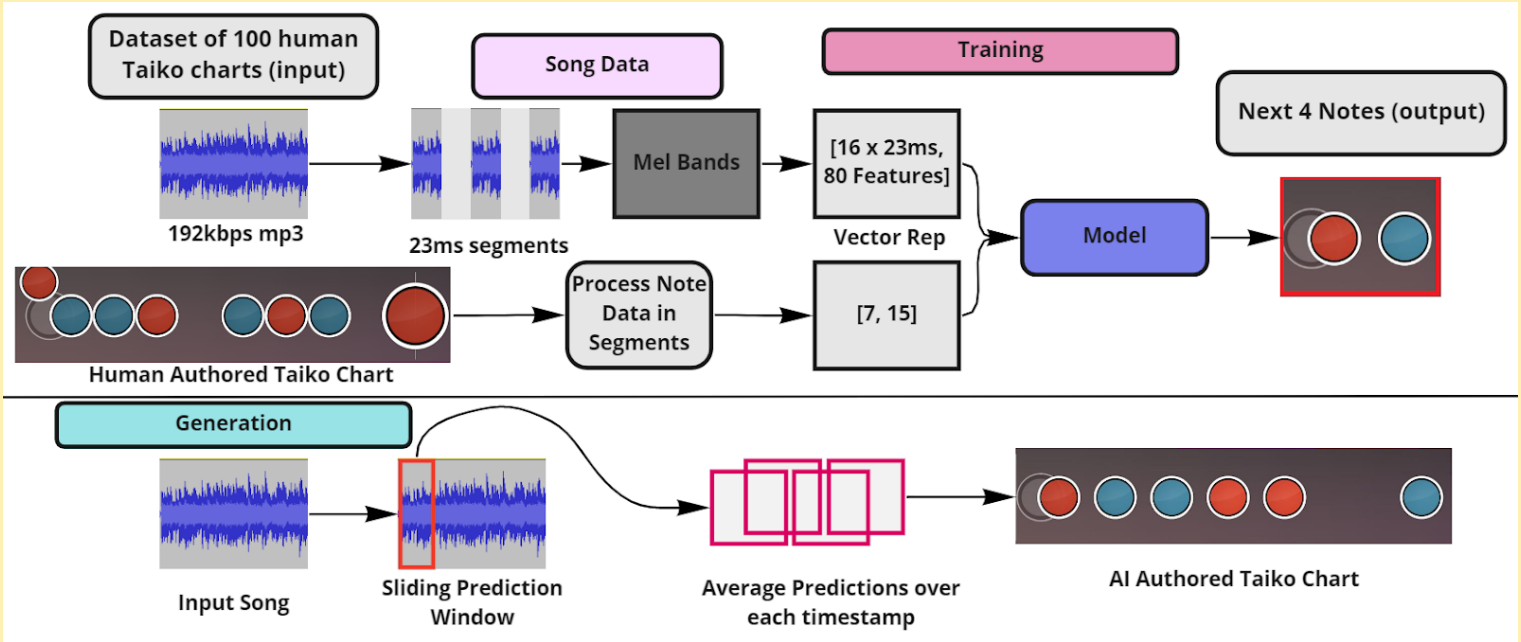
[3]Department of Psychiatry, University of Alberta, Edmonton

For humans accustomed to 1-G environments on Earth, microgravity conditions in orbit and on celestial bodies with lower gravitational field, such as the Moon, can be physiologically compromising. Of these, motor and fine-dexterity tasks involving the extremities, particularly in locomotion, grasp and release, are influenced becoming delayed and placing greater force demands. The authors hereby propose incorporating this same technological innovation into loading suits designed for use in orbit or celestial environment. Current prosthetic systems use electromyography (EMG)-based techniques for creating functional sensorimotor platforms. This model sustains a sensorimotor platform for prosthesis users. However, several limitations in practical use and signal detection have been identified in these systems. Accelerometer-based sensorimotor systems have been suggested to overcome these limitations but only proof-of-concept has been demonstrated. Our group previously suggested the combined application of prosthetic accelerometers in loading suits and EMGs for input signal detection, quantification, and predictive output modelling necessary for improved motion adjustments under microgravity conditions. It is anticipated this technology can enhance tasks such as repairs or construction or perhaps in recreational design when considering commercial and private human access to space. The incorporation of a prosthetic biomechanical sensorimotor system in loading suits to enhance locomotion under microgravity conditions are conceivable; however, demonstration of a proof-of-concept is required before implementation.

TaikoNation: Patterning-focused Chart Generation for Rhythm Action Games

Emily Halina, Matthew Guzdial
Department of Computing Science, University of Alberta, Edmonton

Generating rhythm game charts from songs via machine learning has been a problem of increasing interest in recent years. However, all existing systems struggle to replicate human-like patterning: the placement of game objects in relation to each other to form congruent patterns based on events in the song. Patterning is a key identifier of high quality rhythm game content, seen as a necessary component in human rankings. We establish a new approach for chart generation that produces charts with more congruent, human-like patterning than seen in prior work.



What Nutritional Interventions Exist for Canadian Indigenous Adults? A Scoping Review

Jessica Zhang[1], Levi Frehlich[2], Sonja Wicklum[3]

[1]Department of Psychology, University of Alberta, Edmonton
2Department of Community Health Sciences, University of Calgary, Calgary
3Department of Family Medicine, University of Calgary, Calgary

Colonization and racism imposed through Canadian policy have harmed the family structure and led to intergenerational trauma within Indigenous communities. This unique consequence to Indigenous social determinants of health in combination with nutritional insecurity compromise well-being. Nutritional insecurity, due to rising prices, climate change and the nutrition transition, coupled with a lack of access to physical activity resources also contribute to rates of obesity and associated diabetes and cardiovascular diseases observed in Indigenous populations. We sought to explore the scope of published literature on nutritional interventions for Indigenous adults in Canada. This scoping review is also part of a larger environmental scan for wellness programming including physical activity and other holistic health interventions throughout Canada.

To complete the current scoping review we conducted a scoping review on Indigenous nutrition interventions in Canada based on the Arksey and O'Malley framework. The search included eight databases and grey literature to identify relevant studies. Using Covidence® software, a research assistant and two researchers executed screening and data extraction. The extraction was performed using a designed extraction template.

The scoping review identified 11918 studies published before July 2020. After abstract/title screening, 283 remained. 22 were included for final data extraction. No additional studies were identified in the grey literature. Identified interventions were grouped by geography, intervention type, and limitations. Key themes revealed were Northern Canadian Communities Focus, Country Food, Multifactorial (ie., additional health components to nutrition), Family Focus, Online Delivery, Grocery Impact, Clinical and Other. Majority were at the community level with two at the individual.

These findings will inform current and future health research programming regarding Canadian Indigenous populations. Specifically, it will inform the Wolf Trail Program, a holistic wellness program for Indigenous women, ensuring incorporation of identified best nutritional practices.

Development of an indoor map application for the University of Alberta Hospital

Syed Hussain[1], Chris Fung[2]

[1]Department of Medicine, University of Alberta, Edmonton

[2]Department of Radiology, University of Alberta, Edmonton

Background: Patients, family members, visiting and new students, trainees and staff can find it challenging to navigate the multi-facility, multi-floor University of Alberta Hospital and associated clinical buildings. Helpdesks with staff and volunteers are routinely placed at major entrances of the hospital to provide directions to visitors. However, there are limitations with providing verbal directions and help may not always be available.

Purpose: The purpose of this study was to explore the development of an online indoor map application that hospital visitors and staff from the Department of Radiology and Diagnostic Imaging to help them navigate the University Hospital.

Methods: We aimed to create a user-centered, mobile-friendly web application offering an interactive, multi-floor indoor map of the University Hospital. Through an iterative and collaborative process, we brainstormed design characteristics and practical features that would be desired by users of this application. These included a simple uncluttered layout through the use of collapsible buttons and hide-away menus. Live location and navigation were also identified as key features desired in this application. Accessibility features that were brainstormed included settings to change text size and an application tour option that highlights the application's features for new users.

Results: RadMap was created as an online application accessible at https://www.radmap.online. It is an interactive, multi-floor indoor map application that allows users to see their live location, view hospital pictures, and navigate to their desired endpoint.

Conclusion: Early development and testing suggests an indoor map application for the University Hospital is possible and potentially useful.

Existence of an Equilibrium in Mixed Rings of Coordinators and Anti-coordinators

Achintya Raya Polavarapu, John Bowman
Department of Mathematical Sciences, University of Alberta, Edmonton

A network game is a game over a graph where each vertex is associated with a player and the edges in the graph represent the neighbors of each player. In a network game with binary decisions, players might prefer one action over the other based on the number of neighbors that are choosing it. For instance, a player could take an action if enough neighbors are using that action, as in the spread of innovations and fashion. This player is considered a coordinating player. Alternatively, an anti-coordinating player could take an action if enough neighbors are choosing the opposite action, as in dispersion of crowds and traffic. A network game is said to be at equilibrium when every player in the network reaches a decision with which they are all satisfied. A fundamental question is if a particular network game will ever reach an equilibrium. While it has been proved in a recent paper that in every network game consisting purely of either coordinating or anti-coordinating players there exists an equilibrium, this is not the case when both types of players coexist in a network. In this talk, we establish the conditions for the existence of an equilibrium in certain types of elementary networks which contain both coordinating and anti-coordinating players, using a linear-threshold model.

Return to schedule

Join on Zoom

Educational Game Design for Naloxone Kit Training

Nicole A. Pernal, Aidan Rowe, Gillian Harvey
Department of Art and Design, University of Alberta, Edmonton



The opioid epidemic continues to be a persistent issue in Alberta, and the growth of overdose fatalities has prompted health officials to develop a Naloxone kit distribution program. This program enables citizens to have access to kits containing overdose reversing medication (Naloxone). While this life-saving technology has been proven to decrease overdoses, a recent study shows that Naloxone kits are often present at the site of an overdose but are frequently used improperly or not at all (Government of Alberta, 2017). Building on this information, this project employed research methods such as literature review, case study, and semi-formal interviews to identify two major themes that discourage people from using Naloxone kits. Firstly, people are confused about the injection technicalities required for Naloxone administration. Secondly, people are having trouble managing anxiety while administering Naloxone. As a response to this, an educational card game titled Know Your Naloxone was developed to increase knowledge retention surrounding the Naloxone administration process. Design processes of ideation, prototyping, and user-testing were employed to develop this game. The hierarchal learning format and repetitive nature of the game allows players to familiarize themselves theoretically and practically with needle injections and steps needed to attend to an overdose situation. In addition, the use of game stressors such as time constrains, competition, rewards, and punishment simulate the high-stress situation of an overdose, which in turn, decreases anxiety about needle technicalities. Overall, this project illuminates specific issues that discourage people from using Naloxone kits and aligns with past research that advocates for the use of educational gaming to facilitate long-lasting learning.

Return to schedule

Join on Zoom

Mechanistic studies of Hsp90 chaperone dynamics by NMR

Alissa Minard, Toshi Uyesugi, Xu Hong Chen, Suad Rashid, Leo Spyracopoulos
Department of Biochemistry, University of Alberta, Edmonton

The molecular chaperone Hsp90 is a ubiquitous ATPase, that interacts with a wide variety of client proteins, and is involved in several biological processes. As a result of Hsp90 diverse clientele and abundance in cells, misregulation of its function leads to pathogenesis of diseases, including cancers and neurodegenerative disorders. Given its role in multiple diseases, and its potential as a drug target in treating those diseases, studies of Hsp90 structure and mechanism are clinically significant.

Hsp90 forms a homodimer in vivo, with each copy of the monomer composed of an N-terminal, C-terminal, and middle (M) domain. Hsp90 is typically described as a slow ATPase as there are large energy barriers to achieving its catalytically functional conformational state (closed); however, upon ATP binding and hydrolysis, conversion to the open state and release of ADP and Pi occurs rapidly. The C-terminal domain is primarily involved in dimerization, while the M-domain is responsible for binding client proteins. The M-domain also includes a catalytically important arginine (R380), which in the closed conformation pushes into the nucleotide binding pocket and stabilizes the gamma phosphate of ATP during hydrolysis. The N-terminal domain is responsible for nucleotide binding and ATPase activity. It has a “lid” and a “strap” portion that must move during the conformationally coupled ATPase cycle. The lid moves to cover the nucleotide binding pocket, while the strap crosses over to the other monomer causing N-terminal dimerization.

While the structure of Hsp90 is known, the molecular details of its enzymatic mechanism and client stabilization are not. My project seeks to gain a mechanistic understanding of the strap region of the N-terminal domain of Hsp90 via a variety of fluorine-19 and nitrogen-15 NMR relaxation experiments. This region has previously been studied using fluorescence, however initial MD experiments in the Spyracopoulos lab suggest tighter binding of the strap and different kinetics within the lid region of the N-domain. We probed this region using an 15N enriched single mutant (S3C) of the N-domain, and label S3C with a trifluoroacetonyl derivative (-CH2-S-CH2-CO-CF3). Our NMR studies allowed us to observe both the fast (picosecond to nanosecond) and the slow (microsecond to millisecond) timescale protein motions of the strap region. Our data shows no evidence of intrinsic slow motions of the strap in the microsecond to millisecond range, which suggests tighter binding of the strap than previous studies have shown.

Return to schedule

Join on Zoom

Developing selective inhibitors of Siglec-Sialic Acid interactions by targeting sialyltransferases

Summer Smyth, Emily Rodrigues, Matthew Macauley, Dhanraj Kumawat
Department of Chemistry, University of Alberta, Edmonton

A body's immune cells must identify "self-structures" from "non-self" to avoid autoimmune disorders, but cancer cells exploit this to prevent themselves from being attacked. Cancer cells heavily express a class of receptors called Siglecs. These Siglecs are expressed via the action of enzymes called sialyltransferases, with each enzyme corresponding to a Siglec. Once the sialyltransferase has been matched to a Siglec, we will utilize "metabolic oligosaccharide engineering" to add on chemical groups to sialyltransferase. This will identify which alterations prevent the enzyme's function, with the goal of preventing the expression of its corresponding Siglec. Flow cytometry is a technique which will allow Siglecs that have reacted with the inhibitory chemical to be identified by its fluorescence. The next step will be to incubate cells that have been treated with the chemical group and observe if the immune system, in particular natural killer cells, is able to identify it as "non-self".

Engineering Increased Expression of Human IL10 in *S. boulardii*

Laura O. Enekegho, David T. Stuart
Department of Biochemistry, University of Alberta, Edmonton

Probiotics are an attractive area of research that use live organisms to treat diseases. One of the most widely studied probiotics is the yeast strain, *Saccharomyces boulardii*. In vivo and in vitro experiments have demonstrated that this strain is effective against fighting inflammation in the human gastrointestinal (GI) tract. The effective probiotic nature of *S. boulardii* makes it an attractive host for the expression of therapeutic proteins to treat inflammation in the intestine. One agent is the human protein Interleukin-10, also commonly known as IL10. IL10 is a major immunoregulatory cytokine that plays a fundamental role in anti-inflammatory and immunosuppressive responses. Due to its effectiveness in treating intestinal inflammation, interest in the metabolic engineering of IL10 in the production of probiotics has been heightened. IL10 has been successfully expressed in *S. boulardii* before as a possible probiotic to treat inflammation in the gut. We propose the construction of a poly-protein version of the IL10 gene in *S. boulardii*. Engineering of this yeast system will allow for biologically relevant amounts of the IL10 protein to be secreted from the yeast cells, and allow for an improved probiotic to be produced in the future.

In the eye of the beholder: Examining the influence of arousal on emotion perception

Kayla Huxter, Anthony Singhal
Department of Psychology, University of Alberta, Edmonton

Have you ever felt so angry you could punch a hole in the wall? Or so happy that you could cry tears of joy? Emotional experiences, such as anger and joy, are part of our everyday lives. The purpose of this study was to examine whether an individual's emotional state influences the way that they perceive emotion in other people. Data were collected from 80 undergraduate students at the University of Alberta. Participants listened to a short music clip, aiming to evoke either depressed or neutral mood, and then evaluated photographs of tennis players who had just lost or won the match point (Aviezer et al., 2012). It was hypothesized that participants in the depressed arousal condition would rate the emotion of the images as being more negative (sad, depressed, angry) than participants in the control condition. The results of this study showed no significant differences between the experimental and control group on ratings of emotion or arousal. However, a reciprocal relationship between emotion ratings of faces was found between winning and losing images which suggests that there may be an influence of arousal on emotion perception. Understanding how our internal emotional state influences our perception of other people is important for fostering strong interpersonal relationships. Furthermore, gaining a better understanding of mood induction procedures is beneficial as these methods have the potential to be used therapeutically for individuals with anxiety and mood disorders.

Is Uncertainty a Threat or a Challenge? Effects on Group Identification

Jenna Blumhagen, Kathryn M. Kincaid, David E. Rast, III
Department of Psychology, University of Alberta, Edmonton

We live in an uncertain world. Feelings of uncertainty are aversive, thus people are motivated to reduce uncertainty. Joining or identifying more strongly with a group is an effective way to reduce uncertainty because groups give us a sense of belonging and prescribe how we should act, think and feel. In some situations, uncertainty may be perceived negatively as an anxiety-provoking threat, in others, it may be perceived more positively as an exciting challenge to overcome. Moreover, people may respond differently to uncertainty depending on whether it is perceived as a challenge or a threat. This research examined the effects of framing uncertainty as either a challenge or a threat on group identification. We hypothesized that under high uncertainty conditions, when uncertainty is framed as a threat, people would identify more strongly with a group than when uncertainty is framed as a challenge. A 2 x 2 between-subjects design was used to test this hypothesis. Results did not support hypotheses, instead when uncertainty was framed as a challenge, participants identified marginally more strongly with the University of Alberta when uncertainty was low rather than high. And, when uncertainty was framed as a threat, participants identified marginally more strongly with the Students Union when uncertainty was high rather than low. Results provide preliminary evidence for how group identification may be exacerbated or mitigated depending on how uncertainty is framed. For example, challenge appeals may be more effective if uncertainty is low and threat appeals may be more effective if uncertainty is high.

The Mental Health Implications of Remote learning

Yasmine Abdel Razek, Elena Nicoladis

Department of Psychology, University of Alberta, Edmonton

On March 11th, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic (World Health Organization, 2020). Since then, students around the world have shifted from in-person classes to remote learning. In remote learning, a student and educator are not physically located in a classroom and information is relayed through technology, such as a Zoom call on a laptop (Tophat, n.d.). Although remote learning is the pandemic's "new normal," students experience difficulties concentrating (89%) and increased concerns for academic performance (82%; Son et al., 2020). Similar to Son et al. (2020) the current study uses a survey to assess how student mental health has been affected by remote learning during the pandemic. Students are asked questions about remote learning, their mental health, and their COVID-19 related experiences. We also ask about socioeconomic status (SES), as it has been shown to be associated with a student's mental health and accessibility to resources. We predict that students with lower SES will have worse mental health and more negative remote learning experiences. Our preliminary analysis showed that 75 of the 91 students (82%) felt that remote learning has negatively impacted their mental health. In a thematic analysis of 41 student responses, students expressed loneliness and isolation (54%) and also anxiety towards many facets of remote learning (e.g. increased workload, deadlines, and Zoom; 22%). The results illustrate the aspects of remote learning that have impacted student mental health and provide insight on the ways that remote learning can be improved in the future. The results also demonstrate the positive aspects of remote learning, such as flexibility (18/44, 44%) and recorded lectures (6/44, 22%), which can be incorporated with traditional in-person classes in the future. This way, students with demanding work and life schedules or those with limited technological means can take part in a meaningful and accessible learning experience.

Return to schedule

Join on Zoom

White Matter Correlates of Dual Task Gait in Parkinson's Disease

Ipinuoluwakiye Fatokun, Myrlene Gee, Richard Camicioli
Department of Medicine, University of Alberta, Edmonton

Parkinson's Disease (PD) is a neurodegenerative disease that results in PD patients being more susceptible to gait and mobility issues compared to their cognitively intact (CIE) peers. Under dual-task conditions, where a patient is tasked with walking while simultaneously engaging in a cognitive task, some PD patients experience a much greater slowing of their gait measures relative to health controls. This slowing is known as dual-task cost (DTC) and has been correlated with cognitive deficits in older people. White matter hyperintensities are changes found on MRIs that signify regions of white matter damage in the brain. These changes have also been correlated to cognitive deficits in PD and CIE populations. In this present study, we examined the relationship between DTC and WMH volumes in a PD population that included a greater range of cognitive abilities.

As part of the multicenter CCNA COMPASS-ND study, participants underwent a series of evaluations to have their clinical (demographics, physical examination, and medical history), cognitive (clinical neuropsychology batteries), and neuroimaging data collected. Demographic information including sex, years of education, and duration of disease were considered possible confounds. A Framingham Cardiovascular Risk score was calculated for each participant to control the effects between cardiovascular health and WMH volumes. There were 17 CIE. Of the 56 PD participants of this study, 29 had PD without cognitive deficits, 15 had mild cognitive impairment(MCI), 12 were demented (PDD+ LBD) group, which combined the participants with PD with dementia and Lewy body dementia into one group. For gait measures, the average of three baseline walking speed was used, in addition to walking speed under 3 different verbal fluency tasks: counting backward by one, by 7, and naming animals. For WMH volumes, T1, T2, and FLAIR images were integrated to find the total WMH volumes along with left and right frontal, temporal, parietal, and occipital lobe volumes. These values were log-transformed for normality during analysis.

There were no significant differences between DTC among the groups overall however differences were found in the post hoc analysis. These differences were observed in the single and dual-task baseline speeds and DTC between the CIE and PD-MCI and the PD and PD-MCI groups. There was no significant difference between the total and regional WMH volumes between the groups of this study. The correlation between DTC and WMH did not reveal any consistent regional or global. In the PD-MCI group, the observed correlations were strong but negative. There was not a clear correlation established between DTC and WMH volumes within this study but the observed trends show promise for future studies with much larger sample sizes.

Mechano-Hypoxia Conditioning of Engineered Human Meniscus Fibrocartilage

David X. Li, Alexander R.A. Szojka, Malou E.J. Sopcak, Melanie Kunze, Aillette Mulet-Sierra, Samer Adeeb, Nadr M. Jomha, Adetola B. Adesida

Department of Civil and Environmental Engineering, University of Alberta, Edmonton

Department of Surgery, University of Alberta, Edmonton

Introduction: The knee menisci are partially avascular fibrocartilages with intermediate properties between fibrous tissues and hyaline cartilage. Avascular region injuries are non-healing and are linked to osteoarthritis development. Meniscus tissue engineering aims to generate fibrocartilage replacements with native meniscus-like properties. Here, we performed a series of experiments towards engineering the inner meniscus. We previously found that exposing engineered meniscus to physiologically relevant conditions of the knee (mechanical loading and hypoxia; hence, mechano-hypoxia conditioning) increased inner meniscus-related gene expression. However, only short-term treatment was investigated, and longer-term outcomes remain unknown. In experiment I, we hypothesized that mechano-hypoxia conditioning applied to engineered meniscus repeatedly over 5 days would also promote inner meniscus-related gene expression. During dynamic compression (DC) loading, tissues undergo stress relaxation which includes an initial viscous, fast-relaxation zone and a later elastic, slow-relaxation zone. In experiment II, we hypothesized that loading in the viscous, fast-relaxation loading zone was most important for inducing the gene expression response. Using lessons learned in the first two experiments, we then applied a large-scale automatic DC bioreactor for long-term mechano-hypoxia conditioning. We hypothesized that multiple daily instances of DC in the viscous, fast-relaxation zone under hypoxia would promote inner meniscus-like tissue formation.

Methods: Cells from partial meniscectomy surgical discards (3M/3F, 21-45y, n=3 donors/experiment) were pre-cultured on porous cylindrical type I collagen scaffolds for 3 weeks to form baseline fibrocartilage. In experiment I, tissues underwent DC (60 minutes, 30-40% strain) for 5 days under hypoxia or normoxia (3 or 20% O2) before RNA sequencing. In experiment II, tissues underwent one instance of DC (5 or 60 minutes, 10-20 or 30-40% strain, 1 Hz) before qRT- PCR analysis. In experiment III, tissues underwent DC (5 minutes, 30-40% strain, 1 Hz) applied automatically every six hours (4x/day) for 3 weeks in hypoxia in a large-scale bioreactor mechanical and histological analyses. Groups were compared by ANOVA.

Results: The 5-day mechano-hypoxia treatment in experiment I regulated >6,000 genes, increasing hyaline cartilage markers SOX9 (4-fold) and COL2A1 (10-fold) over static normoxia controls (both $p<0.001$). In experiment II, mechano-sensitive gene c-FOS expression was similar for 5 and 60-minutes of DC but was higher in 30-40 than 10-20% strain ($p=0.01$). In experiment III, all donors showed mechanical property development during the long-term mechano-hypoxia conditioning with the mean dynamic equilibrium modulus reaching 500 kPa (3-4x the baseline value). Tissues also contained the biomechanically functional matrix constituents of meniscus (types I/II collagens, sulphated proteoglycans).

Expression Analysis of Lignin related genes in *Picea glauca* (White Spruce)

Mohana Talasila, Colleen Fortier, Juan A. Aldana, Kate St. Onge, Janice Cooke

Department of Biological Sciences, University of Alberta, Edmonton

Picea glauca (white spruce) is an extensive keystone species in the boreal forests of North America, as it hosts diverse organisms. Monolignol biosynthesis is an important metabolic pathway in these species. It provides protection from environmental and mechanical stresses, and pathogen-pest attacks of Eastern Spruce budworm (ESB), in addition to its role in plant growth and development. In this study, the main objective was to putatively identify the genes that encode lignin biosynthesis enzymes in white spruce using sequence data and phylogenetics. The gene expression for these putative lignin biosynthesis genes was compared at different stages of needle budburst. Histochemical changes in the lignin deposition were observed during these stages, which coincide with the phenological window for feeding by the Eastern Spruce budworm, a major needle defoliator. Significant up and down regulation observed in few genes over the stages correspond to the budworm feeding window. The results indicate a distinct histochemical change in lignification pattern over the budburst and also in the differential gene expression of the gene families involved. Based on gene expression and its regulation at different budburst stages in the needles, CCoAOMT genes appear to have a more prominent change in its expression level. Primers for cloning have been designed and profiling of the identified putative genes with qRT-PCR will follow.

Determination of a novel model of the cytoplasmic (CT) domain of the HIV-1 envelope protein provides evidence that challenges the existing model of the HIV-1 matrix (MA) shell

Riya Mangukia, Joy Ramielle L. Santos, Weijie Sun, Eduardo Reyes-Serratos, Marcelo Marcet-Palacios

Department of Chemistry, University of Alberta, Edmonton

Background: Despite the discovery of type 1 human immunodeficiency virus (HIV-1) in the early 1980s, significant knowledge gaps remain in our understanding of the structure of the HIV-1 matrix (MA) shell. This MA shell is made of protein trimers and houses the viral capsid and RNA. This shell plays an important role in viral entry, a process by which a virus enters host cells. Understanding the structure of the MA shell will address the current existing knowledge gap but also increase our understanding of the mechanism of viral entry for HIV-1. Our research could potentially help create new drug therapies against HIV-1. Current structural viral models of HIV-1 assume the flat 2D structure of the MA shell is a hexagonal lattice, but this is inadequate. This model fails to resolve the overlapping of trimers that would occur when the membrane is folded into a sphere, the shape viruses normally are. It also fails to explain how the MA shell recruits the viral spike envelope (Env) glycoproteins to the viral membrane. These Env proteins are crucial as they facilitate viral entry by interacting with receptors on target cells. In a previous publication, we proposed a 6-sided spherical beach ball arrangement for the MA shell that lacked the presence of Env proteins in part because the complete structure of an Env protein has not been determined.

Objective and Methods: We therefore aimed to provide mathematical feasibility to the arrangement of MA shell trimers and their interaction with Env proteins. In this study, we generated the Env protein model using a combination of predetermined or predicated Env protein domains using predication software tools such as RaptorX and PEP-FOLD3. We validated the structure of the Env proteins using ERRAT and ProSA as well as cryoelectron tomography data.

Results and Conclusion: We then improved the previously proposed 6-sided beach ball model by incorporating Env proteins into the MA shell. Our new model of an HIV spherical structure comprises 1028 MA trimers and 14 Env proteins. Overall, our model increases the understanding of the mechanism of viral structure and challenges the previous structural model of the HIV-1 MA shell and Env proteins. Our model also predicts potential movement of the Env proteins within the plane of the viral membrane which could be a key part of viral maturation and entry into the target cell. Our work has increased understanding about the mechanism of viral entry for HIV-1 and the interactions that are occurring between the MA shell and Env proteins.

Inhibitory Effects of Ubiquitin Variants on the Salmonella Novel E3 Ligase, SspH1

Bradley Dubrule[1], Amit P. Bhavsar[2]

[1]Department of Cell Biology, University of Alberta, Edmonton

[2]Department of Medical Microbiology and Immunology, University of Alberta, Edmonton

Due to rising antibiotic resistance, it has become crucial to improve our understanding of pathogenic bacterial effectors to facilitate the development of novel treatment methods. SspH1 is a Novel E3 Ligase (NEL) secreted by Salmonella enterica serovar Typhimurium, a gram-negative bacterium, and the leading cause of self-limiting gastroenteritis. NELs are conserved enzymes that play a vital role during bacterial infection for many gram-negative bacteria. NELs subvert the host ubiquitin (Ub) system by facilitating the transfer of Ub onto host substrates leading to their modification or degradation in a manner which promotes bacterial invasion and survival. Previous studies have shown that SspH1 expression induces toxicity in Saccharomyces cerevisiae. Using modified ubiquitin variants (Ubv), which have a high affinity for SspH1, we aim to better characterize the function of SspH1 by suppressing SspH1 toxicity in a yeast model. In vitro assays demonstrate a growth suppressive property of SspH1, which is absent in the catalytically mutant SspH1C492A, and limited through co-expression of Ubvs. Additionally, SspH1 expression, but not SspH1C492A expression, delays yeast cell cycle progression. In silico homology protein modelling coupled with protein-protein interaction predictions suggest that Ubvs interact within the SspH1 catalytic site, indicating a possible mechanism for Ubv suppression. By furthering our understanding of the function of NELs in bacterial pathogenesis we hope to contribute to the development of novel antibacterial treatments.

Making Sense of "Antisense Therapy" for Spinal Muscular Atrophy

Esra Erkut[1], Tejal Aslesh[1,2], Rika Maruyama[1], Hong Moulton[3], Toshifumi Yokota[1]

[1]Department of Medical Genetics, University of Alberta, Edmonton

[2]Neuroscience and Mental Health Institute, University of Alberta, Edmonton

[3]Department of Biomedical Sciences, College of Veterinary Medicine, Oregon State University, Corvallis

Spinal muscular atrophy (SMA) is an autosomal recessive motor neuron disease characterized by the degeneration of motor neurons. This leads to progressive muscle atrophy and death in early childhood due to breathing complications. SMA is the leading genetic cause of infant death worldwide. It is caused by a mutation in the survival of motor neuron 1 gene (SMN1), which results in insufficient SMN protein levels and subsequent motor neuron damage. While humans possess a nearly identical copy of this gene (SMN2), it can only produce ~10% of the essential SMN protein due to a single base pair change. This change disrupts proper gene splicing, leading to the production of a truncated and non-functional SMN protein. Antisense oligonucleotide (AON) therapy has been explored for the treatment of SMA, wherein a short, DNA-like “molecular bandage” can bind to SMN2 and restore proper mRNA splicing, thereby increasing the production of full-length, functional SMN protein. Current AON therapies are delivered via an invasive intrathecal injection, which poses many limitations including bleeding complications. Additionally, these therapies are then limited to the central nervous system, however peripheral SMN loss may be contributing to the SMA phenotype as well. Accordingly, we have tested the systemic delivery of an AON (“PMO”) that has been conjugated to a cell-penetrating peptide (“DG9”) to improve the delivery and uptake into target tissues, with the goal of restoring SMN protein levels in both central and peripheral tissues. In this study, we have demonstrated that systemic AON therapy can improve survival and muscle function in a severe SMA mouse model. The administration of DG9-PMO led to a median lifespan of 58 days, as compared to 8 days for non-treated mice. Performance improvements on functional tests such as forelimb grip strength and righting reflex were seen for DG9-PMO-treated mice. Treatment was found to significantly increase full-length SMN2 gene expression and subsequently SMN protein levels in both central and peripheral tissues. SMN protein restoration was even comparable to healthy (non-SMA) levels in some tissues. Muscle pathology also exhibited improvements following AON therapy, as determined by a decrease in percent centrally nucleated myofibers and an increase in myofiber size. Furthermore, the addition of the cell-penetrating DG9 peptide significantly enhanced delivery of the PMO (two-threefold higher than PMO alone), thereby allowing for systemic SMN restoration and amelioration of many SMA symptoms. Preliminary results have demonstrated that DG9-PMO treatment did not elicit an excessive immune response nor significant organ toxicity. The overarching goal of this study is to develop effective and safe therapeutics for the treatment of SMA.

Return to schedule

Join on Zoom

Defining the Role of Caspases in the Human Brain

Longxiang Wang, Luam Araya, Olivier Julien

Department of Biochemistry, University of Alberta, Edmonton

Caspases are a family of proteolytic enzymes that regulate physiological responses, such as programmed cell death, through the cleavage of their protein substrates. Despite the fact that caspase-1 and caspase-3 activation have been demonstrated in a variety of neurological disorders, their substrates have never been characterized in the human brain. This study aimed to elucidate the downstream effects of inflammatory caspase activation in neuroinflammation.

We hypothesize to find new biological pathways, such as the proteolytic activation of Gasdermin D, identified over a decade ago through labelling procedures in cancer cells. Thus, we employ a similar "N-terminomics" labelling approach to identify caspase substrates in human brains. The direct enrichment of protein N-termini will be coupled with mass spectrometry technology to identify new cleavage sites in brain samples following treatment with purified caspases. As the experiment that identified Gasdermin D was performed over a decade ago, recent advances in LC-MS/MS resolution and sensitivity should allow us to detect many low abundance substrates, as well as those specific to the human brain. We optimized the expression of human caspase-1 and -3 in E. coli, purifying them via nickel affinity and gel filtration chromatography. The activity of these enzymes was tested using a multitude of approaches, including fluorescent-based assays and immunoblotting. We were also able to validate the proteolytic activity these caspases through N-terminomics experiments in Jurkat cells and human brain lysates.

We hope to identify novel caspase substrates and biomarkers of neuroinflammation in the brain. The identification of new caspase functions could extend to pharmaceutical interventions during sepsis, an inflammatory response responsible for the second most deaths in intensive care units.

Out of reach: barriers to accessing tele-healthcare amidst the pandemic

Peter Anto Johnson[1], John Christy Johnson[2], Austin Mardon[3]

[1] Faculty of Medicine and Dentistry, University of Alberta, Edmonton

[2]Department of Biomedical Engineering, University of Alberta, Edmonton

[3]Department of Psychiatry, University of Alberta, Edmonton

Introduction: The transition from conventional care to virtual care or telemedicine has permeated both primary care and specialist healthcare settings under the climate of imperative prophylactic measures in place to combat the global pandemic. In fact, advances in remote monitoring, increased patient safety, reduced risk of viral transmission, and convenience of virtual visits are all significant advantages, which have been enabled by telemedicine. Despite this however, many barriers that create disparity among patients have come to light due to the pandemic.

Methods: In this scoping review, we reviewed literature using MEDLINE, EMBASE, and Google Scholar databases to examine studies from March 2020 to present that highlighted health disparities emerging from the pandemic across North America conducted a qualitative synthesis of these findings. Keywords used in our search included: "socioeconomic", "barriers to health", "disparity","telemedicine", "telehealth", "virtual consults", and "vulnerable populations".

Results: We identified 21 studies pertaining to socioeconomic barriers in health. All included studies considered surveys or cohorts of clinical populations that used virtual care services. Of the studies reviewed, several demonstrated parallels to in-person healthcare access as a recurring theme (18/21), determining systemic racial factors (13/21), socioeconomic inequities (10/21), and limitations in rural access to care (8/21). Three studies determined the influence of generational gaps in digital literacy was a poor predictor of access to virtual care and two suggested geographical proximity was more closely associated with access to care. Studies, which have focused on economic status, reported patients with a lower median household income had decreased access to telehealth compared to middle- and high-income patients accessing telemedicine. Of the studies describing demographic factors, increasing age and male sex was associated with lower odds of accessing virtual care. It was also noted Indigenous, Asian, non-English speaking, and other ethnic minority groups were less likely to use virtual services as observed by trends in in-person healthcare. We noted these factors were complex and reflected structural systems, societal frameworks, and personal circumstances that access to virtual care did not address.

Conclusion: Although the use of telemedicine and virtual care during the pandemic has increased the accessibility of health services to the larger population, studies have suggested a sustained disparity among already vulnerable groups - perhaps owing to inherent systemic flaws already present in healthcare.

Association Between Sex and Mental Health Sequelae After ICU Discharge: A Scoping Review Protocol

Emily Marie Checkwitch, Lydia Antwi
Faculty of Nursing, University of Alberta, Edmonton

Background: Following discharge from intensive care units (ICU), it is common for patients to develop new or worsened physical, psychological, and cognitive impairments that affect their quality of life. Mental health impairments post-ICU include depression, post-traumatic stress disorder (PTSD), delirium, and anxiety, among others. Although mental health consequences affect more than 50 percent of ICU survivors, little is understood surrounding risk factors associated with this phenomenon. Previous studies suggest there may be a relationship between sex and post-ICU outcomes, but they have yielded inconsistent results. Moreover, the perception of stress and coping mechanisms, as well as longer-term effects of stress, appear to be sex-specific, with rates of post-traumatic stress disorder, panic disorder, and major depression being higher in women. Although the healthcare community is aware of such effects, the effect of sex and gender in these sequelae is unclear, and there are little evidence-informed strategies in place to alleviate these consequences.

Objective: The aim of our review is to identify and synthesize existing research evidence regarding the association between sex and mental health sequelae in ICU survivors, in an effort to inform future research and clinical practice. Specifically, we will investigate potential associations between sex and the incidence, severity, duration and type of mental health sequelae in adults after discharge from ICU. The secondary objective of this study is to highlight potential gaps in the literature and methodological implications for future study.

Methods: We will be using a scoping review methodology and the six step framework developed by Arksey and O'Malley with expansions from Levac to guide our study. We will be using peer reviewed, primary empirical research studies, descriptive observational studies and cohort studies. This includes English papers published within the last 20 years, with a primary focus on mental health sequelae from ICU discharge and sex differences. Further, using the Critical Appraisal Skills Programme, we will appraise and highlight the most relevant studies. We will extract data regarding author(s), year of publication, study location and ICU type, study design, aims/objective, participant characteristics, time since ICU discharge, presentation of mental health conditions, types of mental health morbidity, presence of adjustment of pre-ICU mental health conditions and other confounders.

Results: Preliminary results will elucidate potential effects of sex in mental health sequelae after ICU hospitalization, as well as to identify knowledge and methodological gaps and recommendations for future research and practice.

Conclusion: Following the completion of the review, we intend to disseminate our findings through publication as well as oral and digital presentation formats. We also intend to engage the public and ICU survivors through tailored presentations to increase awareness and advocacy. A brief will be shared with the Neurosciences, Rehabilitation and Vision Strategic Clinical Network (SCN), and the Critical Care SCN of Alberta Health Services to inform policies around prevention and rehabilitation of post-ICU mental health sequelae.

Assessment of Adherence to Perioperative Anticoagulation Interruption Guidelines in Patients with Atrial Fibrillation and Previous Stroke

Mujtaba Siddique, Asif Butt, Nazeem Sultan, Ashfaq Shuaib
Department of Medicine, University of Alberta, Edmonton

Introduction: Annually, 15% of patients who receive oral anticoagulation require interruption for surgery or an invasive procedure. This study evaluates the adherence of patients with atrial fibrillation (AF) with a history of stroke or TIA to the Thrombosis Canada perioperative guidelines for the discontinuation and reinitiation of anticoagulation treatment.

Methods: We collected data from a prospective patient survey at the Stroke Prevention Clinic in the University of Alberta hospital. Patients' charts were reviewed from the electronic medical records and adherence was looked at according to the Thrombosis Canada Perioperative guidelines for the interruption of anticoagulants.

Results: During the study period (2016-2019), there were 509 patients surveyed. Anticoagulation treatment was interrupted in 150 patients with 98 interrupted for surgical or invasive procedures. The interruption was adherent to guidelines in only 29 (29.6%) of patients and inappropriate or nonadherent in 69 (70.4%) patients. There were 7 ischemic strokes recorded during the period of interruption. The strokes were significantly more in patients where treatment reinitiation was in appropriately delayed (6/61 or 9.8%) compared to those who adhered to recommended re-anticoagulation guidelines (1/29 or 3.4%).

Conclusion: Our results indicate that significant discrepancy between the recommended perioperative anticoagulation guidelines is common in real-life practice. Delay in re-anticoagulation may increase the risk of complications.

Understanding the Role of DDX1 Expression in Neuroblastoma Response to Treatment

Jessica Bennett, Lei Li, Jack Wang, Roseline Godbout
Department of Oncology, University of Alberta, Edmonton

Introduction: Neuroblastoma is a pediatric cancer originating from neural crest cells and is the most lethal extracranial solid tumour in children. If the neuroblastoma is classified as "high-risk", over 60% of children diagnosed do not survive past age five. High-risk neuroblastoma is often associated with amplification (increased copies) of the MYCN oncogene. DEAD box proteins are involved in modification of RNA secondary structure and are involved in cellular stress response. Previous research undertaken by the Godbout lab indicates that the DEAD Box 1 (DDX1) gene is co-amplified with the MYCN gene in about 50% of high-risk neuroblastomas, and it may be possible that amplification or knockdown of the DDX1 gene in neuroblastoma cell lines could improve their survival following treatment with ionizing radiation (a DNA damaging agent).

Hypothesis: Based on the lab's prior knowledge of the role of DDX1, my hypothesis is that DDX1 knockdown will result in an improved cellular response to treatment, as DDX1 is known to play roles in cellular survival as well as in DNA double-strand break repair.

Methods: Neuroblastoma resistance to treatment was measured indirectly using the soft agar colony formation assay. This assay selects for cancer cells and colony counts can be performed to determine the efficacy of treatment. I am examining the effect of DDX1 knockdown on rate of colony formation in DDX1-amplified and non-amplified cell lines, both prior to and one hour following treatment with ionizing radiation, and the chemotherapy drug vincristine.

Results: Knockdown of DDX1 does not appear to have a definitive effect on anchorage independence. While DDX1 knockdown had no effect on colony formation in cell lines treated with the microtubule-inhibiting chemotherapy drug vincristine, DDX1 knockdown resulted in increased resistance to the DNA-damaging agent ionizing radiation.

Conclusion: Based on my results, DDX1 likely exerts some beneficial effects on cells with DNA damage, such as inducing cell death if it is unable to perform DNA repair. Alternative enzyme pathways may be upregulated in DDX1-depleted cell lines in order to facilitate DNA repair. Altering the levels of DDX1 could potentially increase the efficacy of radiation and certain chemotherapy drugs in neuroblastoma treatment, leading to a reduction in the mortality of infants and children diagnosed with high-risk neuroblastoma.

Effect of Irradiation on Cytosolic DNA Release in Colorectal Cancer Subtypes

Angie Chen, Shayla Mosley, Courtney Mowat, Kristi Baker

Department of Oncology, University of Alberta, Edmonton

Colorectal cancer (CRC) is the third most deadly and third most diagnosed cancer in Canada. There are two subtypes of colorectal cancer with the most common being the chromosome instable (CIN) subtype which contains chromosomal abnormalities. The other subtype of CRC, known as the microsatellite instable (MIN) subtype, is characterized by mutations in microsatellite regions due to mismatch repair deficiencies and typically has a better patient prognosis compared to CIN patients due to an increased anti-tumor immune response.

Our lab suspects that this increased immune response is due to the activation of the cytosolic DNA (cyDNA) sensing pathway cGAS/STING. Normally, cGAS/STING senses DNA entering the cell from pathogens such as viruses or bacteria; however, there are two endogenous sources of cyDNA, which are damaged DNA from the nucleus or mitochondria. We suspect that mitochondrial DNA (mtDNA) will be more stimulatory of cGAS due to its bacterial origin, thus the release of mtDNA may be important for the immune activation seen in MIN. Mitochondrial transcription factor A (TFAM) is an important protein for regulating mitochondrial DNA (mtDNA) stability and repair which could influence the release of mtDNA. Thus, we hypothesize that DNA damaging agents will cause an increased release of more stimulatory mtDNA into the cytoplasm due to dysfunctions in TFAM which will lead to an enhanced activation of the cGAS/STING pathway. This effect will be enhanced in MIN compared to CIN due to the deficiencies in DNA repair found in MIN. To model each subtype, specific genes were deleted using CRISPR-Cas9 in MC38 mouse CRC cell lines. **Δ**Mlh1 modeled MIN while **Δ**Kras and **Δ**Rad51 modeled CIN. Irradiation and 5-fluorouracil (5-FU) were used to induce DNA damage and observe changes in cytosolic mtDNA release via qPCR.

Results showed that irradiation led to an increased release of mtDNA while 5-FU treatment showed inconsistent responses. To test the stimulatory nature of mtDNA, ethidium bromide was used to deplete the mtDNA from the cyDNA in the cell. The mtDNA-depleted cyDNA was then used to stimulate vector control MC38 cells to observe the activation of downstream cGAS/STING immune pathways through western blot. Results showed that mtDNA was more stimulatory than nuclear DNA and that cyDNA from MIN cells activated cGAS/STING faster than cyDNA from CIN cells. Further evidence will be obtained through isolation of mtDNA for use in stimulations of vector control MC38 cells. This will test whether cyDNA that contains an increased proportion of mtDNA will increase cGAS/STING activation. TFAM investigation as a potential cause for the release of mtDNA after irradiation yielded inconsistent results upon protein expression analysis with western blots. Thus, further investigation on the importance of TFAM is needed through TFAM knockdowns. Though a TFAM truncation is commonly found in MIN patients, this was not seen in our cell lines upon Sanger sequencing. Through determination of the mechanism behind the increased immune activity in MIN patients, we can acquire knowledge that can be utilized for developing immunotherapy treatments in patients with CIN.

Return to schedule

Join on Zoom

Butyrate and propionate induce immune activation and apoptosis in DNA repair deficient colorectal cancer cells

Ilsa Bhatti, Courtney V. Mowat, Kristi Baker
Department of Oncology, University of Alberta, Edmonton

Colorectal cancer (CRC), which is one of the leading causes of cancer-related deaths and third most common cancer in Canada, can be divided into two major subtypes. There is the chromosomal unstable subtype, or CIN, and the microsatellite unstable subtype, MSI. The subtypes differ in their prognosis, with CIN colorectal cancers having an overall worse prognosis compared to MSI. These two subtypes also have differences in their responses to immunotherapy, and their immune landscape. These differences may account for the poor prognosis seen with CIN CRC compared to MSI CRC. MSI tumors are "hot" tumors, with increased infiltration of immune cells such as CD8+ T cells, contrasting with CIN CRC "cold" tumors. Previous literature has shown an association between T cell infiltration at the site of the tumor and better prognostic outcomes. In addition to this, changes in the profile of the gut microbiota have been linked with CRC, and these changes may influence immunity and immune cell recruitment and activation in the colon, suggesting a possible role of the microbiota in influencing CRC outcomes. One commonly observed change in the gut microbiome is a decrease in abundance of short-chain fatty acid (SCFA) producing bacteria. These bacteria are responsible for producing metabolites such as the short chain fatty acids butyrate and propionate. Therefore, we were interested in investigating if the differences between CIN and MSI CRC may be a result of altered SCFA production from changes in the abundance of bacteria in the gut microbiome, and so we investigated the effects of butyrate and propionate on CRC cells that modelled the CIN and MSI subtypes. We hypothesized that MSI CRC cells would be more sensitive to the G-protein coupled receptor mediated anti-tumor immune and apoptotic effects of butyrate and propionate compared to CIN CRC cells.

Our flow cytometry results showed that stimulation with butyrate and propionate can induce apoptotic cell death in CRC cells. This effect occurs most strongly at lower concentrations of the SCFAs. Stimulation with butyrate and propionate is also able to induce autophagic, and suppress pyroptotic, cell death pathways in CRC cells as shown through our Western Blotting analyses. However, there were no significant differences observed between the CIN and MSI CRC cells. Furthermore, quantitative polymerase chain reaction (qPCR) results indicate that the SCFAs cause an upregulation of cytokine and G-protein coupled receptor expression. These may be factors that contribute to enhanced T cell killing, as we observed increased activation of CD8+ T cells using flow cytometry after co-culture of the T cells with butyrate and propionate-stimulated CRC cells. Interestingly, MSI CRC cells are able to activate T cells more effectively than CIN CRC cells.

This research may present a possibility for butyrate and propionate to act as an avenue for adjuvant therapy in CRC, which may be applied to CIN CRC to improve patient prognosis, as butyrate and propionate may be able to trigger an anti-tumor immune response by interacting with their G-protein coupled receptors at the tumor microenvironment.

Thank you to ISSS and APIRG for supporting the Eureka 2021 Research Symposium.

