2020 Undergraduate Research and Innovation Conference Program and Abstracts

Note: The 2020 Undergraduate Research and Innovation Conference was cancelled due to COVID-19. This program includes the accepted poster and talk submissions that were submitted.

Contents

Class Posters

Exploration of Japanese Culture: MLAN 2700

The students of MLAN 2700 Field School Japan will create and present a poster outlining their research on various aspects of Japanese culture.

Faculty advisor: Cara Cadre, English and Modern Languages

Manuela Ceballos, Dylan Chapman, Arden Davis, Emma Duncan, Chelsea Harms, Bryant Low, and Zach Tucker. *PSYC 2110: Introduction to Research Methods*

Sleep deprivation interacts with time of day (circadian phase) to impair vigilance, reaction time, and higher cognitive processes. Previous research has shown that bright light, particularly at night, can have an immediate positive influence on subjective arousal, enhance alertness, and cognitive performance. For this assignment, students were supplied with hypothetical data that closely resembled data collected in 2010 for a study investigating countermeasures to drowsy driving. The hypothetical data represented RTs, collected using a psychomotor vigilance task, of fifty healthy, young volunteers who were randomly assigned to a night of sleep deprivation, or a night of sleep. RT was assessed for all participants under both bright light and dim light conditions on separate days. It was hypothesized that, overall, RT would be faster under the bright light condition than the dim light condition. RT would also be faster for participants who were rested compared to participants who were sleep deprived. In addition, we predicted that when participants were sleep deprived, bright light would improve RT compared to dim light.

Class Research Coaches: Taryn Coleman and Devon DeVries

Faculty advisor: Denise Weisgerber, Psychology

Debbie Bessa, Ashley Coss, Constance Cui, Karishma Dhanani, Jordan Elfstrom, Ben Philips, Jonas Roman, Molly Tonkin. *Fault Lines: Geography 2220,The Regional Geography of Canada*

With this poster project, each pair created a poster investigating one 'fault line' in Canada's Regional Geography. Fault lines refer to historic and ongoing socio-political tensions taking place in particular regions. Each poster explores the geographic dimensions of a particular fault line. With text and images, the students will convey complex politics and strategies for social change. The fault lines students have identified include Indigenous and Non-Indigenous relations, French-English tensions, and current and historic efforts to protect the environment.

Faculty advisor: Heather McLean, Geography and Environmental Studies

"North Now": ANTH 4040 Final Project Showcase

In this course we journey North – through the layers of meaning, power, politics, history, and representation that come together to form what we know as North. As we do, we are contemplating North as a landscape of (mostly southern) settler colonial desire upon which national-cultural interests are inscribed…North as resource rich. North as pristine wilderness. North as scape of adventure and self-discovery. North as beautiful. North as hostile and terrifying!

As we unpack these cultural representations and imaginaries, we're thinking too about those who for whom these same landscapes are home. We're thinking about the ways that settler colonial desires fold

northern Indigenous peoples into their narratives as either invisible (wilderness is unpeopled, after all) or hypervisible (as tragic figures, destitute communities, or alternatively iconic symbols).

Our goal in this showcase is to carve out a space where contemporary life lived in northern communities can be shared in its own terms. Where media representations of tragedy or hardship are contextualized. Where environmental issues are fleshed out and all ways of knowing and being are honoured.

In this showcase of our final projects, we invite our TRU community to journey North alongside us, reflecting on what we imagine North to be, where this information comes from, what it gets used for, and how we can challenge the ways that settler colonial power relations are reenergized through them.

With gratitude,

Winter 2020, ANTH 4040 Class.

Faculty advisor: Lisa Cooke, Sociology and Anthropology

Cheyanne Abbott, Faith Acquah, Adewale Adewole, Dani Aguilar-Aroche, Nathaniel Bounds, Won Hyang Cho, Laurie Denomme-Chretien, Jeffrey Diment, Nicholas Eccelston, Tiancheng Guo, Kassidy Herrick, Shekinah Jimenez, Justin Kamata, Tate Larson, Beth Lucier, K Malloy, Talia Mortimer, Marie Navratil, SamuelNeilly, Alex Nitereka, Kaylea Prosser, Joshua Rhoes, Poornima Satish, Sydney Schmidt, Tristan Semeniuk, Kendelle Thomas, Jacob Toews, Tapiwanashe Warara. *Sidewalk Snow Clearing Research Project: Walkability and Urban Sustainability in Kamloops, Geography 1100*

Kamloops promotes itself as an environmentally, socially, and economically sustainable community. Being environmentally sustainable includes the ability to walk from place to place easily; however, in winter, snow and ice can inhibit walking. If sidewalks are cleared, one can easily walk in winter and can therefore say that Kamloops is environmentally sustainable. The purpose of this project is to observe how well snow and ice is removed from sidewalks by residents, who are responsible for clearing them. This research involves making repeat observations of snow being removed from the same residential sidewalks. The study is also an exercise to practice research skills in Geography 1100 (Introduction to environmental studies and sustainability). Through the financial support of the TRU Research Office, a senior student has been hired as a Research Coach to assist students with organizing and presenting their research findings. Tentative results are that some residents consistently clear sidewalks immediately after a snowfall --some of them also appear to clear their neighbours' sidewalks. Other residents remove snow a number of hours after it has fallen. Some people seem to ignore shovelling when there is a light, wet snowfall due to rapid melting. Elevation and degree of exposure to the sun affects how much snow needs to be removed and how often. The principal conclusion is that inconsistent snow and ice removal on residential sidewalks produces a patchwork of poorly connected paths that makes walking a challenge, and thus decreases environmental sustainability.

Class Research Coach: Raelene Mahon

Faculty advisor: Tom Waldichuk, Geography and Environmental Studies

Damilola Abiyo, Glory Amukamara, Ols Buta, Yu Cao, Haonan Deng, Nolan Fenrich, Ryuki Furata, Akash Ghosh, Takaya Hirose, Makato Iida, Marie Gabriela Jimenez, Rahab Kariuki, Jihoon Kim, Ziangzhong Kong, Dion Maborekhe, Kosuke Masunaga, Tirth Panchal, Dipak Parmar, Gurpreet Puar, MD Majharul Islam Sabuj, Rutong Shi, Sakina Shikama, Surkamal Singh Jhand, Quian Wang, Dawei Xu, Fengyi Yang, Mengyao Zhu. *Introduction to Community Service-Learning (SRCL 1000)*

Introduction to Community Service-Learning is a general elective open to first to fourth year international and domestic students from a variety of disciplines across campus. Every fall and winter semester each student volunteers at one of 30 local not-for-profit organizations for a full semester. Students are required to complete 24 hours of service as part of their course work. In this poster session, 16 not-for-profit organizations will be represented by 27 SRCL 1000 students. They will demonstrate personal reflections on their service experiences, how their experiences connect to the course work and their organizations, and what they will take back to their own communities after the course is over.

Students representing the following Kamloops not-for-profit organizations:

Active Care Services: Nolan Fenrich

St. John Ambulance: Damilola Abiyo and Ryuki Furuta

Overlander Residential Care: Glory Amukamara

Ponderosa Lodge: Rahab Kariuki

The Kamloops Food Bank: Yu Cao, Surkamal Singh Jhand, Xiangzhong Kong and Ruotong Shi

The ReStore -- Habitat for Humanity: Dion Maborekhe, Fengyi Yang and Haonan Deng

Kamloops Immigrant Services: Dipak Parmar

Maple Leaf School: Qian Wang and Mengyao Zhu

BC SPCA: Dawei Xu

TRU Sustainability Office: Akash Ghosh, Takaya Hirose, Jihoon Kim and Kosuke Masunaga

TRU Horticulture: Ols Buta

Holly Andres, Chloe Bozak, Danny Bunting, Ishwary Chaudhary, Morgan Chave, Padma Ghimire, Bailey Johnson, Marie Kaluza, Vanessa Mafabi, Thomas McKillop, Shay Paul, Jayda Renner, Emily Rogan, Kayla Rosette, Maegyn Seibel, Mikayla Supeene. *SOCW 2120: Improving Social Welfare in Canada: Every Concern Counts!*

Students are introduced to the Canadian welfare state and learn how to make social services more responsive to human needs. On each poster, students briefly summarize the history of the selected social welfare policy concern and describe how it is relevant to social welfare in Canada. Students also provide a general description of the key historical milestones related to the selected concern, target population, and geographic location. Each poster outlines key reasons why the concern is not yet addressed and think critically on what should be done to set things right using the A-word to address the selected social welfare concern.

Maegyn Seibel, Bailey Johnson, Danny Bunting:

Availability of Psychiatric Support for Vancouver's Downtown Eastside

Kayla Rosette:

Accessibility of Affordable Housing for Low-Income Families in Vancouver, BC

Shay Paul:

Accessibility to Food in Northern Ontario for First Nations Communities

Mikayla N. Supeene:

Accessibility of Culturally appropriate Mental Health Services for Transracial Adopted Youth in Canada

Vanessa Mafabi:

Accessibility of Proper Caregiving Services for the Elderly in Canada.

Morgan Chave:

Accessibility to school-based mental health services in British Columbia

Thomas McKillop:

Availability of Adaptive Adventure Sports in the Bow Valley

Marie Kaluza:

Adequacy of Culturally Sensitive Maternity Care for Immigrants in Canada

Emily Rogan, Chloe Bozak, Holly Andres:

Accessibility of Primary Health Care for Women in Nunavut

Jayda Renner:

Affordability of Cognitive Behavioural Therapy in B.C

Ishwary Chaudhary, Padma Ghimire:

Affordability of Nutritious food in Nunavut for Single parents

Faculty advisor: Oleksandr Kondrashov, Social Work

Talks

Ashley Salmen. Mental Health Stigma in Emergency Responders

The overall all purpose of this research is to address the lack of assistance with stigmas that surround the mental and emotional health issues emergency responders experience on a daily basis. These health issues can culminate in burnout and compassion fatigue, which can lead to Post Traumatic Stress Disorder (PTSD). The research methods drawn upon for this presentation are articles written by retired paramedics and advocates for occupational health and safety. As suicide rates rise each year, it must be concluded that there is not enough being done to help emergency responders. It is clear there is also a distinct lack of research into the long-term effects on today's emergency responders verses the short-term effects from events such as war and natural disasters. The research on which current systems are based is out of date and does not address the current long-term traumatic stress issues that emergency responders experience. Therefore, it is evident that our emergency responders mental and emotional health is overlooked because there are not enough available support systems in place that allow them to feel safe and supported.

Faculty advisor: Tara Chambers, English and Modern Languages

Raelene Mahon. Stolen Lands and Broken Promises: Settler Colonialism and the Making of British Columbia

British Columbia finds itself in a unique position relative to other provinces in Canada regarding Indigenous land rights. Due to a lack of Treaties (with the exception of the Douglas Treaties on the island and the overlap of Treaty 8 in the North-East) and a rushed reserve system, BC finds itself at a particular confluence of land rights, resource extraction industries, and capitalist economic development initiatives. With the territory being unceded and increasing pressure from the UN to improve the treatment of Indigenous peoples, moving forward Indigenous-Settler relations are at the forefront of provincial and national concern. In this presentation I will examine settler colonialism as a fundamentally land-based process rooted in the continuous dispossession of Indigenous peoples from land. This project will review the history of Indigenous-Settler relations in BC as it relates to land by exploring the history of settlement, the creation and persistence of legislation including Treaties, and the Indian Act and Reserves, all as technologies of power and tools of cultural oppression and erasure. Understanding the complex history of Indigenous-Settler relations in BC is key in developing successful approaches to meaningful and impactful strides in reconciliation as well as developing a political climate of equality, trust, and respect. Utilizing shared Indigenous perspectives, I aim to present potential means by which such strides may be achieved with special consideration of how we as a province, and ultimately a nation, may move forward together, improving and ultimately strengthening Settler-Indigenous relations.

Faculty advisor: Lisa Cooke, Sociology and Anthropology

Jeanne Albutra and Alexzandra (Sasha) Anzulovich. Research Coaching: Learning While Peer Mentoring in an Introduction to Social Welfare in Canada Course

Research is a process that can foster self-directed learning, encourage application and creation of knowledge, and promote creativity and innovation in any discipline; however, the idea of 'doing research' may be intimidating and overwhelming for students. There might also be misconceptions about who and what research is relevant to. TRU addresses this issue by offering the Research Coach

program; upper-level undergraduate students work with professors and connect with the professors' first and second year students to guide them through the research process and class projects. The Bachelor of Social Work student presenters are research coaches for SOCW 2120, Introduction to Social Welfare in Canada. Students in this course are to identify Canadian social welfare concerns and specific affected geographical locations and groups of people, and propose possible evidence-based solutions. With the professor for this course, the research coaches will help students identify and explore social welfare topics they are passionate about, develop research questions, find appropriate scholarly sources, access academic supports on campus such as the Writing Centre, and share their research findings in various ways. Research peer mentoring will benefit the students in the class gaining research experience, as well as the research coaches who will develop effective mentoring skills and improve their interpersonal communication skills as they help build students' confidence in doing research. This presentation will focus mainly on the research coaches' growth and learning gained from being a research coach, which could be helpful for the developers of the Research Coach program and future research coaches.

Faculty advisor: Oleksandr Kondrashov, Social Work

Jordan Motruk. The Impact of High Intensity Exercise on Carotid Artery Longitudinal Kinetics

Longitudinal kinetics (LOKI) describe the bidirectional movement of the inner lining of arteries. With each cardiac cycle an anterograde movement occurs in early systole, followed by a retrograde movement later in systole and a second anterograde movement in diastole. Prostaglandins are powerful local vasodilators and availability is reduced with ibuprofen (IBU) administration. Our aim was to determine the impact of high intensity cycling exercise and concurrent prostaglandin inhibition on longitudinal displacement. A ramp incremental test on a cycle ergometer was used to determine VO_{2max}, ventilatory threshold (VT) and respiratory compensation (RC) points of participants. An intensity of 33% of the difference between VT and RC was calculated for subsequent trials. On two separate days, participants either ingested IBU or echinacea (control) two hours before testing. Testing began with a 5-minute warm-up immediately followed by 45 minutes of the high-intensity exercise. Three 5-s ultrasound video clips of the carotid artery were obtained immediately before, after and 45 minutes after testing. We used speckle tracking software to analyze longitudinal movement of 4-10 cardiac cycles. A 2-way RM-ANOVA was used to assess differences between conditions at the various time-points. There was no significant difference between conditions, but exercise reduced LOKI immediately and 45 minutes after testing (Pre: 11.8 Â± 3.2 Post I: 9.3 Â± 1.7, Post 45: 9.4 Â± 2.2, $p < 0.01$). This suggests that complex interactions between sympathetic nervous activity, shear and cardiac dynamics alter longitudinal movements; however, more comprehensive analyses of anterograde and retrograde movements need to be assessed.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Gabrielle Dagasso. Determining Fusarium Head Blight Resistances in Bread Wheat Using Genome-Wide Association Studies

Wheat is a staple crop and an integral part of the world economy; however, these crops are frequently threatened by FHB, a fungal disease. Genome-Wide Association Studies (GWAS) is a powerful computational approach to identify the causal relationship between genetic single nucleotide polymorphisms (SNPs) within a species and the phenotypic differences between individuals of the same

species. In this study, we apply different GWAS models to identify the linkage between wheat SNPs and Fusarium Head Blight (FHB) resistance and to identify the best GWAS models.

The Genome Association and Prediction Integration Tool is used in this study. Associations are predicted with three statistical models, general linear model, mixed linear effects model (MLM), and the multiple locus mixed effects model (MLMM), taking into account the covariance between individuals by feeding in a k-matrix. Shell scripts were then developed to obtain the most common and significant SNPs for each phenotype with multi-year data and across the statistical tests for each phenotype.

Some of the resultant QQ-Plots do not show that the model fits the data well; however, this is due to the fact that the 90k SNP array only detects SNPs in "preselected" genomic regions that have a higher likelihood to be associated with traits of interest without including any irrelevant positions. Overall, the MLM and the MLMM fit the data best.

In the future, we will incorporate phenotype data that is being evaluated from greenhouses for the current season and will use other GWAS programs in order to verify and compare significant SNPs found.

Faculty advisor: Lingling Jin, Mathematics and Statistics

Deanna Brady. A History of Dispossession: An Analysis of Indigenous-Settler Relations in the Secwepemc, Nlaka'pamux, and Syilx Territories of British Columbia

The piece of land which we now refer to as British Columbia was first the home of a multitude of Indigenous cultures, territories, languages, and people. Throughout history, the British Crown referred to this land as Terra Nullius, meaning empty land. There were treaties made on Vancouver Island, but the majority of the province remains unceded in reference to Indigenous title to land. Yet, here we are in 2020 with colonial civilization flourishing. How we got here, specifically in the Interior region of BC, is my research question. I investigate this topic by focusing on the relationship between newcomers and Indigenous peoples. In the Interior of BC, the relationship between Indigenous peoples and newcomers has changed over time. What was once a mutually respectful relationship quickly became lacking of everything a trusting relationship requires. When explorers such as Simon Fraser came to the Interior, he wrote of amicable interactions with the Nlaka'pamux people in the Thompson Region. Further explained in the Sir Wilfrid Laurier Memorial, fur traders were also experienced similar interactions in this territory and surrounding nations. However as other whites, including settlers and miners, began encroaching on Indigenous land, their relationship began to change. In this presentation, the relationship between newcomers and Indigenous peoples from these territories are analyzed in order to understand why the Interior of British Columbia remains unceded.

Faculty advisor: Tina Block, History

Sage Raymond. Using Novel Methods to Assess Instream Movement of Migrating Western Toads

Western toads are a species of conservation concern in BC; they participate in numerous ecological processes, act as an indicator species for ecosystem health and are in decline throughout much of their range. Understanding western toad movement is an important component of toad ecology and conservation; a historically overlooked element of toad migration has been instream movement. I studied the instream movements of a regionally and provincially significant population of western toads at Summit Lake, BC. I established used Fyke nets within streams to capture toads; this is a novel

methodology for toad capture that has thus far only been employed in two studies, both of which occurred in Montana. I successfully captured toads in all non-larval life stages. A notable finding was the capture of a considerable number of toadlets involuntarily moving downstream during attempted migration to upland habitat. The high success rate in capturing toads and toadlets using Fyke nets suggests that there are many potential conservation applications for this methodology.

Faculty advisor: Nancy Flood, Biological Sciences

Sage Raymond. Grizzly Bear Behavioural Changes in Response to Sudden Fish Decline in an Interior Salmon System

Landlocked kokanee salmon are an important food source for grizzly bears in the Lardeau River Valley. A local bear-viewing company has been collecting citizen-science data on grizzly bear sightings since 2012. Following a catastrophic decline in kokanee numbers, bear activity in the valley has changed in space and time. In this study I combine kokanee enumeration data collected by the provincial government and bear sighting data collected by citizen scientists in order to evaluate the impacts of a changing salmon population on bear activity and behaviour. I found that, while grizzly bears have the dietary plasticity to change their habits in the short-term, their predator-prey relationship with salmon is important for continued success in the Lardeau River Valley. The results of this study are relevant given ongoing climate change and salmonid crashes within grizzly bear range.

Faculty advisor: Nancy Flood, Biological Sciences

Stefano Stamato. Overview of Technology Use Against Illegal Fishing Using AIS Data

This presentation explores the issue of illegal fishing under the scope of Social Network Analysis. Illegal, Unreported and Unregulated (IUU) fishing is a criminal industry estimated to account for over 10 billion dollars annually, and plays a large part in the excessive exploitation of fish stocks around the world. Research has been conducted on this matter, and researchers are now able to assess suspicious activity at sea by analyzing data from the Automatic Identification System (AIS) and cross-referencing that information with other sources, such as Synthetic Aperture Radar (SAR) imaging. However, even with the success of these technologies culminating in vessel apprehensions by law enforcement agencies, the infrastructural impact this entails is dwarfed by the profits obtained from these activities. One of the factors contributing to the difficulty in end-point monitoring for marine products of illegal origins is the use of transshipment vessels. These collect products from both legal and illegal fishing vessels and transport it to ports with more lax regulations, where they can offload their untraceable cargo into mainstream markets and generate profits for the illegal organizations that coordinate these operations. This presentation proposes that we analyze the network of transshipment vessels in the ocean by visualizing it under the scope of Social Network Analysis. We create a social network graph from the vessels at sea, and define the connections between them according to encounters between these vessels. By visualizing the vessels in this manner, we can infer which are likely to be used for transshipment purposes. Determining these interactions between vessels could provide useful information to aid law enforcement efforts around the world in understanding the structure of the illegal organizations profiting off of these activities, and contribute to a data-driven approach in combating these operations worldwide.

Faculty advisor: Andrew Park, Computing Science

Ryan Ficocelli. Computer Model of Police Control of Large Event Egress

The research presented uses agent-based modelling and simulation to create a model of event attendees leaving an outdoor event. The specific event modeled in the simulation was the Celebration of Lights in Vancouver, British Columbia, which has been known to have over 1.4 million people attending. With this many people attempting to leave an area at the same time, public officials need to plan for the bulk movement of these individuals in order to assure an orderly and timely exit from the event. The crowd modelling software includes crowd agents that are attempting to leave the event, and police agents that both block crowd agent movement and give directions for alternative routes to take. The research compares different deployments and strategies that could be utilized to help with the event egress in a virtual environment that models the Celebration of Lights.

Faculty advisor: Andrew Park, Computing Science

Rowan Froese, Steven Lapointe, Connor Millar. The 'Happy City' Panel -- Kamloops and the Urban Ideals of Charles Montgomery

For a Local Government in Canada course, students are required to write three separate papers contrasting the ideals and analysis of Charles Montgomery's ***Happy City: Transforming Our Lives Through Urban Design*** with their lived experience and observations on the City of Kamloops. The papers contrast Kamloops with the happy city ideals, examine the potential to adopt alternative design models, and compare the 'happy city' project with planning initiatives by the City of Kamloops. Panelists will present their assessments of Kamloops as a "happy city" with proposals for the best alternatives in advancing towards this ideal. As the moderator for the panel, I will quickly and briefly lay out the happy city ideals of Montgomery -- and panel presentations by students will focus on their individual assessments and preferred alternatives for making the City of Kamloops a happy city.

Faculty advisor: Terry Kading, Political Studies

Bronwen Evans. A Consolidation Algorithm for Fractionated Genomes Without a Reference

After a genome duplication event, genes are deleted essentially at random from duplicated regions in a process called fractionation. This fractionation of the genome can lead to overestimation of the evolutionary distance between species. Software to identify these regions and correct for the distortion caused by fractionation is available, but it relies upon an "ancestor" genome which did not experience a duplication event for reference. This means that the distortion cannot be corrected for some species when a reference genome is not available. To gain a better understanding of the evolutionary history of these species, we are developing software to identify fractionated regions with a consolidation algorithm that does not require a reference genome.

Faculty advisor: Lingling Jin, Computing Science

Aaron Brandoli. Good City Principles: A Case Study of the Mission Hill Neighbourhood in Vernon, BC

This presentation reports on results from ongoing research seeking to answer the following two research questions: First, what are the key planning principles proposed in the sustainability, livability, age friendly and smart growth literature that should be adopted in order to enhance the physical and mental well-being of suburban residents? Second, how does the Mission Hill neighbourhood located in Vernon, BC -- a typical, mature, suburban community, fare with regard to those "good city" principles?

The complex nature of the socio-economic composition and behavioural organization of the Mission Hill neighbourhood is captured through the analysis of key indictors from the 2006 and 2016 Canadian census, and through observations conducted at various times over three days of field work. Following the comparison of the outcome from the empirical analysis with the list of good city principles, preliminary results reveal that access to public transit; walkability and other mobility issues; housing affordability, quality and diversity; the quality of the physical and social environment; and perceptions of safety, are some of the key issues facing residents in this neighbourhood. Five recommendations are proposed to address these concerns.

Faculty advisor: Gilles Viaud, Geography and Environmental Studies

Maria Clara Batista de Sousa. Challenges and Opportunities of RMG Exports to Brazil

This presentation compiles information about the ready-made garment Industry in Brazil. In addition, it showcases an interpretation of an International Business point of view on challenges and opportunities faced by one of the biggest economies of South America and the world. The relationship between Brazil and Bangladesh, weaknesses on the economy of scale system, the taxation barriers, and recommendations on how to overcome challenges and build profitable businesses in this market are foremost topics. Within analytical details from official government sources, data on the chain of garments production (factor endowments) had a decrease in the initial textile industry but ultimately an increase in the garment industry. The research and its uniqueness helps potential investors and companies to understand the prospects of Brazil, as very little data on this subject is found online, especially in English, which often impedes the acknowledgement of the Brazilian economy's capability.

Faculty advisor: Muhammad Mohiuddin, Business Administration

William Primrose, Adrian Batista. Effects of High pH at Near-ambient Temperature on Decomposition Rate Kinetics of Xanthates in Mining Waters

Xanthates are a class of compounds used in the mining industry to bind to metals within ore samples as a way to collect the metals for further refinement. How pH conditions for a given solution of xanthates that would be representative of a real sample in an industrial setting (such as a flotation tank or a tailings pond) affect rate kinetics has been studied previously; however, the surface has only just been scratched. Optimizing pH values for the best rate kinetics near ambient temperature for an industrial process remains an unsolved problem. The primary method for analysis was headspace Gas Chromatography-Mass Spectrometry (GC-MS). Previous work by this group looked at two xanthate species; in this study, samples of five different xanthates in high pH solutions were analyzed by testing for the generation of carbon disulphide (CS2) gas at specific time intervals. The five xanthates studied were: potassium amyl xanthate (PAX), potassium butyl xanthate (PBX), potassium ethyl xanthate (PEX), potassium isopropyl xanthate (PIPX), and sodium ethyl xanthate (SEX). Optimal pH level for the rate of xanthate degradation was studied and the rate constants at these pH levels were compared. The column temperature was set to 33 ÂºC by the GC-MS instrument and pH was controlled by the addition of sodium hydroxide. Stabilization or destabilization of the xanthate decomposition shows a measurable change in the evolution of CS2 gas. This change is calculated and helps to determine the positive or negative effects of a given pH level. By controlling pH as well as temperature, better insight into the nature of these compounds may be elucidated.

Kingsley Donkor, Chemistry

Jinghan Tan. Analytical Study of Epicatechin Levels in Green Tea from Different Geographical Origins using Ultraviolet Spectrophotometry

Epicatechin is a type of natural phenol and antioxidant, and it is a secondary metabolite found in green tea. Some research suggests it has a neuroprotective function because it is able to pass through the blood-brain barrier and activate the brain-derived neurotrophic factor (BDNF) pathways. In this work, UV-Vis spectrophotometry was used to quantify the levels of epicatechin in the tea samples. The result obtained were used to compare the amounts of epicatechin in up to 20 different brands of green tea from different geographical origins. Various experimental conditions such as different water types for making the tea, temperature and time used for the tea and sugar additives were also investigated to determine their effect on the levels of epicatechin in the green teas. The precision, accuracy, and sensitivity were determined to validate the method. Principal component analysis (PCA) was employed to discriminate green teas in order to test the hypothesis that there is a difference of epicatechin level in green teas which grow in different geographical origins.

Faculty advisor: Kingsley Donkor, Chemistry

Mixon Madland. Effect of Sports Training on Visual Processing in Peri-hand Space

The area immediately surrounding the hand has been shown to give rise to alterations in visual perception. This area is referred to as peri-hand space. When viewing objects in this area, studies have shown that people are slower to look away from objects and faster to detect new objects compared to objects that are not in peri-hand space. Studies have shown that practice with visuomotor skills enables the brain to become more plastic and strengthens the brain areas used, such as: the optic nerve, motor cortex, parietal cortex, superior frontal gyrus, posterior cingulate cortex, and the postcentral gyrus. As such, we hypothesize that athletes will have greater visual processing alterations when viewing objects in peri-hand space compared to non-athletes, due to the refinement of the previously mentioned brain areas that results from extended practice.

We will test this by having a group of athletes and a group of non-athletes perform a visual search task where they have to identify a target image amongst an array of distractor images while wearing an eyetracker. We expect that athletes will be quicker to react to objects presented in their peri-hand space, that they will take longer overall to complete the task, and that they will be more accurate than the control group. If we find significant results, this will provide insight into how visuomotor experience might alter visual processing near the hand.

Faculty advisor: Jenni Karl, Interdisciplinary Studies

Ryan Maddeaux. Student Homelessness and Housing Insecurity at Thompson Rivers University: A Quantitative Study Focused on Housing Issues Among the TRU Student Body

Homelessness and housing insecurity are issues that have been researched extensively regarding the general population and the K-12 student; however, these issues are under-researched regarding post-secondary students. The existing research includes studies mostly conducted in the United States with limited research being conducted in Europe; furthermore, the existing research has determined that student homelessness and housing insecurity negatively affect the outcomes of a student's academic experience. These studies have concluded that student homelessness and housing insecurity are significant issues that require further research to develop new plans of action. In April of 2019, I began a quantitative research study focused on determining the prevalence of student homelessness and

housing insecurity at TRU. As little was known related to the extent of these issues on the TRU campus, we decided that a straight-forward questionnaire with closed and open-ended questions was the appropriate method to obtain the information that we required. This presentation will briefly discuss some of the background on these issues and the existing research, will discuss the findings of the current research study, and will offer some analysis on the importance of the issue and the results of study.

Faculty advisor: Dawn Farough, Sociology and Anthropology

Kate Greffard. A Deep Dive Into Paper Cuts

Paper cuts are an everyday inconvenience; they are nothing special, nothing new. But have you ever stopped to consider the microscopic war your body wages every time the skin is broken? This creative non-fiction essay explores the immune response launched by the human body to protect itself when exposed to a world crawling with pathogenic predators. From that first sharp pain of a sheet of paper slicing through the skin, to the destruction of pathogens by white blood cell warriors, our immune systems must always be up to the task of protecting us.

Faculty advisors: Lyn Baldwin and Matt Reudink, Biological Sciences

Guillermo Garcìa Díez. Theoretical Study of the Secondary Antioxidant Activity of Aminoguanidine

Glycation (or nonenzymatic glycosylation) is a natural process in which sugars in the bloodstream attach to nucleophilic groups present in proteins, lipids or DNA, forming harmful new molecules. In turn, these can further react to form advanced glycation end-products (AGE), which may lead to a wide arrange of diseases. The main mechanisms to inhibit glycation are believed to be the scavenging of carbonyl and radical species and the chelation of metal ions such as Cu(II) and Fe(III), which increase the formation of AGEs. Aminoguanidine is known to be a glycation inhibitor. Its free radical activity has been recently studied.

A systematic study of the thermodynamic stability of various Cu(II) and Fe(III) complexes with aminoguanidine (protonated and neutral) is carried out at physiological pH in a polar environment. Calculations are performed at the M05/6-31++G(d,p) level of theory combined with the SMD continuum solvation model. We aim to identify the most thermodynamically stable complexes and to explore the secondary antioxidant capacity of aminoguanidine.

Aminoguanidine is said to have secondary antioxidant capacity if, by forming a complex with Cu(II) or Fe(III), it can slow down the initial step of the copper- or iron-catalyzed Haber-Weiss reaction and reduce the potential damage caused by $^{\bullet}OH$ radical formation in the second step (the Fenton reaction).

Faculty advisor: Nelaine Mora Diez, Chemistry

Hailey Stevens. The Countdown: Racing Against Cancer

The ultimate constraint that we face in life is time. We are constantly trying to beat the clock and finish everything before the alarm goes off. In this creative non-fiction essay, I tell the story of Michael Fraser during his final months of life. A family man, Michael wanted nothing more than to watch his family grow; however, once he was diagnosed with sinonasal undifferentiated carcinoma, a rare form of cancer, his entire perspective was shifted. Yet, instead of choosing to feel sorry for himself, he chose to use any small victories that he could and keep on living until the very end. The purpose of this essay is to

not only celebrate Michaels courageous journey, but to delve into the complex nature of cancer. By exploring the biology behind cancer, this essay grapples with cancer's complexity and devastating beauty. This is not a story I ever thought I would be telling, but I am grateful to be given the ability to share it with others.

Faculty advisors: Lyn Baldwin and Matt Reudink, Biologial Sciences

Ian Paluck. Peter Pan: The Boy Who Tried to Grow Up

The research presented on Peter Pan offers and introspective look into one of the key elements of children's literature. Maturation. Children's literature often tries to express societal expectations of children as it relates to the process of maturation; however, if this is true, how is Peter Pan relatable? How can Peter experience maturation when he is encapsulated in a perineal state of childhood? These questions were the basis for the research, and they are the questions that will be answered throughout the presentation.

On this surface this story seems to be about a child who will never grow up; however, the evidence through close textual analysis suggests that Peter, although unable to grow up in physical stature, does experience emotional maturation. Although Peter feels as though he is in control of his maturation process by rejecting the idea of entering into adulthood, the research shows that Peter may in fact long to grow old. This is a story of self-realization. This story is relevant to our own human experience because it is a creative outlet that simultaneously allows children to reconcile with their anxieties about not being able to control their aging process, while also giving adults the ability to examine their anxieties of never fully maturing.

Faculty advisor: Elizabeth Reimer, English and Modern Languages

Meghan Ngai, Wenjing Han, Morgan Hunter, Kody Clark, Jennie Bui. Examining Social Media Panel: The Role of Influencers in the Digital Era

Students from Dr. Blair McDonald's CMNS 3210: Digital Communities, provide an in-depth examination of today's leading social media influencers. As part of these presentations, students will discuss their impact, popularity and persuasive impact on a variety of audiences and demographics. Furthermore, students consider the ways in which these influencers play a role in re-shaping how contemporary audiences engage, follow and participate with media online outside of traditional, broadcast platforms.

Faculty advisor: Blair McDonald, Journalism Communication and New Media

Jeanne Albutra. Exploring Child Poverty Reduction Policies and Strategies in Canada

Child poverty is a threat to society's future because child poverty harms the well-being and development of the citizens and leaders of tomorrow. Poverty causes negative life, social, and health outcomes, such as food insecurity and homelessness. It affects everyone in society because it also creates inequalities among citizens, barriers to participation in society, and avoidable costs to humanity and the state's resources. In doing a research paper assignment for the SOCW 3000 Canadian Social Policy course, the social work student presenter has explored the issue of child poverty in British Columbia, and how societal views and approaches to child poverty have changed over time. This presentation will summarize some Canadian policies and strategies that aim to address child poverty, such as the 2016 Canada Child Benefit. Possible amendments and additions to this policy will also be discussed.

Faculty advisor: Oleksandr Kondrashov, Social Work

Amanpreet Madan. Self-directed Practicum: Finding One's Passion in Social Work Education

As a third year practicum student, I have been challenged with a self-directed placement. The reason for the practicum is that students get a chance to apply their theoretical knowledge in the real work settings and to develop professional skills. Normally they are placed in an agency where they learn and develop their professional skills under the supervision of a social worker. I actually got a chance to enhance my practical skills under the supervision of Dr. Sasha Kondrashov, but in a very unique way.

In my self-directed practicum, which will be discussed in this presentation, I created my own practicum activities, goals and projects which were linked to the course learning objectives. With the guidance of Dr. Sasha Kondrashov, I was able to create activities and tasks to meet my learning needs. Together we connected each activity to performance indicators to evaluate the practicum learning experience. Currently I am working on the project called Voices Social Work where I am connecting with Social Workers and get to know about their professional experiences. I am helping Sasha in Welcome to Kamloops program that is offering in March and is open for public free of cost to learn more about Kamloops. I am gaining hands on experience as well by volunteering at Kamloops Hospice Association as a child support worker. I am also leading a project that is to create a spreadsheet for the Funding opportunities for Social Work. Overall it's a practicum opportunity full of learning and gaining a lot of different experiences to meet course outcomes.

Faculty advisor: Oleksandr Kondrashov, Social Work

Marcus Marasco. China in Africa: How Chinese Investment is Impacting Developing Nations

This presentation will examine China's relationship with various African nations such as Nigeria, Ethiopia, Angola, and Zambia. The relationship between China and these nations stems from China's Belt and Road Initiative, which is a program created by the Chinese to invest in major infrastructure projects in nations around the world. These include projects like large ports, railway lines, and even simple roads. China has focused on several African nations which have received much more funding and investment, and the purpose of this research is to examine exactly how much money has been invested and for what projects, the effects that these projects have had on the countries they are in, and what the implications are for those countries, and for China, moving forward. This research takes an unbiased stance on the work China is undertaking, and instead looks objectively at the positive and negative impacts that Chinese investment brings to the various countries of Africa.

Faculty advisor: Terry Kading, Political Studies

Anna Horst. Decolonizing Mental Health Practices.

In this presentation I will explore the ways that my studies of psychology and Indigenous Studies come together and contemplate how I, as a settler and mental health worker, can best attend to the specific needs of my clients. Canada is a settler colonial structure that reinforces the dominant settler culture, and requires the ongoing dispossession of Indigenous peoples from land. Emerging from these structures of power are various lasting lived implications for Indigenous peoples. As a mental health care provider I have a responsibility to understand the legacies of intergenerational trauma and mental health issues from residential schools, forced relocations, the creation of the reserve system, and the effects of racism that is built into Canadian laws through the Indian Act. Health, illness, psychology, and wellness are socially constructed and defined in the westernized sense. In this presentation I will explore

how I can hold space in my Western/settler-informed training in psychology for Indigenous peoples' views on health and wellness, as well as how Indigenous values can be incorporated into current health care practice. This research seeks to study the differences between the westernized biomedical model of mental health, and Indigenous ways of knowing and being, and what that looks like in mental health practice. Further, the goal of this research is to consider my role in decolonizing current practices in counselling, behaviour intervention, and mental health care, to legitimize Indigenous knowledge and integrate it into a holistic approach.

Faculty advisor: Lisa Cooke, Sociology and Anthropology

Michael Garagan. The Natural History of Coldstream Vineyard

The purpose of this project was to explore the natural history of a small vineyard that is relatively new, just outside of Vernon, B.C. By documenting the history, geography, geology, botany and wildlife presence on the property, I was able to advocate for the practicality and importance of observing the natural world. After all, observation is the first step in conservation. No government is able to afford to pay biologists, naturalists, or environmentalists to monitor all that needs to be monitored. Engaging the general public could contribute much to the protection and the proper stewardship of the land around us. Whether in a wild, rural, or an urban environment, a watchful eye can contribute baseline observations against which future change can be measured. By outlining and recording natural observations, species sightings, geographic and geological factors on this rural agricultural property within the Okanagan, I was able to complete a detailed ecological account of a 16-ha property over a two-month period. The vineyard is on a South facing, gradual slope, North of Kalamalka Lake, B.C. and was originally granted in 1864 and would be owned by both Lord Aberdeen and the Vernon brothers, as part of the Coldstream Ranch. The property is about 85 percent agricultural land, mostly planted with grapes, but also 1-ha of garlic, strawberries, tomatoes, potatoes, and other vegetables. The remaining portion of the property is a small pond and bulrush wetland, placed in the hollow of the property before raised train tracks. Over the period of two months, I observed 44 species of birds, 57 plant species and several large mammals including a family of coyotes who, having a den nearby, were regular visitors. The work of this project emphasizes the importance of the role that we can all play in preserving the world around us. Certainly, the completion of this project reminded me of the complexities of interactions between species and the importance of diversity and proactive community stewardship of the land.

Faculty advisor: Lyn Baldwin, Biological Sciences

Robyn MacDonald, Julia Lowe, Madison Cook. Bicultural Immersion as a Strategy to Promote A Healthy Professional Role Transition for New Graduate Registered Nurses

The transition to professional practice for newly graduated nurses (NGN) finds them struggling to balance the ‘ideals’ taught in their undergraduate education with the ‘realities’ of the contemporary workplace. Failure to successfully navigate this struggle is playing out in alarming statistics related to NGN attrition, with 33-61% NGNs changing their place of employment or leaving the nursing profession within the first two years, 45.5% expressing uncertainty about their decision to remain in practice, and 25% claiming they would actively discourage someone from going into nursing. The intent of this study was to explore how NGNs experience the cultures of education and the workplace and how the relationship between NGNs and senior nursing staff influences the experience of transition. Duchscher’s *Professional Role Transition Risk Assessment Instrument* was used to determine correlations between

mentoring support and the NGNs experience of transition shock. Preliminary findings indicate that a mentor's knowledge of the transition experience is imperative to the provision of adequate support. Further to this, the process of guiding the NGN through the transition experience is significantly facilitated when meetings are structured and framed by the Stages of Transition theory variables. Further findings indicate a potential shift in the approaches of NGNs to work, with casualization offering them control over the pace and intensity of their transition. It would appear that previous experience on the ward to which the NGN is hired positively influences their experience and night and day shifts need to be intentionally balanced to provide both stability and growth.

Faculty advisor: Judy Duchscher, Nursing

Kathryn Dunn. Understanding Multilingual Identities.

In a world with 6500 languages and only 195 countries it is almost impossible to have been exposed to only one language. In some way most people have heard or seen languages other than their native language, whether that is through work, school, global news, a subtitled movie, borrowed words, online friends, tourism, or food. Inherent to this exposure is knowledge of other cultures, which can have an impact on identity. Understanding Multilingual Identities is about the intersection of language, culture and identity. This study collected original data on university students who spoke more than one language, at any level, who had also lived in the culture of their second language. Students were asked to self-identify any area of change to their identity or language use due to living in another culture and using another language. They were also asked to identify whether, and under what circumstances, those changes persisted after their return to their home country and main language. Data was collected through interview methodology which will be supplemented with survey data.

Faculty advisor: Annette Dominik, English and Modern Languages

Serena Girard. Pornography and Relationships: The Hidden Negative Effects of Sexually Explicit Materials

This presentation argues that the consumption of pornography, or sexually explicit materials (SEM), by men in heterosexual and committed relationships has negative impacts on the relationship itself and the individuals involved. The method used is philosophical argument backed by psychological research. Pornography is usually consumed mostly by men (e.g., see Morgan; Minarcik, Wetterneck and Short; Veit, Å tulhofer and Hald). Harm can be a direct result of the production of pornographic content and a result of men wanting to imitate extreme pornography within their relationship. Men may begin to view women as sexual objects and change their sexual expectations to match those akin with pornography. Watching SEM when in a committed relationship tends to adversely affect both the emotional and sexual connections between partners. The watching and actions resulting from SEM may be mirrored to infidelity when in a committed intimate partner relationship, due to the hiding, shame, guilt and indirect extraneous parties involved. As research mainly points in the direction of men watching and women being negatively affected, this paper will focus on heterosexual relationships. However, anyone may experience negative repercussions from engaging in the watching of pornography. The aim of this presentation is to provide a solution to the issue of overconsumption of pornography and the resulting negative effects. Just as we are taught from a young age that if we use drugs and alcohol or have sex that we must do so safely, we should be taught the same about safe pornography use.

Faculty advisor: Robin Tapley, Philosophy

Roger Monreal Corona. Theoretical Study of the Iron Complexes with Lipoic and Dihydrolipoic Acids: Exploring Secondary Antioxidant Activity

Following a recent theoretical study of the secondary antioxidant activity of the deprotonated forms of lipoic and dihydrolipoic (DHLA) acids through their formation of complexes with copper,[1] the present work focuses on the complexes that these species can form with iron. To this effect, the thermodynamics of the formation equilibria of twenty *Fe(III)* complexes was studied at the M06/6-31++G(d, p) level of theory combined with the SMD continuum solvation model in water under physiological pH conditions at 298.15K. Fifteen of these complexes were selected to explore the kinetics of their reduction to *Fe(II)* complexes with , the first step of the Haber-Weiss cycle (see eq (1)). The second step of this cycle (called the *Fenton* reaction, see eq (2)), leads to the formation of biochemically harmful Â·OH radicals. A compound is found to have secondary antioxidant activity if its complex with *Fe(III)* (or with *Cu(II)*) is able to slow down the first step of the Haber-Weiss cycle.

(1) $[Fe(H_2O)_6]^{3+} + O_2^{Â·-}$ ---> $[Fe(H_2O)_6]^{2+} + O_2$

(2) $[Fe(H_2O)_6]^{2+} + H_2O_2$ --> $[Fe(H_2O)_6]^{3+} + OH^- + {}^{Â·}OH$

The three most thermodynamically stable complexes calculated contain doubly deprotonated DHLA coordinating to *Fe(III)* with one or both carbonyl oxygen atoms and the deprotonated sulfur. Two of these complexes were found to have antioxidant activity as they seem to be able to reduce by up to 30 times the rate constant of the first step of the Haber-Weiss cycle. Similar *Cu(II)* complexes lead to a much larger rate constant reduction, of up to 217 times, at the same level of theory.

[1] R. CastaÃ±eda-Arriaga, J. R. Alvarez-Idaboy, N. Mora-Diez, *RCS Adv.*, **2016**, *6*, 107924-107932.

Faculty advisor: Nelaine Mora-Diez, Chemistry

Avery Danyluk. The Impact of Social Capital on the Recovery from the 2011 Tohoku Earthquake, Japan

The theories and ideas of social capital have been incorporated in various disciplines, but few studies have explored social capital's role in disaster recovery. This presentation seeks to understand how social capital is integrated into the four phases of the disaster management cycle, specifically its function during the post-disaster recovery of the 2011 Tohoku earthquake and tsunami in Japan. By studying the recovery after such a devastating event other countries can learn and adapt from the strengths and weaknesses of Japanese response and recovery practices. Because the theories of social capital are applicable to a variety of hazards and academic disciplines, a wide range of literature from other fields was used in this project. Several texts on disaster management education were also referred to in the context of the Tohoku earthquake. The results conclude that social capital at the community level was vital to post-earthquake and tsunami recovery in Japanese cities, particularly in Iwate, Miyagi, and Fukushima prefectures. Japanese engagement in social networks and mutual trust increased individual participation and mobility. Additionally, structural social capital (existing social networks and societal structures) and cognitive social capital (mutual trust, norms, and behavior) contributed to community resilience and regrowth in differing ways, but when they were both combined, recovery efficiency increased. To be better prepared for future disasters a more thorough analysis of the impacts of social capital should be considered. In conclusion, creating stronger social frameworks for communities would prove useful to both Japanese and international governments.

Faculty advisor: Tom Waldichuk, Geography and Environmental Studies

Bryan Caillier. How Canadian Healthcare Holds Compared to the Best in the World

Canadians have been proud of their healthcare for a long time. They see it as a part of the Canadian identity and put it on the top of the priority list. The problem is that the healthcare that we get is often near the bottom in terms of services for the price paid when compared to many other countries. Canada does not cover prescription drugs with a pharmacare, nor does it have dental or other comprehensive coverage like others. In fact, Canada is the only country with universal healthcare that does not have universal drug coverage. In this presentation I will draw on literature to go over the strengths and weaknesses of Canadian healthcare, and use world indicators to compare it to other countries like the UK and France. Through a policy analysis and an examination of some comparative ideas such as preventative healthcare versus reactive care, the argument will be made that Canada can do more with the money that is currently spent on healthcare.

Faculty advisor: Terry Kading, Political Studies

Posters

Avery Pottle. The DNA of Cambridge Bay: An Analysis of the Microbial Community within the Permafrost Layer of Cambridge Bay, Canada

Permafrost is a permanently frozen layer below the Earth's surface, composed of soil, gravel and sand contained in ice. Ground is defined as permafrost that has been frozen for 2 years consecutively. Globally, permafrost environments account for the storage of 1672 petagrams of carbon. This carbon may be transformed to CO_2 and CH_4 by microbial processes as permafrost thaws. Few studies of permafrost microbial community composition have been completed in the Canadian Arctic, and no research has been conducted into the composition of the microbiome in Cambridge Bay, Nunavut. In this study, permafrost cores were obtained from Cambridge Bay near the Canadian High Arctic Research Station (CHARS). Six cores were processed to remove contaminating non-permafrost material and split into top and bottom sections. DNA was extracted from 10 samples (0.70-0.90 g) and DNA was quantified. A PCR was then conducted to amplify the 16S rRNA gene, which is a typical marker used to identify bacteria. The samples then underwent gel electrophoresis to confirm the results of the PCR amplification and a second round of PCR was conducted to prepare the amplicons for sequencing. The resulting DNA was sequenced on the ION S5 sequencer in the TRUGen sequencing facility. A bioinformatics approach is being taken to describe the microbial community composition in the permafrost samples. This data will provide baseline information on microbial community characteristics in these soils that will inform future research evaluating the effects on the microbiome as temperatures in the Arctic continue to rise.

Faculty advisor: Eric Bottos, Biological Sciences

Faith Manke. Impact of Slow Release Fertilizer Packs on Planted Interior Douglas-fir Seedlings After One Growing Season in the Elephant Hill Burn

Regeneration of planted Interior Douglas-fir (*Pseudotsuga menziesii var. glauca*) has been a challenge for foresters in the interior of British Columbia (B.C.) due to frost damage, drought, and low mycorrhizal associations. With the need to plant large volumes of Interior Douglas-fir after the 2017 and 2018 wildfires in B.C., foresters are looking for methods which will increase production and survival of seedlings in burnt areas. In this study the effects of slow release fertilizer packs on Interior Douglas-fir planted seedling within a high severity fire area in the Elephant Hill Wildfire area are examined after one growing season. Planted on May 24, 2019 then measured and assessed on August 20and 21, 2019, the fertilized seedlings, compared to the control seedlings, showed no differences in growth parameters which included leader length, root collar diameter, shoot weight, root weight and total weight. Fertilized seedling had a statistically larger height compared to control seedlings (P value = 0.02) but when seedling with no leaders present were removed from the height data set no statistical difference was found (P value = 0.43). Seedling vigour was scored on a scale of 1 to 5, there was no statistical difference in vigour for fertilized and control seedlings. Leader damage caused by frost, insects or browse effected 35% of the control seedlings and 22% of fertilized seedlings. These results indicate that using slow release fertilizer after a high severity fire does not provide increased growth or vigour after one growing season in the interior of B.C.

Faculty advisor: Wendy Gardner, Natural Resource Science

Kali Mailhot. Comparison of Omega 6:3 Fatty Acid Ratios in Milk from Conventional, Grass-fed, and Sprout-fed Dairy Cattle Using NMR Spectroscopy

Feeding systems of cattle are returning to fresh forage, making use of modern technologies such as hydroponics for year-round access. In order to be labelled as Grass-Fed milk, operations must now adhere to national standards set by the Dairy Farmers of Canada. To meet quality assurance standards, the 18:2 n-6/18:3 n-3 ratio in milk is required to be less than or equal to 3.5 in the first 12 months of testing, and less then or equal to 3.0 thereafter. The analysis of omega fatty acids in milk is possible by NMR spectroscopy, and with the emergence of benchtop NMR spectrometers, in-house testing may be possible in order to meet this quality assurance guideline. In collaboration with the Nutriva Group, which feeds dairy cattle hydroponically grown grass and sprouts, the omega fatty acids of raw milk samples are currently being analyzed by 1H and 1D TOCSY NMR spectroscopy. The overall goal of this experiment is to provide findings on omega fatty acids, as well as polyunsaturated, monounsaturated, and saturated fats in milk provided by the Nutriva Group and to compare them with conventional milk products.

Faculty advisors: Dipesh Prema and John Church, Chemistry

Roger Monreal Corona. Study of the Binding Interaction between Î²-Cyclodextrin and Carbendazim using Nuclear Magnetic Resonance Chemical Shift Titrations

Following a recent study of the interaction between Î²-Cyclodextrin and thiabendazole,[1] the present study focuses on the interaction between the same macrocyclic polymer and another guest molecule, carbendazim. To this effect, solubility tests using water, acetone, chloroform, acetonitrile, methanol and dimethyl sulfoxide deuterated were performed in order to determine the best NMR solvent for the analysis. We found that DMSO-d_6 was appropriate.

In order to quantify the strength of the interaction between the two chosen molecules, stock solutions of both host and guest molecule were prepared, and ^{1}H-NMR chemical shift titrations have been carried out. From the data obtained, we are determining the binding constant (K_a) applying the Rose-Drago Method. Calculated binding constants using NMR spectroscopy will be compared to those obtained by other analytical methods.

[1] Albert Guillem Adserias Rodriguez; Nuclear Magnetic Resonance Spectroscopy Study of the Binding Interaction between Î²-Cyclodextrin and Thiabendazole: A Supramolecular Inclusion Complex.

Faculty advisor: Dipesh Prema, Chemistry

William Primrose. Hydrogenation of Cyclohexene using Wilkinson's Catalyst: Development of a Chemistry Laboratory for 3rd and 4th Year Students

The goal of this experiment is to synthesize, characterize, and utilize the catalyst chlorotris(triphenylphosphine)rhodium(I), also known as Wilkinson's Catalyst, on a small scale using Nuclear Magnetic Resonance (NMR) spectroscopy. The synthesis of the catalyst and hydrogenation of cyclohexene is carried out entirely in an NMR tube; this technique of small-scale synthesis and characterization is employed often in graduate studies and synthetic labs but is not often utilized at the undergraduate level. As such, small quantities are used throughout. This reaction is monitored throughout using NMR spectroscopy.

We have successfully developed a new microscale experiment that can be used in 3rd and 4th year inorganic laboratory courses: the only glassware required is a J. Young NMR tube. Green chemistry is incorporated because the students will be using smaller amounts of heavy metals, organic compounds, and solvent. Furthermore, less waste is produced. Students gain experience with the NMR, which is an instrument used extensively in research laboratories.

Faculty advisor: Dipesh Prema, Chemistry

Isaac Stephens. Synthesis and Characterization of Novel Iminophosphine Ligands and their Complexes

The development of environmentally conscious and cost-efficient catalysts is an important aspect of synthetic inorganic chemistry. Due to the cost and potentially harmful effects of many late row transition metals, the use of abundant, less toxic, first-row transition metals is necessary. We are particularly interested in activating N-H Bonds in ammonia and amines.

Two new iminophosphine (bidentate N, P donor) ligands have been synthesized via Schiff Base Condensation of 2-(diphenylphosphino)benzaldehyde and corresponding anilines. Ligands are stable to atmospheric moisture and oxygen. Ligands have been characterized by ^{1}H and ^{13}C Nuclear Magnetic Resonance (NMR) spectroscopy. A characteristic resonance for the imine hydrogen is visible at ~8.8 ppm and ~163 ppm in ^{1}H and ^{13}C NMR spectra respectively. We have begun complexation reactions using Nickel (II) Triflate, Nickel (II) Chloride, and Nickel (0) Cyclooctadiene. We are working towards obtaining crystal structures via X-ray crystallography. Once complexes have been characterized, we will carry out catalytic studies with the intent of activating N-H bonds in ammonia and amines.

Faculty advisor: Dipesh Prema, Chemistry

Serena Girard. Domestic Violence and Animal Abuse: The Differences in Perceptions of Animal Companions Between survivors and Non-experiencers of Abuse

The aim of this study was to explore the differences in perceptions of animal companions between survivors and non-experiencers of domestic violence (DV). Survivors in the shelter group (SG) were interviewed via focus group method. Non-experiencers in the community group (CG) were interviewed via semi-structured interview method. Participants were adult women with previous and/or current animal companions. Transcripts were analyzed in terms of thematic analysis. Three key themes, with various subthemes emerged: *Theme 1: Relationship between guardian and animal companion*; *Theme 2: Animal companion perceived as important by guardian*; and *Theme 3: Relationship between animal companions and abuse*. Overall, many women viewed their animal companions as important and as members of the family. The SG women were separated from their animal companions, viewed money as a barrier to having animals, and viewed animals as a protective support system. The CG women were generally not separated from the animal companions, did not view money as a barrier to having animals, and perceived their animals as a form of responsibility rather than support. As existing literature (e.g., Meyer, 2012; Barrett et al., 2018; Stevenson, Fitzgerald & Barrett, 2018) indicates that many women delay leaving abusive relationships due to concern for their animal companions, the goal of this research is to ensure that both human and nonhuman survivors of violence are safe in situations of DV. Given that SG women saw their animals as sources of protection and support, domestic violence shelters should allow animal companions. To mitigate potential issues surrounding having animals in shelters (e.g., fears and allergies), there should be specific rules in place. Overall, housing should aim to allow

companion animals and not discriminate against those with animals (*speciesism*). The goal is to see a future where, regardless of species, all survivors of domestic violence are allowed in a safe space.

Faculty advisor: Rochelle Stevenson, Sociology and Anthropology

Solenn Vogel. Zeolite: an Emerging Tool for Mine Reclamation

Tailings sites left from mining operations contain heavy metals which have the potential to bioaccumulate and leech into the surrounding soil and watersheds. Although some heavy metals are essential for biological processes, higher concentrations can be toxic and negatively impact nearby ecosystems and human health. Current tailings reclamation processes are often insufficient in preventing heavy metal bioaccumulation or too expensive and time demanding to be realistically incorporated into mine reclamation strategies. Absorbent porous minerals have been used in industrial wastewater management to remove contaminants. In this study we used one such absorbent mineral, zeolite, to test its ability in neutralizing lead, arsenic and cadmium metals in gold and copper mine tailings. We compared three different concentrations of zeolite in tailings soil and the subsequent effects on plant growth. Although treatment differences in plant biomass was not statistically significant in relation to zeolite concentrations, forthcoming data on heavy metal uptake by the plants will offer more detailed information on the zeolites affect on plant growth. The two native plants used, bluebunch wheatgrass (*Pseudoroegneria spicata*) and field locoweed (*Oxytropis campestris*), responded differently to the pH and zeolite tailings treatments. The soil acidity significantly impacted field locoweed biomass; alkaline tailings was correlated with increased biomass. Biomass of field locoweed also showed a trend of increasing in relation to increased concentration of zeolite. The opposite was true for bluebunch wheatgrass. The results of this study indicate that although the zeolite treatment may be beneficial in increasing biomass and reducing heavy metal uptake in plants, species respond differently to reclamation treatments. This study points to zeolite in combination with field locoweed as being a new and useful tool for mine tailings reclamation in the interior of British Columbia.

Lauchlan Fraser, Biological Sciences

Deanna Brady. A History of Dispossession: An Analysis of Indigenous-Settler Relations in the Secwepemc, Nlaka'pamux, and Syilx Territories of British Columbia

The piece of land which we now refer to as British Columbia was first the home of a multitude of Indigenous cultures, territories, languages, and people. Throughout history, the British Crown referred to this land as Terra Nullius, meaning empty land. There were treaties made on Vancouver Island, but the majority of the province remains unceded in reference to Indigenous title to land. Yet, here we are in 2020 with colonial civilization flourishing. How we got here, specifically in the Interior region of BC, is my research question. I investigate this topic by focusing on the relationship between newcomers and Indigenous peoples. In the Interior of BC, the relationship between Indigenous peoples and newcomers has changed over time. What was once a mutually respectful relationship quickly became lacking of everything a trusting relationship requires. When explorers such as Simon Fraser came to the Interior, he wrote of amicable interactions with the Nlaka'pamux people in the Thompson Region. Further explained in the Sir Wilfrid Laurier Memorial, fur traders were also experienced similar interactions in this territory and surrounding nations. However as other whites, including settlers and miners, began encroaching on Indigenous land, their relationship began to change. In this presentation, the relationship between newcomers and Indigenous peoples from these territories are analyzed in order to understand why the Interior of British Columbia remains unceded.

Faculty advisor: Tina Block, History

Hannah Sierzputowski. Evaluation Tools for New Graduates in Rural Perinatal Nursing

PURPOSE: To explore practice gaps in rural perinatal nursing and examine existing tools for new graduate evaluation. This scoping literature review examines existing competency assessment tools for new graduates in the perinatal specialty with the goal of creating a new evaluation model to assess the competencies of perinatal practice in rural facilities. DESIGN: A scoping review exploring gaps in rural perinatal nursing around the world as well as tools that exist for nursing evaluation. METHODS: Literature was reviewed between the dates of January 2010 and February 2020 through EBSCO hosed databases (ie. SwePub, ScienceDirect, Academic search Compete, CINAHL…) and Google Scholar. The search strategy used MeSH and key words including rural, perinatal, nursing, evaluation, assessment, maternity, and single room maternity. The review was restricted to English language articles. Qualitative, quantitative and mixed method studies were collected and organized into an evidence table. MAIN FINDINGS: Our interim search of the literature revealed primary and secondary qualitative, quantitative and mixed method studies from eight different countries. The text focused primarily on RNs, midwives, and physicians. CONCLUSIONS: Interim findings suggest deficiencies in the quality of rural perinatal nursing due to staffing shortages and low birth quotas in functioning facilities. Further, evidence indicates that assessment tools play a valuable role in ensuring nursing competencies are met and maintained. Implications of this study advise the implementation of competence evaluation tools in perinatal practice areas to meet training needs and identify further gaps in knowledge.

Faculty advisor: Katheryn Banks, Nursing

Nesa White. A Preliminary Overview of the Ecological Role of Amelanchier alnifolia (A. alnifolia) in the Southern Interior of British Columbia

This research project is a literature review that will document existing information about A. alnifolia--a common shrub/tree species in BC and around the world. The purpose of gathering the information is to gain a greater understanding of the ecological role of this species within the ecosystems of the hot and dry southern interior of British Columbia (BC). Information will be gathered on the taxonomy, ecology and social importance of the species including identification, description, and classification; habitat, adaptation and species interactions; and human uses and potential benefits. A secondary objective will be to identify absent or limited knowledge on the species in general, but more specifically limited knowledge within the southern interior BC region. Results of the findings will provide a basis for further study aimed at expanding the knowledge of the ecological role, and the potential for A. alnifolia to be classified as a keystone species in the restrictive environment of the southern interior.

Faculty advisor: Karl Larsen, Natural Resource Science

Donavin White. Pixie Transceiver.

A 7MHz (40m band) radio transceiver was constructed and tested. The transceiver was tested and characterized for power consumption, output, transmission distance, interference, signal gain, and attenuation on the antenna. Upon completion of successful testing the transceiver will be then miniaturized using surface mount technology. Surface mount components should decrease the area and also reduce interference in the circuit. The project is meant to provide a low cost, interesting, surface mount project for future students.

Faculty advisor: Mark Paetkau, Physics

Paula Sabaté Fàbregas. Revealing Sleep's Hidden Functions.

There are two universally observed states of awareness found in all animal species studied up to date, awake and asleep. Wakefulness is characterized by a high arousal level in which the organism is aware of the environment, a state of consciousness in which an individual engages in coherent cognitive responses. In contrast, sleep is defined by a low level of awareness, a quiescent behavior with a reduced responsiveness in which most external inputs to the brain are excluded from neural processing. While the biological function of sleep remains obscure, it has been observed that sleep deprivation has severe consequences for health and well-being, up to and including death. Proposed sleep functions include energy conservation, repairing wear and tear in cellular machinery, removing chemical waste products produced during the waking hours and reinforcement of learning and memory consolidation.

This poster will review the literature to date and focus on recent works suggesting that sleep is required to detoxify the metabolic waste products that accumulate during the wake period. This neurotoxic waste clearance is thought to be done by cerebrospinal fluid transport via the glymphatic system. Recently, the restorative effects of sleep have been linked to the synaptic plasticity observed in learning and memory, the ability of synapses to strengthen or weaken over time in response to changes in their activity. The synaptic structural changes involve both gene expression linked to the formation of new synapses and the covalent modifications of preexisting synaptic machinery.

Faculty advisor: Don Nelson, Biological Sciences

Bronwen Evans. A Consolidation Algorithm for Fractionated Genomes Without a Reference

After a genome duplication event, genes are deleted essentially at random from duplicated regions in a process called fractionation. This fractionation of the genome can lead to overestimation of the evolutionary distance between species. Software to identify these regions and correct for the distortion caused by fractionation is available, but it relies upon an "ancestor" genome which did not experience a duplication event for reference. This means that the distortion cannot be corrected for some species when a reference genome is not available. To gain a better understanding of the evolutionary history of these species, we are developing software to identify fractionated regions with a consolidation algorithm that does not require a reference genome.

Faculty advisor: Lingling Jin, Computing Science

Violeta Planells I Romeo. Synaptic Pasticity and Memory Editing.

Learning and memory are linked processes by which an organism can acquire, store and retrieve new information.

The process of encoding new information is based on the principle of synaptic plasticity that establishes that neurons can vary the strength of their synaptic connections depending on specific patterns of the synaptic activity. Both pre-synaptic and post-synaptic mechanisms can contribute to the expression of synaptic plasticity.

The memory can be either short-term or long-term. Short-term memory is achieved by covalent modifications of pre-existing proteins, whereas long-term memory requires gene expression that will lead to the synthesis of new proteins and the establishment and strengthening of new synaptic connections. The mechanism by which short-term memory is converted into long-term memory is known as consolidation.

During consolidation; and during the posterior re-storage after retrieval, also known as reconsolidation, the memory trace which is the pattern of neurons and synapses that represent long-term memory at the cellular level, will overcome a transient destabilization. This window of plasticity opens the possibility of memory editing.

This poster will review the recent literature focusing on the synthesis of new synapses as a form of synaptic plasticity and the possibility of memory editing during consolidation.

Faculty advisor: Don Nelson, Biological Sciences

Yekaterina Ankudinova. Burglary Prediction using Deep Learning.

Residential burglary is still prevalent in most cities. It is sometimes difficult to predict where this kind of crime will happen. However, many cities have made their crime data available to the public. By analyzing these big crime data sets, it is possible to discover the patterns of urban structures that increase the risk of burglaries. In this study, deep learning was utilized to extract relationships between various house and environmental metrics and burglary. Through these relationships, the houses that have the higher risks of being burglarized can be identified. The City of Austin, Texas has been used for our case study since the city discloses various data sets including crime, street networks, demographics, and many others. This study can be used to deploy police patrols to the areas that are likely being burglarized. This can also provide an insight for making the urban environment safer by changing environmental cues and structures.

Faculty advisor: Andrew Park, Computing Science

Nicholas Piroddi. Antimutagenic Assay Analysis and Lectin Extraction Relative to Genotoxicity in Arceuthobium Americanum

It is expected that one in two Canadians will be affected by cancer in their lifetime, and one in four will die from it. Due to the abundance and lethality of the disease, alternative methods of treatment are being looked at to slow down the rate of DNA mutations. Antimutagens work by preventing spontaneous DNA damage, which could potentially lead to permanent, irreversible damage. In Europe, some studies have shown the effectiveness of combining *Viscus album* extracts as an antimutagen concurrently with chemotherapy to slow down the rate of DNA damage upon tumorigenesis. In British Columbia, the Lodgepole Pine Dwarf Mistletoe (*Arceuthobium americanum*) grows, which is in the same phylogenetic family as *V. album*, and shares its parasitic nature. Studies have shown that the lectins (carbohydrate binding proteins) in *V. album* play a vital role in the antimutagenic properties, likely due to the high binding affinity to N-acetylglucosamine and N-acetylneuraminic acid sugars, which are found on the cell surface, and therefore interaction with them could alter the regulation of programmed cell death. This study aims to extract and identify a similar lectin in *A. americanum*, and use the extract to begin testing for antimutagenic properties in Prokaryotic systems, using the Ames test and SOS Chromotest in *Salmonella typhimurium* and *Escherichia coli* respectively, using xenogenic mutants of the respective bacteria cultures to test for growth of cultures upon a lack of a specific nutrient in the former case, or the catabolism of lactose in the latter case.

Faculty advisor: Joanna Urban, Biological Sciences

Nicholous Welychko. Think Outside the Barrel: An Overview of Building-integrated Photovoltaic Windows

Modern renewable energy technologies have been at the forefront of development and implementation for the past few decades. With the current structure of our society being heavily dependent on energy and more environmentally friendly energy solutions, research into new and innovative technologies in energy production is where we, globally, should invest. A renewable technology that has seen many advances is the solar photovoltaic (PV) industry. Solar PV's have become more efficient at harnessing the energy of the sun and converting it into energy for many different real-world applications. With conventional solar cell technology having established itself as a reputable alternative energy source, advances in this industry within the past decade have gained interest and consideration. One of these advances is building-integrated photovoltaics (BIPV). This technology utilizes photovoltaics "...to replace conventional building materials in parts of the building's envelope such as roofs, skylights, or facades" (Radut & Mihai, 2015, p.35). This project will examine one specific BIPV, solar PV windows, also known as PV glazing. Additionally, this project argues that with an ever-increasing demand for energy in buildings within the urban core of a city, applications of BIPV need to be considered in order to reduce the environmental footprint of these buildings, while also proving renewable energy for these buildings and in turn requiring less energy from the grid. Furthermore, this project will examine current technologies available within the field of BIPV's in regards to solar PV windows, current applications of BIPV windows with real-world performance figures, as well as the benefits of this renewable energy application can provide within an urban context.

Faculty advisor: Michael Mehta, Geography and Environmental Studies

William Osborne. Burglary Prediction using Synthetic Training Data for Supervised Machine Learning

Incredible amounts of crime data are freely available to the public through open data initiatives. These data sets give the time and general location of hundreds of thousands of crime reports. This wealth of well-labeled information is ideal for Supervised Machine Learning, allowing for analysis and prediction to help future civic planning and law enforcement. Unfortunately, these data sets have flaws that make them challenging to use with Machine Learning methods. To predict future burglaries, both example homes that have been burgled, as well as example homes that have not been burgled are needed. As no city records locations where a crime has not occurred, only half the picture needed to make predictions exists.

To solve this problem, we constructed a set of synthetically generated times and locations that do not correspond with known burglary reports, but accurately represent the geography and distribution of buildings within the city. By combining these synthetic points with the real crime data, a complete picture is formed and a predictive model can be trained. Additional features were combined with these locations. For Vancouver, this included weather and lighting data from Environment Canada, and the local density of street trees, traffic signals, and light poles from the Vancouver Open Data Portal. The resulting Machine Learning model was able to correctly classify more than 80% of burglaries in this data.

The ability to generate Synthetic Training Data cheaply and quickly can be a major boon to fields such as Computational Criminology, where one-sided sets of data like this are common, lacking the whole picture needed for common Machine Learning tools.

Faculty advisor: Andrew Park, Computing Science

Christopher Birch. Investigation of the Development of a Method for Determining Haloacetic Acids in Drinking Water Using Combined Derivatization and Static Headspace Analysis with GC/MS

Haloacetic acids (HAA) are Disinfection By-products (DBP) formed when water with natural organic matter is disinfected with chlorine. HAA are regulated in Canadian drinking water at a maximum acceptable concentration (MAC) for total HAA in drinking water of 0.08 mg/L (80 Âµg/L). They are considered to have potential health impacts so therefore monitoring them in drinking water is required. Standard methods for determination of HAA are time consuming and involve multiple steps and reagents. Many recent literature studies have focussed on development of alternative methods using less solvent and fewer steps. Some examples are Carador et al that use micro-extraction with pentanes and Sarrion et al that uses solid phase micro extraction (SPME). Both methods use Static Headspace GC-MS as their choice of instrument and detector. The goal of the research is to investigate development of a method to determine Dichloroacetic Acid as a model HAA by combining in-situ derivatization in water with Static Headspace (SH) GC-MS. The initial approach has been to build on the work of Sarrion. It is the goal to remove these extraction processes and to see if the aqueous derivatization and SH GC-MS will allow analysis of HAA in drinking water. Results to date will be presented and discussed.

Faculty advisor: Sharon Brewer, Chemistry

Rebecca Wiltzen. An Altered Peri-Hand Space in Autism.

When an object is located near the hand (in peri-hand space) it is subject to enhanced visual processing. This is proposed to facilitate the development of accurate visually guided reach and grasp movements in childhood. For infants at risk of Autism Spectrum Disorder (ASD) research suggests that impairments in reaching and grasping can be seen as early as six months of age. The cause of these deficits is largely unknown. One possibility is that abnormal multisensory integration could interfere with peri-hand space function during development. If this were the case, impaired sensory processing in near-hand space could have a cascading effect on motor development and the subsequent development of higher level social and communication abilities. Thus, we hypothesize that peri-hand space effects will be altered in individuals with Autism, compared to typically developing individuals. To test this, adults particpants with and without an ASD diganosis will complete a visual search task that requires them to locate a target object among an array of distractors on a computer screen. Each participant will complete the task under two conditions: right hand near the screen (within peri-hand space) and right hand on the lap (outside of peri-hand space). We expect to find that peri-hand sapce effects will be stronger when the right hand is placed close to the screen in typically developing particapants only. These results may indicate that processing in near hand space is altered in ASD and could lead to a reliable marker of the disorder, subsequently leading to earlier interventions.

Faculty advisor: Jenni Karl, Psychology

Jared Sonnleitner. Evolutionary Association Between Ultraviolet Light, Migration Distance and Non-breeding Latitude and Secondary Moults in North American and European Migratory Passerines

Most migratory birds moult after breeding, replacing worn-out feathers from the previous season with new feathers, just prior to beginning their migratory journey south to the tropics. However, some

species of migratory birds undergo a second moult on their overwintering grounds, replacing some, or all, of their feathers. Not all migratory birds undergo this prealternate moult and the evolutionary drivers of this behaviour remain unclear, but one potential driver of this strategy could be disproportionately high amounts of feather wear in species that undergo a second moult. The three main sources of wear I examined were ultra-violet (UV) radiation, migration distance, and migratory latitude. Birds exposed to longer day lengths throughout the winter due to their wintering location are exposed to a higher amount of UV radiation. Because migration is an intensive process requiring maneuvering harsh terrain and variable weather conditions, longer migration distances may lead to a higher amount of wear. Finally, the latitude at which birds overwinter may affect the amount of wear on their feathers through habitat or environmental conditions. Using a phylogenetic logistic regression to control for shared ancestry, I found that species undergoing a longer migration, wintering at more southern latitudes, and those experiencing longer and more variable day lengths all showed an evolutionary association with prealternate moult. In other words, my results suggest that high feather wear experienced by some migratory passerines drove the evolution of a secondary moult.

Faculty advisor: Matt Reudink, Biological Sciences

Sophie Barnes. Content Analysis of the Selected Accessibility Services Websites at the U 15 Group : What Services Are Available?

Accessibility is not only a requirement put forth by the Canadian Charter of Rights and Freedoms, but it is necessary to equalize university access for disabled individuals. The aim of this presentation is to share results of the study to determine what accessibility services are provided by 4 of the U15 group of research universities, through the use of institutional accessibility centres' websites.

This research investigated accessibility services on websites of specific Canadian universities and used the Kouroupetroglou, Pino, and Kacorri (2011) three-tiered model to determine if additional services are available at Canadian universities that were not captured by the original model.

The explorative pilot study utilized qualitative content analyses techniques outlined by White and Marsh (2006). Their main research question “what accessibility services are available according to the university website” will guide the initial approach to the data, but the process will be inductive and “the evidence [will play a] significant role in shaping the analysis...” (p.37).

These preliminary findings of the study will be shared. The study findings contribute to accessibility knowledge that is required to strengthen accessibility centers across Canada. The study can benefit universities as they can compare their efforts on providing campus accessibility and highlight areas of excellence and future growth based on the data generated by the project. Canadian universities accessibility service representatives could then update their accessibility websites based on the recommendations from the study to better inform disabled students on what supports they can receive. This research is beneficial to Canadian government efforts to increase accessibility, and to disabled students’ knowledge of accessibility services that are provided by Canadian universities.

Faculty advisor: Oleksandr Kondrashov, Social Work

Mariah Ediger. The Role of Local Temperatures in the Timing of Egress and ingress of Western Rattlesnakes (Crotalus oreganus)

Climate change is projected to have various effects on plant and animal life. Considerable research has been done on how mammals may respond to climate change, yet ectotherms may be significantly affected as their body temperature is largely environmentally dependent. In particular, denning ectotherms near their northernmost limits may face challenges adjusting to new seasonal temperature patterns that will influence ingress (entering hibernation) and egress (exiting hibernation). We investigated ground, air, and den mouth temperatures using temperature-recording dataloggers at 7 western rattlesnake (*Crotalus oreganus*) communal dens located throughout the Thompson-Okanagan, during the 2019 ingress and egress periods. As expected, correlation matrices showed that maximum, minimum, and average temperatures for individual den temperature profiles were highly correlated. Regression analysis has determined that maximum and minimum ground temperature variation between dens is not often a function of time, and temperatures between dens are usually significantly different. Ultimately, these results will be compared to the actual ingress and egress patterns of the snakes that is simultaneously being documented by cameras.

Faculty advisor: Karl Larsen, Natural Resource Science

Lavraj Lidher. Assessing the Relationship between Cluster of Differentiation 34 Positive (CD34+) Stem Cells and Platelet Microvesicles during High-Intensity Exercise

Platelet microvesicles (PMVs) originate from platelets, have a submicron diameter, and transport biomolecules. PMV levels are elevated during high-intensity exercise (HIE) and previous work shows PMV-mediated angiogenesis through endothelial cell proliferation. Cluster of differentiation 34 positive ($CD34^+$) stem cell levels are also elevated after HIE. Whether this HIE-related increase in $CD34^+$ stem cells results from PMV stimulation is unknown. The present study investigates this relationship through platelet function inhibition by non-steroidal anti-inflammatory drug (NSAID) ingestion. Ten participants performed an initial test to determine aerobic fitness (VO_{2max}), and two experimental trials (NSAID and control). For the VO_{2max} test, participants performed a step-wise ramp protocol (4W every 10 seconds) until volitional exhaustion. Blood pressure, breath-by-breath gas exchange, and heart rate were recorded and the data analyzed using the Beaver and Wasserman method and COSMED OMNIA software. Power output set points for the two experimental trials were calculated using one-third the difference between the first and second ventilatory thresholds. For NSAID and control trials, participants ingested either 600 mg of ibuprofen or a placebo two hours prior to 45 minutes of cycling. Nine mL of blood was drawn at 0, 45, 90, 135 minutes. Blood was stained with CD34, CD45, and CD133 fluorescent antibodies for progenitor cell enumeration using flow cytometry. Other blood fractions were centrifuged and the plasma frozen at -80Â°C for future PMV enumeration. PMV and $CD34^+$ progenitor cell counts from both experimental trials will be compared to assess if a relationship exists between PMVs and $CD34^+$ progenitor cells during HIE.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Jordan Motruk. The Impact of High Intensity Exercise on Carotid Artery Longitudinal Kinetics

Longitudinal kinetics (LOKI) describe the bidirectional movement of the inner lining of arteries. With each cardiac cycle an anterograde movement occurs in early systole, followed by a retrograde movement later in systole and a second anterograde movement in diastole. Prostaglandins are powerful local vasodilators and availability is reduced with ibuprofen (IBU) administration. Our aim was to

determine the impact of high intensity cycling exercise and concurrent prostaglandin inhibition on longitudinal displacement. A ramp incremental test on a cycle ergometer was used to determine VO_{2max}, ventilatory threshold (VT) and respiratory compensation (RC) points of participants. An intensity of 33% of the difference between VT and RC was calculated for subsequent trials. On two separate days, participants either ingested IBU or echinacea (control) two hours before testing. Testing began with a 5-minute warm-up immediately followed by 45 minutes of the high-intensity exercise. Three 5-s ultrasound video clips of the carotid artery were obtained immediately before, after and 45 minutes after testing. We used speckle tracking software to analyze longitudinal movement of 4-10 cardiac cycles. A 2-way RM-ANOVA was used to assess differences between conditions at the various time-points. There was no significant difference between conditions, but exercise reduced LOKI immediately and 45 minutes after testing (Pre: 11.8 Â± 3.2 Post I: 9.3 Â± 1.7, Post 45: 9.4 Â± 2.2, $p < 0.01$). This suggests that complex interactions between sympathetic nervous activity, shear and cardiac dynamics alter longitudinal movements; however, more comprehensive analyses of anterograde and retrograde movements need to be assessed.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Taryn Coleman. Perceived Responsibility of Natural Disaster Victims' and our Willingness to Assist

In this study we examined people's perceptions of natural disaster victims and the impact of these perceptions on willingness to help and judgements of responsibility. Weiner (1995) asserted that deciding to offer assistance involves an attributional process; victims perceived as less responsible for their predicament are more likely to evoke more sympathy and aid than victims perceived to be responsible for their predicament. Marjanovic et al. (2009, 2012) found that people's beliefs of victims' preparedness impacted their perceptions of victim responsibility and the amount of help offered. Given these findings, we are hoping to potentiate these perceptions with changing post-disaster behaviours. The participants were students attending Thompson Rivers University. Participants read an article about the victims of hurricane Dorian, which occurred in 2019 in the Bahamas, followed by questions to measure their emotional response to the victims, perceptions of victims' responsibility and their willingness to assist. The article, adapted from Marjanovic (2009, 2012), depicted victims as either cooperative, responsible and helpless to the events or as uncooperative and having partial responsibility for the impact of the aftermath. Victims are also depicted as either continuing similar behaviours they executed prior to the disaster or as seeking new technologies to better prepare for the future. We will present the results to test the prediction that victims described as being partially responsible for their situation with intent to continue inadequate preventative behaviours following the disaster will receive stronger judgements of responsibility and elicit less overall help than those perceived as less negligent.

Faculty advisor: Sandra Vermeulen, Psychology

Jeanne Albutra. Identifying Critical University Supports for Low-Income Students: A Mixed-Methods Study

Students need to be supported throughout their academic journeys so that they can grow and realize their potentials, enter and be successful in their chosen professions after graduation, and share their knowledge, skills, worldviews, and experiences within communities in the future. Decreasing barriers to educational attainment can help promote inclusivity, address social and global issues, address social inequities, and work towards reconciliation. The 4th year Bachelor of Social Work student presenter is

currently doing a UREAP mixed-methods research project, which will use online surveys and semi-structured interviews to identify Thompson Rivers University's (TRU) critical student services and supports that facilitate its self-identified low-income students' educational success and well-being. The ways in which students identify, navigate, and access these services will also be explored using an online questionnaire that the student presenter developed. The online questionnaire and the research project's design will be the main focus of this presentation. Gaining a better understanding of low-income students' barriers to education, support networks and resources, and experiences in navigating and accessing student services is expected to have implications on student services' strengths, areas of improvement, accessibility, student awareness on these resources, and how to better meet low-income students' needs. Current and future students and faculty in TRU, and other post-secondary institutions, may benefit from this research project's findings.

Faculty advisor: Oleksandr Kondrashov, Social Work

Stefano Stamato. Overview of Technology Use Against Illegal Fishing Using AIS Data

This presentation explores the issue of illegal fishing under the scope of Social Network Analysis. Illegal, Unreported and Unregulated (IUU) fishing is a criminal industry estimated to account for over 10 billion dollars annually, and plays a large part in the excessive exploitation of fish stocks around the world. Research has been conducted on this matter, and researchers are now able to assess suspicious activity at sea by analyzing data from the Automatic Identification System (AIS) and cross-referencing that information with other sources, such as Synthetic Aperture Radar (SAR) imaging. However, even with the success of these technologies culminating in vessel apprehensions by law enforcement agencies, the infrastructural impact this entails is dwarfed by the profits obtained from these activities. One of the factors contributing to the difficulty in end-point monitoring for marine products of illegal origins is the use of transshipment vessels. These collect products from both legal and illegal fishing vessels and transport it to ports with more lax regulations, where they can offload their untraceable cargo into mainstream markets and generate profits for the illegal organizations that coordinate these operations. This presentation proposes that we analyze the network of transshipment vessels in the ocean by visualizing it under the scope of Social Network Analysis. We create a social network graph from the vessels at sea, and define the connections between them according to encounters between these vessels. By visualizing the vessels in this manner, we can infer which are likely to be used for transshipment purposes. Determining these interactions between vessels could provide useful information to aid law enforcement efforts around the world in understanding the structure of the illegal organizations profiting off of these activities, and contribute to a data-driven approach in combating these operations worldwide.

Faculty advisor: Andrew Park, Computing Science

Nicholas Hilton. Measuring the Effect of Sympathetic Nervous Activation on Carotid Arterial Longitudinal Motion

Arteries within the systemic circulation bring oxygenated blood from the heart to organs. These vessels act as reservoirs by storing elastic potential energy by stretching when blood enters them with each heart contraction, then return this energy to the circulation to help propel blood throughout the periphery. This distention of the large arteries has been extensively studied and decreases with aging, a process known as arteriosclerosis. Less well studied, however, is the movement of the inner lining of arteries in the longitudinal direction (with or against the direction of blood flow) which was only recently

discovered. Links have been drawn between attenuation of this movement and heightened cardiovascular disease risk suggesting that potential exists for a clinical application as a diagnostic tool; however, the physiological factors that confound this metric first need to be better understood. One factor is activity of the sympathetic nervous system, the component of the autonomic nervous system activated under stress. The aim of this research was to measure the effect of sympathetic activation on the longitudinal motion of the common carotid artery. This involved ultrasound imaging coupled with custom software to quantify the longitudinal motion of the artery during two sympathetic nervous system manipulations: a cold pressor test and post-exercise circulatory occlusion. Various physiological parameters (ECG, blood pressure, respiration rate) were also continuously measured. A cross-correlational analysis between these parameters and carotid arterial longitudinal motion was performed to explain relationships between the sympathetic activation and longitudinal movement of the artery.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Seth Keenan. Effects of Asymmetry in Landfill Gas Flow.

The most common method of waste disposal in North America is the use of landfills. Landfill gas refers to the hazardous emissions produced by the waste in a landfill. Landfill gas needs to be controlled, which is done by extracting the gas through wells placed horizontally or vertically and then removing it from the area. Predicting the effect of a change in the function of a single well on the other wells in the landfill is very important to the design and operation of a landfill. The integrated normal flux between cells is an important parameter for a prediction model of this type. This is because the flux is equal to the difference in production of the two wells in question, which is a very easy thing to measure in the field. The effect of asymmetry on the landfill gas flow field in configurations with multiple suction points placed side by side or stacked was determined. The flux was found to have quite simple dependencies on the relative suction strengths of other cells in close proximity. As such, the proposed models would be easy to set up in many different configurations.

Faculty advisor: Yana Nec, Mathematics and Statistics

Seth Keenan. Interaction Study Between Benzimidazole Fungicides and Î²-Cyclodextrin by Affinity Capillary Electrophoresis

Most fungicides are dissolved in an aqueous medium for the purpose of increased biological activity. However, benzimidazole fungicides such as carbendazim, fuberidazole, and thiabendazole are mainly limited in their usage by not being very soluble in water. Î²-cyclodextrin is a large glucose polymer with a hydrophobic interior and a hydrophilic exterior. As such, Î²-cyclodextrin can form guest-host complexes with many molecules. This complex has the possibility of being more water soluble than the original molecules by themselves. Î²-cyclodextrin is a molecule that can form a complex with the benzimidazole fungicides. Therefore, complexation of the benzimidazole fungicides with Î²-cyclodextrin may be able to increase the water solubility, which could increase their fungicide action. The analytical technique that was used to determine the interactions of these molecules is affinity capillary electrophoresis. The expected outcomes are the binding constants of carbendazim, fuberidazole, and thiabendazole with Î²-cyclodextrin. The stability of the complex and the solubility of the fungicide in the presence of Î²-cyclodextrin can be determined with the help of the calculated binding constant.

Faculty advisor: Kingsley Donkor, Chemistry

Ryan Ficocelli. Computer Model of Police Control of Large Event Egress

The research presented uses agent-based modelling and simulation to create a model of event attendees leaving an outdoor event. The specific event modeled in the simulation was the Celebration of Lights in Vancouver, British Columbia, which has been known to have over 1.4 million people attending. With this many people attempting to leave an area at the same time, public officials need to plan for the bulk movement of these individuals in order to assure an orderly and timely exit from the event. The crowd modelling software includes crowd agents that are attempting to leave the event, and police agents that both block crowd agent movement and give directions for alternative routes to take. The research compares different deployments and strategies that could be utilized to help with the event egress in a virtual environment that models the Celebration of Lights.

Faculty advisor: Andrew Park, Computing Science

Paula Manzano Castro. Development of Incubation Chambers for Studying Microbial Interactions in Permafrost

Due to climate change, permafrost environments are changing: the active layer (which thaws seasonally) is thickening; permafrost (which has remained permanently frozen) thaw is accelerating, mobilizing the large reservoir of stored organic carbon. This stored carbon will be transformed into carbon dioxide and methane by microbial processes. Alteration of the permafrost environment can have important ecological effects, as new interactions develop between microorganisms in the thawing permafrost and with microbes in the active layer. With this knowledge, it is necessary to study how the microorganisms and the nutrients become mobilized within the permafrost and between the active layer and the permafrost. The purpose of this research is to develop a technique that will allow us to study how the microorganisms interact in the permafrost and predict what changes will occur in the microbial community. To study the nutrient and microbial mobility in permafrost, *Escherichia coli* DH5-alpha with the GFP plasmid will be placed in incubation chambers designed to permit or restrict microbial dispersal from the chambers. To test the chambers we will carry out qPCR to quantify the number of *Escherichia coli* DH5-alpha that disperse out of the chambers. The development of these incubation chambers will allow us to study how the interaction between the microorganisms from the active layer and the permafrost will affect the ecological processes that arise following permafrost thaw.

Faculty advisor: Eric Bottos, Biological Sciences

Ramya Kalaivanan, Sabrina Gutsche. The Effects of Anxiety on Cognitive Function in Older Adults

Recent research suggests that working memory capacity, which declines with age, is a key moderator of anxiety and cognitive performance. Specifically, older adults with age-related cognitive decline are more vulnerable to the negative effects of anxiety -- mainly, decreasing attention control and short-term memory capacity. The relationship between cognitive function and anxiety may be a key issue for older populations as cognitive assessments may induce anxiety, undermining the accurate diagnosis of their cognitive abilities. Our aim is to examine the relationship between anxiety and cognitive function in healthy older adults compared to young adults.

For this purpose, we recruited 20 young adults (18-25 yrs) and 16 older adults (65-70 yrs). All participants completed a State-Trait Anxiety Inventory questionnaire (STAI-6), and performed cognitive assessments which included the California Verbal Learning Test (CVLT3), the Montreal Cognitive Assessment (MoCA) and Trail Making Tests (TMT) A and B. Additionally, an eye-tracking task, measuring

antisaccade responses, was also implemented to examine inhibitory errors in two experimental blocks: (memory) delay and attention. Linear regression analysis was used to compare inhibition errors, anxiety scores and cognitive scores across age groups.

This study uniquely examined the relationship between anxiety and cognitive function during ecologically valid cognitive assessments in older adult populations. Our results show the distinct effects of anxiety between young adults and older adults and how these changes may be influenced by varying cognitive abilities. It also highlights the links between anxiety and cognitive function (attention and working memory), measured by objective and reliable eye-tracking methods.

Faculty advisor: Claudia Gonzalez, Psychology

Madeline Tuai. Capillary Electrophoretic Simultaneous Separation of Bisphenol Analogues

Bisphenol A (BPA) and its structural analogues are used in the production of polycarbonate plastics, epoxy resins, and personal care products. Some of these analogues including BPA, BPS, and BPF are proven to have endocrine disruptive effects in humans and animal species in very low concentrations. Many studies have reported bisphenols as an environmental contaminant, showing increased concentrations in air, water, soil, sediment, and organism tissues. The attempt to replace BPA with structural bisphenol analogues such as, BPAF, BPF, BPP, BPS, and BPZ has resulted in increased concern with these unstudied compounds and their effects on the body and environment. This project sought to optimize a simultaneous separation method for 13 bisphenol analogues (BPA, BPAF, BPB, BPBP, BPC, BPE, BPF, BPFL, BPG, BPM, BPP, BPA, BPZ) using capillary electrophoresis. The optimization of experimental parameters such as pH, concentration of buffer, applied voltage, and the addition of organic modifiers including methanol, ÃŸ-cyclodextrin, and acetonitrile was explored. This method was designed with the goal that it could be coupled with extraction methods of suspected bisphenol-containing products and successfully separating and identifying the analogues present.

Faculty advisor: Kingsley Donkor, Chemistry

Johara Ahmed. Isolation and Characterization of Microvesicles in Blood Plasma by Size-exclusion Chromatography

Extracellular vesicles (EVs) (50,nm to 2,Î¼m) are a heterogeneous collection of membrane-enclosed structures that are located in the extracellular space and released from the surface of many different cell types into different bodily fluids. EVs includes exosomes (30-100nm), apoptotic bodies (>1000 nm), and microvesicles (100 nm-1000nm) which may deliver bioactive cargo such as lipids, signaling molecules, growth factors, mRNA and non-coding mRNA that are released from the cell of origin to their target cells. Recent studies demonstrate that plasma-derived microvesicles may play a role in cell-cell communication, may potentially be diagnostic, or are even prognostic biomarkers of diseases. However, to establish any of these roles for MVs, we need to be able to isolate them from blood plasma easily without contamination by proteins and lipids that are quite abundant. Therefore, isolating extracellular vesicles from blood will be of great importance in understanding their biological role and to use EVs as biomarkers of disease. In this study, we built size exclusion chromatography columns and then used them to isolate MVs from platelets-free blood plasma samples and assessed their effectiveness compared to typical centrifugation protocols. We measured the protein concentrations of each eluted fractions and found that fractions 19-26 had a higher protein concentration and, as expected, protein content gradually increased with each fraction. Using flow cytometry, we enumerated $CD41^{+}$ (platelet)

and CD62e^{+} (endothelial) derived MVs. Unlike protein, fractions 9-12 contained the highest concentrations of the platelet-derived vesicles similar to previous studies. In conclusion, our custom-made size exclusion chromatography column performed as expected and separated blood plasma MVs from proteins effectively.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Arnau Garcia I Salmeron. Study of Microbial Communities in Non-contaminated and Contaminated Arctic Soil

Soils in some regions of the Arctic may have three layers, which are from top to bottom the soil surface, active layer, and permafrost. The active layer thaws during the summer and freezes during the winter, while the permafrost remains frozen continuously through the seasons. Because of climate change, the active layer is becoming deeper and may not refreeze during the winter, and permafrost thaw is increasing. In both the soil surface and the active layer there is an active flow of compounds. Hydrocarbon contamination can occur in the Arctic due to fuel spills, and as a result of the increasing temperatures they can be transported within the active layer and down to the permafrost. Since there are some microbial communities that are able to degrade these compounds, there might be some variations in microbial communities in contaminated soils in comparison with the communities from the non-polluted soils. The objective of this research is to determine the differences between microbial communities present in non-contaminated and contaminated Arctic soils, to better understand the biodegradation potential of these communities. In order to do so, DNA will be extracted from the soils and community 16S rRNA gene sequencing will be completed to allow a comparison between bacterial species found in different communities. As a consequence of climate change some contaminants could arrive to bodies of water such as rivers and lakes, however, some of these communities could run bioremediation reactions, so a future prediction of the process will be exposed in this research.

Faculty advisor: Eric Bottos, Biological Sciences

Katie Shouldice. Analysis of Particulates in the Air on the Kamloops Indian Band Reserve

MiniVol Tactical Air Samplers were placed in three locations to collect samples from January 30 -- February 29, 2020. Two sampling locations resided on the Kamloops Indian Band reserve, one residential area in Sun Rivers and one industrial location on Athabasca Way; one remained at the TRU Weather Station to collect background. The $PM_{2.5}$ matter collected on membrane filter papers over an average period of 24 hours. Concentrations of metals--lead, arsenic, cadmium, chromium, copper, zinc and iron--were determined spectroscopically. Filter papers were prepared for metal analysis by microwave digestion (Anton Paar Multiwave GO) with Aqua Regia and relative amounts were determined using a Varian Flame Atomic Absorption Spectrometer (F-AAS). Small, but detectable levels of metals were found. The relative amounts of metal varied by location, with higher concentrations corresponding to the sampler in the industrial location. This project was carried out with the permission of the Tk'emlúps te Secwépemc Band council, who provided the air-samplers.

Faculty advisor: Marten Lettinga and Kingsley Donkor, Chemistry

Madison Oud. Does Island Living Shift the Mechanisms of Plumage Ornamentation in Passerines?

Mainland birds are often much more colourful than their island counterparts. Additionally, island birds commonly have little sexual dichromatism (difference in plumage colour between sexes) when compared to mainland species. These plumage trends may be due to independent trait selection in

response to environmental pressures exerted by islands, in which many colourful species underwent parallel evolution, becoming duller on islands. Alternatively, fewer dull songbirds could have successfully emigrated to islands and speciated; thus, dull birds on islands are similarly the result of evolutionary happenstance. This study aimed to determine whether island and mainland songbirds differ in plumage colour and sexual dichromatism within the context of evolutionary history. To do so, I compiled island occupation status and plumage colour scores for 5811 global passerine species. I used a Phylogenetic Generalized Least Squares analysis to control for phylogenetic influence. Male plumage scores differed between island and mainland counterparts, while female and sexual dichromatism plumage scores were not significantly different. The next step will be to examine whether island size influences plumage colouration and sexual dichromatism. This will be accomplished by analyzing the relationship between average island surface area and plumage colouration of North American island passerines.

Faculty advisor: Matthew Reudink, Biological Sciences

Genevieve Ward. Effects of Age, Rainfall, and Temperature on Feather Colouration in Mountain Bluebirds

In sexually dichromatic birds, ornamentation can play an important role in mate selection. Males with greater ornamentation tend to experience greater reproductive success, presumably because feather colouration provides an indicator of individual quality or is simply more attractive to females. While numerous studies have examined factors affecting ornamentation in birds that possess carotenoid-based plumage coloration (where carotenoids ingested through the bird's diet are directly deposited into the feather, creating red, orange, or yellow plumage colour), less is known about the factors that affect birds that exhibit structural-based plumage coloration (where the color is based on microscopic feather structures). This study attempts to explore the effects of individual age, rainfall, and temperature on feather coloration in mountain bluebirds, a species with structurally-based UV-blue plumage coloration. Feathers were collected during bluebird breeding seasons (May-August) from 2011-2019 in the Kamloops area, and scanned using reflectance spectroscopy. An R-based color analysis program was used to analyze reflectance measurements, and the results were then analyzed using principal component analysis and mixed effects models to compare feather colouration on both an individual and population level. Within individuals, we found that colour decreased in older males in both rump and tail feathers, while at a population level, young males and females showed greater ornamentation as they aged. While the results from the weather models are not yet well understood, it appears that males and females were affected differently by rainfall and temperature, in terms of resulting plumage colouration.

Faculty advisor: Matt Reudink, Biological Sciences

Nestor Uroz. The Impact of Ketone Salt Supplementations on Heart Rate Responses Muscle Metabolism During Exercise

The consumption and marketing of some ketone supplements has been increasing recently suggesting that inducing muscle ketosis may improve performance, despite little evidence. In fact, several ketone effects may actually lead to poorer performance caused by acidification of the blood, alterations in heart rates and potential changes in muscle efficiency and substrate utilization. The purpose of this study was to determine the effects of dietary ketone salt supplementation during rapid changes in exercise intensity and muscle metabolism. We had participants attend the lab on 5 occasions with the first visit to determine maximal aerobic fitness (O_{2max}) and specific workloads for the subsequent 2 placebo and 2

ketone exercise trials. At each subsequent visit (placebo or ketone), we had participants complete a 5 min warm-up at 50 watts and then an immediate intensity change to a higher work-rate for 8 minutes. We continuously monitored heart rate and oxygen uptake throughout these sessions. We then compared work efficiency (metabolic rate/workrate) of both placebo and ketone trials over last 3 minutes of each trial. In addition, we fit the heart rate responses with a monoexponential equation to examine differences in heart rate responses between conditions. With this research we expect to gain insight about whether dietary supplementation with ketone salts affects our metabolic efficiency and heart rate responses thus contributing or detracting from exercise performance.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Narain Spolia, Scott Wood, Breanna Sartori. Analysis of Solar Potential in British Columbia: A Geospatial Reference to the Province's Hotspots for Solar Generation

In today's economy, energy generation has moved to the forefront of technological and environmental innovation with a growing shift towards renewable energy. Further investigation suggests that solar power generation is one of the most promising forms of renewable energy, compared to hydroelectric generation, as it is not as restricted by land or water. This project analyzes the viability of solar energy as a renewable resource within British Columbia (BC). By compiling spatial data of BC, we isolated variables of slope, elevation, solar azimuth and the resulting hillshade effect. Using Esri ArcGIS mapping software, we compiled this data onto a digital elevation model of a 1 metre resolution, to represent areas of the province that receive the greatest degree of incoming solar radiation, for the peak periods of each season. This data was then averaged out over the year, and visually represented through regional boundaries to better highlight areas of concentration. The preliminary results suggested that almost all of the province receives high amounts of solar radiation during most of the year, making a large proportion of the province suitable for solar power generation. When controlling for variables to highlight the best places to build solar panels, such as specified slope angles, we saw a slight reduction in viable area; however, not enough to cause any statistical significance. This resulted in the main conclusion that BC has a high geographical potential for solar power generation, and should be further explored by industry and government as an alternative, renewable source of energy.

Faculty advisor: David Hill, Geography and Environmental Studies

Jennica Wlodarczyk. Children's Ability to Act as Alibi Witnesses for Adults

Alibi research is a relatively new topic in forensic psychology, and there is a dearth of research on child alibi witnesses. An alibi is a report of one's own whereabouts and activities during a given timeframe, and an alibi witness is someone who can confirm this information. The lack of mature cognitive abilities such as attention and memory may hinder children in providing alibi witness statements. This study investigated children's ability to act as alibi witnesses, as no prior research has addressed this topic. Eighty-three children (M age = 7.1 years) participated in a 2 (Researcher presence: Leave, No Leave) x 2 (Delay: No Delay, 1-Day Delay) between subjects study design. Two research assistants, one male and one female, led a series of science games for approximately 45 minutes, and this occurred either directly before or one day before participants were interviewed. Because this research is exploratory in nature, specific hypotheses were not developed. Though only the female research assistant ever left the room (in the Leave condition), children's reports of whether or not a research assistant left did not differ between the male (77% of children said the male did not leave) and female (63% of children said the female did not leave) research assistants, $z = 1.40$, $p = .16$. Further, the difference in reports of leaving in

the Leave (19%) versus No Leave (8%) conditions did not differ statistically significantly, z = 1.70, p = .08. These findings indicate that children may be poor alibi witnesses.

Faculty advisor: Heather Price, Psychology

Sophia Dodic. Now Try the How and Why

Exploration of innovative ways to connect with observers in contemporary curatorial practice is crucial in order to expand localization and education in galleries. The exhibition *Now Try How and Why (NTHW)* explores the perceptions and connections created toward and through the curation of abstract artworks. By encouraging observers to curate the placement of these artworks through the generation of narratives, this exhibition will offer an alternative to typical visitor contributions and educational activities with its inclusion of an interactive technological aspect, and its opportunity to explore the roles of a curator. This show has a variety of influences from the humanities, spanning philosophy, ethics, educational models, stories and literature theory. When *NTWH* is presented in April 2020 in Thompson Rivers University's Graduating BFA exhibition it will seek to answer questions posed in the gallery community, where presently art galleries are updating their practices and possibilities of curating and improving their public spaces through interactive exhibitions that strive to develop stronger and more inclusive educational and socio-cultural space for visitors. This research intends to predict the future of these institutions; it is of interactive and educational importance to remain inclusive and open to all kinds of knowledge.

Faculty advisor: Donald Lawrence, Visual and Performing Arts

Puneet Parihar. Determination of the Octanol:Water Partition Coefficient of Indolicidin45 by Micellar Electrokinetic Chromatography

Antibiotic resistant bacteria (superbugs) are becoming a real problem in today's world. There are new bacteria emerging that are completely resistant to the pharmaceutical industry's conventional antibiotics such as penicillin. These superbugs are extremely dangerous as there is essentially no way to kill them and many resulting sicknesses have fatal results. In recent years, antimicrobial peptides (AMPs) have begun to garner interest. AMPs show a lot of potential to becoming a solution for the antimicrobial resistant pandemic the future holds. The AMP, indol45, an analog of indolicidin which has had the 4^{th} and 5^{th} tryptophan residues replaced with alanine, has shown increased antimicrobial activity along with reduced hemolytic activity when compared to indolicidin, making it a more viable candidate as an antimicrobial agent. The antibacterial properties of this peptide are still unknown. Whether the bacteria are killed via lyses of its membrane or by an intracellular mechanism is unknown. The aim of this research is to utilize the VEKC technique to determine the octanol-water partition coefficient. VEKC is a vesicular variation of Micellar Electrokinetic Chromatography (MEKC). By determining the partition coefficient, the ability of the drug to pass through the membrane of bacteria can be determined, helping us better understand the mode of action of indol and its derivative indol45's antibacterial properties, elucidating its potential ability as a therapeutic antimicrobial agent.

Faculty advisor: Heidi Huttunen-Hennelly, Chemical Biology

Jessica Guthier and Julia Lowe. Nursing Students' Identification of Quality Indicators During a Third Year Summer Preceptorship

***Background**:* Baccalaureate nursing education provides students the opportunity to develop the theoretical knowledge and clinical skills necessary to become successful, practicing Registered Nurses. A

pivotal part of nursing education is the ability to practice clinical skills in a professional setting under the supervision of nurse preceptors. However, there is limited research on how students view or value such an experience. Using a mixed-methodology approach, this study was aimed at evaluating the preceptorship experiences of third-year student nurses at a nursing school in British Columbia.
***Methods*:** A literature review was conducted before gathering student data; seventeen articles were used for this research. Through a combination of survey and focus groups, both quantitative and qualitative data were used to evaluate the effectiveness of preceptors, unit staff, and clinical placements on student experiences. Themes were developed according to Krueger's Framework (Krueger, 1994).
Results: Twenty-eight students responded to the survey (n=82), providing a 35% response rate. In the survey, respondents predicted approachability would be the most important quality in their preceptor. Eleven students (n=82) participated in the interviews and the themes of workplace culture, relational practice, preparedness, and scheduling emerged.
Conclusion: Findings from this study provide novel understanding of students' perceptions of preceptors which can help inform nursing curriculum development related to preceptorship experiences.

Faculty advisors: Tracy Hoot and Tracy Christianson, Nursing

Hailey Stevens, Amanda Field, Lauren Letham, Kate Greffard, Marie Busch, Aaron Veale. *The Power of Mapping.*

For hundreds of years, maps have been used to link people with place. Maps can guide us near and far, hold records for future generations and tell the stories of the places we hold dear. However, in an increasingly global world, many of the maps we use lack transparency and say little about our experience in place. The purpose of this visual exhibit is to use maps to depict our experience creating potluck dishes from ingredients sourced as close to Kamloops B.C. as possible. From field to table, copious amounts of information can get left behind in the dust. Collectively our maps will detail the process each student went through to acquire their ingredients, as well as outlining the journey the ingredients themselves made just to get here. Each map uses a unique combination of inks and paints fabricated from local flora--both domestic and native--found within our ecosystem. From the places we visited, to the people we met along the way, the maps tell our story of finding place through the intersection of food and botany.

Faculty advisor: Lyn Baldwin, Biological Sciences

Chris Melvin. The Impact of Prostaglandin Inhibition on Platelet Microvesicle Dynamics During High-intensity Exercise

Microvesicles are small (100nm-1Î¼m) membrane-derived vesicles that confer information about a cell's status. Platelet microvesicles (PMV) have recently been described in a plethora of papers for their role in cell-cell signalling and disease. Bouts of high intensity exercise increase the concentration of circulating PMVs within the blood, which may adversely increase blood coagulation but also may stimulate new blood vessel formation. Alternatively, non-steroidal anti-inflammatory drugs (Ibuprofen, Aspirin, etc.) inhibit platelet function, which could blunt PMV production. Ten participants were recruited and their maximal oxygen uptake (VO_2) max determined by having them exercise on a stationary bike until exhaustion during a ramp of 4 watts every 10 seconds. Their ventilatory thresholds (VT) were identified and the work-rate at 1/3 of that between VT1 and VT2 was determined for subsequent experimental trials. During these trials, participants ingested a placebo or ibuprofen (600mg) pill 2 hours prior to exercise. Nine ml blood samples were taken immediately prior, post, 45 minutes post, and 90 minutes

post exercise. Platelet-free plasma was isolated from the blood by two rounds of centrifugation. One hundred microlitre aliquots of the centrifuged samples were placed into 1.7ml centrifuge tubes and frozen at -80Â°C. Samples will be thawed and double stained with cluster of differentiation 41-fluorescein isothiocyanate (CD41-FITC) and CD62E-Phycoerythrin (PE) conjugated antibodies prior to being analyzed by high resolution flow cytometer for PMVs quantification. We will determine if NSAIDs inhibit the release of platelet-derived microvesicles.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Sage Raymond. Grizzly Bear Behavioural Changes in Response to Sudden Fish Decline in an Interior Salmon System

Landlocked kokanee salmon are an important food source for grizzly bears in the Lardeau River Valley. A local bear-viewing company has been collecting citizen-science data on grizzly bear sightings since 2012. Following a catastrophic decline in kokanee numbers, bear activity in the valley has changed in space and time. In this study I combine kokanee enumeration data collected by the provincial government and bear sighting data collected by citizen scientists in order to evaluate the impacts of a changing salmon population on bear activity and behaviour. I found that, while grizzly bears have the dietary plasticity to change their habits in the short-term, their predator-prey relationship with salmon is important for continued success in the Lardeau River Valley. The results of this study are relevant given ongoing climate change and salmonid crashes within grizzly bear range.

Faculty advisor: Nancy Flood, Biological Sciences

Sage Raymond. Using Novel Methods to Assess Instream Movement of Migrating Western Toads.

Western toads are a species of conservation concern in BC; they participate in numerous ecological processes, act as an indicator species for ecosystem health and are in decline throughout much of their range. Understanding western toad movement is an important component of toad ecology and conservation; a historically overlooked element of toad migration has been instream movement. I studied the instream movements of a regionally and provincially significant population of western toads at Summit Lake, BC. I established used Fyke nets within streams to capture toads; this is a novel methodology for toad capture that has thus far only been employed in two studies, both of which occurred in Montana. I successfully captured toads in all non-larval life stages. A notable finding was the capture of a considerable number of toadlets involuntarily moving downstream during attempted migration to upland habitat. The high success rate in capturing toads and toadlets using Fyke nets suggests that there are many potential conservation applications for this methodology.

Faculty advisor: Nancy Flood, Biological Sciences

Keegan Koning. Mineral Precipitation Potential of Cave Bacteria and their Contribution to the Formation of Cave Speleothems

Typically, caves are characterized by low organic carbon nutrients due to the absence of light and a high degree of oxidation due to water erosion and subsequent exposure to air (Northup & Lavoie, 2001; Ortiz et al., 2013; Barton et al., 2004). Due to the low levels of organic carbon, bacterial diversity is determined by the ability of each organism to specifically utilise the environmental conditions in that particular ecosystem. Limestone caves represent one such oligotrophic environment, including a high

degree of oxygen, mild temperatures, high humidity, circumneutral pH and little-to-no exposure to sunlight (Ortiz et al., 2013). Speleothem (a secondary cave structure) composition was determined using inductively coupled plasma mass-spectrometry (ICP-MS) and provided a basis from which to develop precipitation media. To understand the role bacteria play in the formation of speleothems, we focused on microbiologically-induced carbonate precipitation, which is a form of biologically-induced mineralization (BIM), in the lab setting, whereby bacteria precipitate carbonate which coordinates with free calcium ions in the environment, thus producing calcium carbonate. In this study, bacterial isolates collected from ICC speleothems were tested for the presence of an integral MICP enzyme, urease. Urease positive (U+) isolates were grown on modified precipitation agar to provide ample time for crystal formation. U+ isolates produced crystals of varying structures and were imaged using a petrographic microscope. The next step is to grow U+ isolates in broth culture to understand the bacterial mechanisms of speleogenesis.

Faculty advisor: Naowarat Cheeptham, Biological Sciences

Tay Powrie. Response of River Discharge due to Forest Disturbance

In this research project, we analyzed the effects of forest disturbance on the discharge of fourth order rivers within the associated watershed. The changing climate (i.e., unpredictable precipitation patterns and fluctuating temperatures), anthropogenic landscape disturbances (i.e., industrial forestry practices, mines) and stochastic natural disturbances (i.e., landslides, forest fires) all have differing effects that may result in a shift in the magnitude and timing of discharge in rivers. Shifts in the magnitude and timing of discharge may result in an increase of drought and/or flood events that effect aquatic and riparian ecosystems as well as water management in terms of use and allocation.

The discharge of six fourth order rivers within Interior British Columbia (Chilcotin, Chilko, Mesilinka, Nation, Osilinka, and Spius) were analyzed with frequency analyses to understand trends in discharge and with modified Double Mass Curves to understand if shifts in discharge could be attributed to forest disturbance when removing the effects of climate.The rivers within the same principle drainage area showed similar trends in discharge magnitude and timing when analyzed with frequency analyses and 50% of rivers, not associated by principle drainage area, portrayed shifts in discharge not attributed to climate when analyzed with modified Double Mass Curves. Understanding what land use and/or landscape disturbance may be the cause of a shift in discharge can build on the knowledge used to manage watersheds to protect integral ecosystems and water utilization.

Faculty advisor: Thomas Pypker, Natural Resource Science

Cyrene Catenza. Signal Enhancement for the Sensitive Detection of Nisin in Milk by Capillary Electrophoresis

Nisin is a class A1 lantibiotic produced from the Gram-negative bacteria *Lactococcus lactis*, and it is widely used as a preservative in alcoholic beverages and foods such as dairy products. To date, nisin is the lantibiotic that is FDA approved and a GRAS (generally regarded safe) bio-preservative due to its low toxicity. Besides, it is effective against the growth of Gram-positive bacteria such as *Staphylococcus, Bacillus, Clostridium* and the common food pathogen *Listeria monocytogene*. However, one problem associated with using nisin as a preservative is that its activity degrades over time due to changes in temperature, pH, and some components of the food. Therefore, this project will use micellar electrokinetic chromatography (MEKC) to not only determine the quantity of nisin added to milk

products but also to monitor its stability throughout the product's shelf life. In addition, the technique called large volume sample stacking (LVSS) will be applied to enhance the sensitivity of the MEKC method. Also, the detection limit of the LVSS-MEKC method will be improved by incorporating the sample preparation technique of solid-phase extraction (SPE), which can be used to extract and preconcentrate traces of nisin and remove interfering components from the sample matrix. The results obtained in this work will be compared to the previous study done with just MEKC. Successful optimization of the SPE-LVSS-MEKC method will be beneficial not only to food industries but also to alcoholic beverage industries. This method would present an inexpensive, fast, and easy way to monitor and determine the quantity of nisin in different food and alcohol products such as dairy products, meats and wines.

Faculty advisor: Kingsley Donkor, Chemistry

April Read. Characterization of the Antimicrobial Secondary Metabolites Produced by the Cave Bacteria Streptomyces ICC1

The progression of antibiotic resistant microorganisms has hindered some of the commercially available pharmaceutical drugs ineffective. Therefore, there is an overwhelming need for new alternatives against multi-drug resistant microbes, or mankind is likely to be surpassed in the current coevolution race between ourselves and bacteria. This study examines the secondary metabolites produced by cave-dwelling *Streptomyces* sp. ICC1 strain, which is prevalent in the isolated environment of the Iron Curtain Cave in Chilliwack, British Columbia. The secondary metabolites secreted by *Streptomyces* sp. ICC1 strain have shown antimicrobial properties that are effective against both laboratory and multi-drug resistant strains of *Escherichia coli* and *Staphylococcus aureus*. In extreme-conditions, such as a cave, microbial species often exhibit bioactivity that arises from resilient physiology and specialized metabolic pathways.

Streptomyces sp. ICC1 strain will be grown in a temperature of 15Â°C in both nutrient agar and broth. This strain has been exposed to many different media types and seems to favour a simple nutrient broth, here the cave dwellers produced the characteristic brown pigment in 72 hours. Bioassays will be performed to confirm antimicrobial activity in both laboratory and drug-resistant strains of *Escherichia coli* and *Staphylococcus aureus*. Upon presence of bioactivity, extractions will be performed to isolate the active compound(s), which will then be purified via high performance liquid chromatography. The secondary metabolites have been reasoned to exhibit both polar and non-polar substituents. Therefore, further instrumental analysis performed on pure samples must be done to reveal the true molecular nature of the bioactive metabolites, as well as their mode of action.

Faculty advisors: Heidi Huttunen-Hennelly and Naowarat Cheeptham, Biological Sciences

Tyson Strandt. The Impact of Exogenous Ketone Salt Supplementation on Oxygen Uptake Kinetics During Heavy Intensity Exercise

Exogenous ketone supplementation and inducing dietary ketosis is a popular strategy suggested to improve performance. However, exogenous ketone salt supplementation has been shown to decrease performance, but mechanisms have not been examined. We aimed to examine whether supplementing with exogenous ketone salts alters heavy exercise domain oxygen uptake kinetics compared to an isocaloric carbohydrate supplementation. Participants completed a ramp incremental test on a cycle ergometer to determine VO_{2max}, ventilatory threshold (VT), and respiratory compensation (RC) point. An

intensity of 33% of the difference between VT and RC was calculated for subsequent trials. On 4 separate days, participants ingested either a ketone salt or carbohydrate drink ~30-minutes before testing. This was followed by a brief warm-up (5-minutes: 50W), then the exercise immediately transitioned to the heavy-intensity exercise domain for 8-minutes before returning to 50W. Each trial was mono-exponentially fit and the time-constant of the primary component (t), baseline and amplitude of the VO_2 response was determined. Participants exhibited similar baselines (p=0.56) and amplitudes (p = 0.70) across conditions. This preliminary data did show slower kinetics, under the ketone condition, but this did not reach significance (41.1 Â± 12.7 vs. 32.5 Â± 21.2, p = 0.17). These data suggest that metabolic efficiency is similar and that ketone salt supplementation does not improve the transition from one metabolic rate to another during exercise. In conclusion, these preliminary data suggest that ketone salt supplementation may not be ideal in those seeking to improve intense exercise performance.

Faculty advisor: Mark Rakobowchuk, Biological Sciences

Karizza Catenza. Oligosaccharides as Biomarkers for Characterization of Differences in Dairy Milk

Oligosaccharides are carbohydrates that constitute the third most abundant solid component in mammalian milk. Human milk oligosaccharides (HMOs) exhibit several useful biological functions such as their effectiveness as prebiotics, anti-effectives, and immunoregulators, hence they are recently recognized as novel, potent bioactives. However, due to the current limitation in the supply of HMOs, current studies are now directed to bovine milk oligosaccharides (BMOs) as potential sources of these beneficial oligosaccharides. Recent structural analysis of BMOs has identified that two major sialylated oligosaccharides (SOS), 3êžŒsialylactose (3êžŒSL), and 6êžŒsialylactose (6êžŒSL), are identical to HMOs. BMOs are generally present in concentrations of 1 g/L immediately *post-partum* and rapidly decrease to trace amounts in mature bovine milk; hence the development of precise analytical techniques to accurately characterize and quantify BMOs is pertinent. The proposed research project would provide a sensitive and rapid capillary electrophoresis (CE) method for detecting and quantifying sialylated oligosaccharides (SOS) in dairy milk. This study would attempt to improve the sensitivity of CE for two dominant oligosaccharides in both human and bovine milk, 3êžŒSL and 6êžŒSL. The CE signal enhancement strategy of large volume sample stacking (LVSS) will be explored to enhance the CE analysis and improve the sensitivity and detection limit of the analysis. Having a sensitive method of analysis for BMOs would facilitate in various food processes such as accurate determination of oligosaccharide concentration in several food supplements, and rapid detection of adulteration in commercial milk products.

Faculty advisor: Kingsley Donkor, Chemistry

Sabrina Gutsche. The Effects of Anxiety on Older Adults.

It is well known that anxiety disrupts cognitive functions such as attention and working memory. Mella et al (2018) found that the detrimental effects of anxiety on cognition are more prominent in older adults with low working memory capacity. Although researchers have found a link between anxiety and cognition, discrepancies regarding what aspects of anxiety (i.e., the worry and/or arousal) affect cognitive functions still exist, particularly, given that direct measures of arousal are largely missing from such findings. This has important implications when obtaining reliable research and clinical interpretations of older adults' cognitive abilities. The current study looked to analyze the relationship that anxiety components (worry and arousal) have on the cognitive functioning of healthy older adults.

Thirty six participants, twenty young adults (18-25 yrs), and sixteen older adults (over 64 yrs) underwent physiological and psychological testing to assess levels of anxiety during the implementation of cognitive assessments, including the California Verbal Learning Test 3 (CVLT3), the Montreal Cognitive Assessment (MOCA), and the Trail Making Tests (TMT) part A and B. Physiological arousal was measured during the tests using a thermal imaging camera (FLIR E-60) capturing face temperature, a blood pressure monitor (CNAP Monitor 500), and two samples of salivary cortisol. Participants also completed a short version of the Depression Anxiety Stress Scale (DASS) and the State-Trait Anxiety Inventory (STAI-6). Multiple regression analyses were implemented to examine the correlation between measures of anxiety and cognitive function in each assessment and across the age-groups.

Faculty advisors: Claudia Gonzalez and Mark Rakobowchuk, Psychology

Jinghan Tan. Analytical Study of Epicatechin Levels in Green Teas from Different Geographical Origins using Ultraviolet Spectrophotometry

Epicatechin is a type of natural phenol and antioxidant, and it is a secondary metabolite found in green tea. Some research suggests it has a neuroprotective function because it is able to pass through the blood-brain barrier and activate the brain-derived neurotrophic factor (BDNF) pathways. In this work, UV-Vis spectrophotometry was used to quantify the levels of epicatechin in the tea samples. The result obtained were used to compare the amounts of epicatechin in up to 20 different brands of green tea from different geographical origins. Various experimental conditions such as different water types for making the tea, temperature and time used for the tea and sugar additives were also investigated to determine their effect on the levels of epicatechin in the green teas. The precision, accuracy, and sensitivity were determined to validate the method. Principal component analysis (PCA) was employed to discriminate green teas in order to test the hypothesis that there is a difference of epicatechin level in green teas which grow in different geographical origins.

Faculty advisor: Kingsley Donkor, Chemistry

Guillermo Garcìa Díez. Microwave Promoted Suzuki Reactions Suitable for Undergraduate Experiments

The Suzuki reaction is a coupling reaction in which an aromatic organoboron species reacts with an aromatic organohalide compound in the presence of a palladium catalyst and results in the efficient synthesis of biphenyls. The Suzuki reaction is now used widely by the chemical industry in the synthesis of drugs and other materials.

In the present research we have investigated a simple microwave promoted set of conditions that provide rapid and high yield examples of the Suzuki reaction. The goal is to develop a number of examples that can be used in undergraduate teaching experiments. Phenylboronic acid is combined with a number of bromobenzene compounds in the presence of palladium (II) chloride as a catalyst in a simple green solvent system consisting of water and ethanol. The whole reaction is carried out in a microwave heating apparatus using small quantities of chemicals in order to reduce waste. We are studying the yields of the Suzuki reactions carried out using these conditions. Undergraduate students who will be carrying out these examples will also be required to interpret the proton and carbon NMR spectra of the products, as well as the IR spectra. The students will be able to perform a “green” version of a Nobel prize winning

name reaction and study the scope of this chemical process. Moreover, the students will make use of a heating device, seldom used in undergraduate labs but with important applications in the chemistry world.

Faculty advisor: Norman Reed, Chemistry

Oluwafemi Francis Ogunyemi. Investigating the Interaction Between Bisphenol-S and Human Serum Albumin Using Affinity Capillary Electrophoresis

Bisphenol S (BPS) has been identified as a suitable subsitute to bisphenol A (BPA) due to its high stability and other features. Recent studies have shown that BPS might have a similar effect as BPA by acting as a potential endocrine-disrupting chemical with a harmful effect on human and animal health. Exposure to BPS has a negative effect on the reproductive, endocrine and cardiovascular system. Human serum albumin (HSA) is the most abundant protein in the human blood plasma and is involved in the transport of various fatty acids, hormones and other molecules around the body. Due to its function and abundance, it is the Ideal protein for the study of the health implications of the new substitute (BPS).

This study aims to determine the interaction between BPS and HSA using affinity capillary electrophoresis (ACE) and nuclear magnetic resonance (NMR) spectroscopy. From the changes in migration time at different concentrations of the additive (HSA), ACE will yield a binding constant that represents the strength of the interaction. A similar study is done using NMR spectroscopy. A change in the chemical shift upon the addition of increasing concentration of BPS is modelled to calculate the binding constant and give an indication of the strength of interaction. The result of this interaction study will provide more information on the health effects of BPS.

Faculty advisor: Kingsley Donkor, Chemistry

Gabrielle Dagasso. Determining Fusarium Head Blight Resistances in Bread Wheat Using Genome-Wide Association Studies

Wheat is a staple crop and an integral part of the world economy; however, these crops are frequently threatened by FHB, a fungal disease. Genome-Wide Association Studies (GWAS) is a powerful computational approach to identify the causal relationship between genetic single nucleotide polymorphisms (SNPs) within a species and the phenotypic differences between individuals of the same species. In this study, we apply different GWAS models to identify the linkage between wheat SNPs and Fusarium Head Blight (FHB) resistance and to identify the best GWAS models.

The Genome Association and Prediction Integration Tool is used in this study. Associations are predicted with three statistical models, general linear model, mixed linear effects model (MLM), and the multiple locus mixed effects model (MLMM), taking into account the covariance between individuals by feeding in a k-matrix. Shell scripts were then developed to obtain the most common and significant SNPs for each phenotype with multi-year data and across the statistical tests for each phenotype.

Some of the resultant QQ-Plots do not show that the model fits the data well; however, this is due to the fact that the 90k SNP array only detects SNPs in "preselected" genomic regions that have a higher likelihood to be associated with traits of interest without including any irrelevant positions. Overall, the MLM and the MLMM fit the data best.

In the future, we will incorporate phenotype data that is being evaluated from greenhouses for the current season and will use other GWAS programs in order to verify and compare significant SNPs found.

Faculty advisor: Lingling Jin, Mathematics and Statistics

Alex McDonald. Understanding the Survival and Success of Red Squirrels (Tamiasciurus hudsonicus) in Kamloops Within the Context of Diet and Behavioural Energetics, Comparing the Past and Present

Existing literature on Red Squirrels highlights quite extensively the ecology of how these animals make their living mostly as cone hoarders, but also through diet supplementation with fungal fruiting bodies among other things. This study is designed to see how this life strategy affects the maintenance of body condition and survival of Red Squirrels through winter in the Kamloops region. Success will be measured through body condition and survival. Primary body condition metrics will be body weight, coat condition, and post-zygomatic breadth (jaw width). I will utilize mark and recapture as a measure of survival, as the territorial nature of Red Squirrels results in a notedly high trap fidelity. I will determine what extent they are using fungi as supplemental food by analyzing feces for presence of fungal spores. I am also using radio-telemetry to analyze the daily behaviours of Red Squirrels throughout the winter to determine what may be driving these behaviours. This study also aims to determine if overwinter success has changed in the past two decades when compared to the results of an honours thesis completed in 1999.

I am currently still in the process of collecting and analyzing data and will be finished in the month of March. Current trends are showing mostly good success over winter with very little deviation in body weight and coat condition. Preliminary observations of fungal fruiting bodies located at squirrel middens are pointing to conclusive use of mycophagy to supplement primary food consumption of cones.

Faculty advisor: Karl Larsen, Natural Resource Science

Vincent Daley. Laser Sourced Computed Tomography.

Computed tomography (CT) has been used for decades by medical professionals to detect and diagnose various injuries and ailments. CT scanners are teeming with interesting physics, but due to their bulk, cost and safety, hands on experience with a medical CT scanner is unrealistic for undergraduate students. Therefore, an operationally similar, yet small, safe and inexpensive CT scanner is desirable. This poster details the design and operation of one such apparatus. First, the medical CT's X-rays were replaced by light, a far safer type of radiation. A 5-mW laser was the light source and a photodetector sensed the light once it has passed through a scan

subject. Pyrex glass was chosen as the scan object. Glass was used because a key property of CT scanning is to differentiate densities by their absorption characteristics, so scanning an object which obscures the laser light is not sufficiently similar to medical CT. A consequence of that choice was that laser light interacting with glass resulted in significant refraction. In order to minimize the refraction, the glass was bathed in mineral oil, which has the same index of refraction as Pyrex. With that taken care of, the next step was image reconstruction. Keeping in line with the low-cost goal the image reconstruction program was written in R, an open source programming language. The program takes data from the absorption of the light transmitted through the object at various positions and forms an image based on locations of high or low absorption.

Faculty advisor: Mark Paetkau, Physics

Aaron Veale. Are Island Birds Giants? Testing Foster's Rule Across All Passerines

Species on isolated island systems often experience different environmental conditions compared to their counterparts on the mainland. These conditions can provide unique challenges and opportunities and the isolation can even lead to insular dwarfism in large animal species, and insular gigantism in small species -- a process known as Foster's rule. The goal of this study was to perform a large-scale analysis to determine if members of the order Passeriformes (perching birds) follow Foster's rule, with island species exhibiting comparatively larger body sizes. Being one of the most diverse groups amongst vertebrates, passerines often also have high rates of dispersal and can be found on many unique island habitats. I analyzed the masses of over 5,000 extant species endemic to either islands or continental regions around the world. I then conducted phylogenetically-controlled analyses to account for shared ancestry and demonstrate clear support for Foster's rule in passerines.

Faculty advisor: Matthew Reudink, Biological Sciences

Lynden Sandy. Population Analysis of Invasive Goldfish (Carassius auratus) in Dragon Lake, BC

The common goldfish (*Carassius auratus*), an invasive species in British Columbia, has been introduced into several waterbodies containing rainbow trout throughout the province. In 2009, a productive population of goldfish was identified by the Ministry of Forest, Lands, and Natural Resource Operations and Rural Development (MFLNRORD) in Dragon Lake, a eutrophic lake near Quesnel, British Columbia. Electrofishing was used to collect a sample of goldfish from Dragon Lake in order to analyze their population. The goldfish appeared to exist in 4 separate age cohorts, and there was a significant relationship between length and weight with a linear regression of the natural log of length and weight with an equation of y=-12.78+3.44x. The goldfish also displayed a growth rate that slowed between the ages of 5 and 6 years old. To limit damages caused by invasive goldfish the BC government should undertake immediate action to eradicate or reduce the goldfish population within Dragon Lake; public education to help eliminate further goldfish introductions is also needed.

Faculty advisor: Brian Heise, Natural Resource Science

Elisha Balazo. Determination of Major Components in Propolis by Capillary Electrophoresis

Propolis is a viscous substance collected by honeybees and used as a hive protector. Its bioactive properties such as antibacterial, antioxidant, and antifungal activities are what makes it a popular natural remedy that has long been used by humans in pharmacological settings. Essential components in

propolis that are responsible for its beneficial biological properties are polyphenols which include flavonoids and phenolic acids. These compounds are proven to act as inhibitors of specific enzymes, hormone and neurotransmitter mimetics and scavenge for free radicals. A rapid and sensitive method was developed to determine the major components in propolis using capillary electrophoresis [CE]. Method parameters such as the wavelength monitored by the UV detector, pH and concentration of the buffer, the voltage and injection time on the CE were optimized. Under the optimum conditions, four flavonoids and one phenolic acid were separated within 35 min in a borate buffer with sodium dodecyl sulfate (pH 9.0). This method was successfully used for the analysis of propolis tinctures without an extraction step. Future work would include the identification and quantification of other flavonoids and phenolic acids in differently sourced propolis and to test their bioactivity against certain harmful bacteria and fungi.

Faculty advisor: Naowarat Cheeptham, Biological Sciences

Emily Schmidt. Development of Directed Lateral Lithiation Reactions for Use in Advanced Undergraduate Experiments

Directed lithiation reactions involving aromatic compounds containing a “directing group” have become an essential method for the synthesis of a variety of aromatic compounds that are difficult to synthesize by other methods. Many of these compounds have found important applications in industry, especially in the synthesis of pharmaceutical drugs and technologically advanced materials such as liquid crystals. Our research involves the development of examples of the above named class of reactions suitable for use as organic synthesis projects at the advanced undergraduate laboratory level. A series of these reactions and the compounds synthesized will be described, along with detailed results of the characterization of the various compounds.

Faculty advisor: Norman Reed, Chemistry

Travis Bellmore, Adam Whitaker-Wilson. Acoustic Impulse Response Capture and Reverb Convolution Modelling

For our study, the goal is to simulate, capture and analyze the acoustic properties (in particular reverb) of real space locales to the best of our abilities with the equipment we currently possess. An impulse response is a sort of unique audio signature which describes how a given impulse of sound will reverberate and echo at a particular location. If one can capture that response, it’s possible to create a model which can transform input sounds to the soundprint of the measured location, thus giving the illusion that those sounds were played at the original location. We will construct said model, and present it at the conference along with a poster describing the research we did to come to it. Interested viewers will be able to listen to the different reverbs through a pair of headphones that will “transport” them to different locations around the school. This technology has a lot of applications in sound design for film, video games, virtual reality, music production, audio forensics, among other related areas. The process of capturing the impulse response is essentially to measure the input and output signals generated by a location and deconvolve them. This will be done using a set of microphones and speakers, with the deconvolution done digitally in the Csound audio programming language. Our reverb model will convolute the impulse response with some input signal (a users voice for example) and play back a transformed version of that signal to the user, repeating the process in reverse. Our model will be contained within a VST ï¬le suitable to be loaded into a multitude of Digital Audio Workstations (DAWs). By examining several acoustically interesting areas around TRU, we hope to successfully

capture there impulse responses (soundprints) with minimal pre-ringing, abrupt pulsive noises, skewing, cancellation, and timesmearing. To accomplish this, we have conducted research on related protocols and propose to implement the preliminary tests, equipment alignments, signal capturing, and analysis methods presented by Angelo Farina and suggested by our co-supervisor Richard Taylor. These methods include Equipment Equalization, Exponential Sine Sweep (ESS) and Artifact Reduction. Analysis of the results will be conducted through the use of various software applications and hardware devices. To simulate the captured models we are developing a software application called a VSTi (Virtual Studio Technology Instrument) that will contain the captured models to be used for presentation. The VSTi will also contribute to the audio industry by being made available to the public for free.

Faculty advisors: Mark Paetkau and Richard Taylor, Physics

Braydon Slack. Enhanced Visual Processing for Objects in Peri-hand Space: Does it Matter Which Hand Acts on the Object or Will Any Hand Do?

Visual information near the hands may be processed differently, leading to enhanced visual attention, object recognition, and working memory for objects located within peri-hand space. It has been proposed that peri-hand space may have evolved to facilitate visually guided hand movements such as reaching and grasping for an object near the hands. While it is well known that the intention to act activates sensorimotor brain regions responsible for generating the action, it is not known whether the intention to act on an object near the hands might also potentiate visual processing of objects in peri-hand space. To test this, undergraduate students (n= 30) wore an eye tracker and completed a visual search task. Participants either rested their dominant hand near the screen and used the same hand to act on the target object, placed their dominant hand near the screen and used their opposite hand to act on the object, or placed both of their hands in their lap and acted on the target object with their dominant hand--all three conditions were repeated using the participant's non-dominant hand to control for handedness confounds. The eyetracker and visual search software recorded three dependent variables: accuracy, visual search time, and target fixation duration. We predict that peri-hand space effects will be enhanced when the participant intends to act on the object with the hand that is nearest to it. This would provide preliminary behavioural support for the idea that peri-hand space may have evolved to facilitate visually-guided hand movements.

Faculty advisor: Jenni Karl, Psychology

Brandon Hayashi. Aqueous Film-Forming Foams and Associated Polyfluoroalkyl Substances: Their Effects on Microbial Community Composition

Aqueous film-forming foams (AFFF) are composed of per- and polyfluoroalkyl substances (PFAS), a group of synthetic aliphatic compounds. When used to fight fires, these compounds are often released in large quantities directly into the environment. Due to the structural stability of PFAS, these compounds do not undergo spontaneous degradation under environmental conditions and are therefore prone to bioaccumulation in terrestrial and aquatic ecosystems. Though the effect of PFAS on microbial community composition is not well understood, microbes perform certain ecological functions such as co-contaminant degradation, which may alter the composition of these compounds in the environment and influence patterns of community composition. To assess the effects of PFAS contamination on microbial community composition, soil samples were obtained from several contaminated sites, including airports, military training bases, and sites of previous fires, throughout Eastern Canada. DNA was extracted from samples and 16S rRNA and 18S rRNA gene sequencing was completed to

characterize bacterial and fungal community composition, respectively. Community composition and diversity were compared using RStudio. This study is improving understanding of the functional consequences of PFAS exposure in microbial community composition and the bioremediation potential of certain bacterial species.

Faculty advisor: Eric Bottos and Jonathan Van Hamme, Biological Sciences

Emily Toews. Incorporating Renewable Energy Sources and Green Material into Residential Dwellings to Maximize Energy Efficiency

With global temperatures rising, climate change growing more prominent, and the concern of lower energy security, the incorporation of green technologies has never been more important. While large scale change in green technology is important and what tends to be highlighted in media, small scale, localized change can make a large difference. The incorporation of energy efficient building materials and renewable energy are being explored more in residential building sites. Looking into the benefits of each suggested efficient material, we see that there are many viable ways to incorporate renewable energy systems for small scale, residential use. Some of the variables explored in this presentation are infrastructural design, sustainable consumption, and energy efficient technologies. These are further analyzed through outlining the regulations and standards set within BC to look at the environmental and economic cost-benefits of sustainable development/consumption within individual homes. Although cost is a major hurdle for many homeowners, the benefits outweigh the reservations. By conducting this analysis, we find that a mass switch by individuals can have a huge effect on the global movement towards sustainable development. The main conclusion of this report suggests that fossil fuel use can be limited by developing more residential homes with green technologies, efficient power systems, and the addition of renewable energy use.

Faculty advisor: Michael Mehta, Geography and Environmental Studies

Clarence Todd. Pangenome Construction Pipeline for Eukaryotes

In the field of plant genomics, there is an increasing trend towards the study of a species' full complement of genes, termed the species' **pangenome**, which can be used to capture the entire gene repertoire of a clade. This has created an expanding demand for tools relating to the construction of pangenomes for eukaryotes, especially for plants. The creation of a complete eukaryotic pangenome tool remains hindered due to the increased complexity placed on such a tool as a result of the large genetic duplicity and genome size within eukaryotes. Many tools capable of completing functions that are part of the pangenome construction process, such as genome assembly and annotations, already exist. This project explores how to employ and customize certain of these existing tools to create a pipeline that will serve as the complete pangenome construction. To identify these tools, numerous existing plant pangenome studies were reviewed to locate those tools common to multiple studies and then to combine them through experimentation to create the pipeline. By creating a complete pangenome construction pipeline for eukaryotes, pangenomes can be constructed for a larger number of and for more complex species. Through these pangenomes, biologists can identify which genes serve core functional needs or as a variable component between individuals and subspecies to further understand the variations of each subspecies.

Faculty advisor: Lingling Jin, Computing Science