

# UNBC Research Week

Thursday, March 3<sup>rd</sup>, 2022

10:00am–11:30am

## Faculty of Science and Engineering Master's Student Presentations

Join us for this exciting session of presentations from the Faculty of Science and Engineering, with a cash prize for the best master's student presentation!

Zoom link:

<https://unbc.zoom.us/j/69555823995?pwd=ZWd3SG9TSW0zS0JMUWxFS0RNZHRKZz09>

Passcode: 274654

### Modelling of small-scale constructed wetland systems for domestic wastewater treatment and reuse

*Mario Alberto Salinas Toledano, MSc NRES, School of Engineering*

Mexico faces two key water problems, water pollution and distribution, despite the city's use of conventional technologies. This prompts a review of new technologies to address these issues. Since treatment wetlands systems (WS) are considered highly efficient, economical, and easy to operate technologies, they are a potential alternative to conventional wastewater treatments. WSs are nature-based engineering systems consisting of a waterbed with plants and a substrate layer as its foundation, where physical, chemical and biological processes combine to clean wastewater.

In this study, the performance of two pilot-scale treatment wetland systems (WS) prototypes, WS1 and WS2, were monitored for 16 months (from January 2020 to April 2021). The WSs treated domestic wastewater in two households of San Mateo Tlaltenango (SMT), Mexico City. Both systems are considered replicates and consist of a biodigester, a Subsurface Horizontal Flow Wetland (SHFW), and a Subsurface Vertical Flow Wetland (SVFW). Sampling was carried out monthly, and six water quality parameters were determined from the influent and the effluent: Chemical Oxygen Demand (COD), nitrites, nitrates, phosphates, total and fecal coliforms, and Total Suspended Solids (TSS).

The results indicate that the prototype is efficient and robust and allows for safe on-site water treatment and reuse. Current work on the in-silico modelling of the prototype will be proposed to understand better the degradation processes, which may lead to its operational optimization.

### Dissociation of H<sub>2</sub> + H<sub>2</sub> on two potential energy surfaces

*Abid Afzal, MSc student, Chemistry*

The interstellar medium (ISM) is a dynamic landscape of vast turbulent structures in which stellar birth and death occurs. Shock fronts play a vital role in the star formation. The fate of a shock front depends on how it loses energy and cools. Molecular hydrogen is the dominant molecular species present in the ISM and has an important role in this cooling. Collisions can excite molecular hydrogen to higher rotational and vibrational states (v,j). This excitation can be followed by emission of radiation by permanently removing energy from the cooling shocks. Understanding cooling through dissociation requires detailed information on the rate coefficients of this process. The collisional process can be

simulated through quasiclassical trajectory calculations if the forces of interaction are known. The potential energy surfaces (PES) provide the information on these forces. In this study two potential energy surfaces for H<sub>2</sub> + H<sub>2</sub> are being used, the BMKP2 PES and the Hinde PES. The Hinde PES appears to be the better PES based on the agreement of calculations with experiments for transitions among low (v,j) states. Trajectory calculations on the Hinde PES are computationally expensive. The first phase of this research is to assess whether results on the Hinde PES differ sufficiently from the earlier results on the BMKP2 PES to justify this more expensive calculation. Results to date show significant differences some of which raise questions about the validity of the Hinde PES for dissociation.

### **Molecular characterization of early adipose tissue remodeling and fibrosis in a mouse model of diet-induced obesity**

*Katie Timms, MSc student, Interdisciplinary Studies*

One of the many pathophysiological changes associated with obesity is the build up of structural and physiochemical extracellular matrix components in adipose depots, known as adipose tissue fibrosis. Like liver fibrosis, adipose tissue fibrosis occurs as a response to chronic injury and inflammation, and can perpetuate inflammation and impede proper tissue functioning. Key adipose tissue fibrosis markers have been identified in obese adipose tissue, including collagen VI and its cleavage product endotrophin, however, adipose tissue fibrosis remains poorly characterized, particularly in its initiating phases. We have developed and characterized a murine model of diet-induced obesity (12 weeks of high fat feeding), insulin resistance, and early fibrotic development in both sexes. While diagnosable fibrosis was absent, as determined by picrosirius red staining, we detected elevated collagen VI, TGF- $\beta$ , TNF- $\alpha$ , and TIMP-1 mRNA in gonadal white adipose of both sexes. TIMP-4 was decreased in males but elevated in females. Immunohistochemical analysis revealed pericellular build up of collagen VI immunoreactivity in males only, co-localized with immunoreactivity of its protease MMP-14, which is known to generate the pro-fibrotic fragment endotrophin. This work identifies key sex differences and that collagen VI, TIMP-1 and other extracellular matrix remodeling markers are present during the initiation of adipose tissue remodeling and fibrosis, earlier than diagnosable fibrosis can be detected, highlighting their potential as therapeutic targets for prevention or reversal of fibrosis in the treatment of obesity and insulin resistance.

### **Pituitary adenylate cyclase-activating polypeptide receptor expression in sympathetic ganglia innervating adipose tissue**

*Parleen Pandher, MSc student, Biochemistry*

Obesity is a disease that occurs when energy intake exceeds energy expenditure, concomitantly increasing risk of chronic diseases, including metabolic diseases such as diabetes. Research into therapeutics to correct dysregulations in energy balance is on the rise, and one notable neuropeptide being studied is pituitary adenylate cyclase-activating polypeptide (PACAP). PACAP has been shown to regulate thermogenesis, an energy burning process regulated by the sympathetic nervous system (SNS) in response to cold stress and overfeeding, but its role within the sympathetic nerves innervating and regulating energy metabolism in adipose tissues is not well understood. We hypothesize that PACAP is acting on PACAP receptors (PAC1, VPAC1, VPAC2) expressed in stellate ganglia innervating brown adipose tissue, the main thermogenic organ in mammals. We have established a reliable protocol for

the isolation of two ganglia of the SNS (stellate and superior cervical) and provided recommendations of reference genes to use as internal controls for gene expression studies. For the first time, we confirmed PACAP receptor gene expression in the stellate ganglia, and saw sex-specific, differential gene expression based on housing temperature. We subsequently analyzed the expression of PAC1 splice variants in the stellate ganglia and our positive control tissues (adrenal gland and superior cervical ganglia), identifying at least two variants in these SNS tissues. This work adds to current literature on the study of thermogenesis and energy balance, and encourages future work characterizing G-protein coupled receptors (GPCRs) for their therapeutic application, enhancing our fundamental understanding of autonomic physiology in mammals.

### **The role of histone deacetylase Sirtuin 2 in oligodendrocytes: identifying direct binding partners with co-immunoprecipitation**

*Samantha Smith, MSc student, Chemistry and Biochemistry*

Damage to the myelin sheath can lead to neurological disease such as multiple sclerosis (MS). In the central nervous system, myelination of neuronal axons is performed by cells called oligodendrocytes. Oligodendrocyte progenitor cells are recruited to sites of injury, but often fail to differentiate and remyelinate damaged axons. The deacetylase enzyme Sirtuin2 (Sirt2) is a key regulator of oligodendrocyte proliferation and differentiation, presumably by removal of acetyl groups from lysine residues of cellular proteins to regulate the activity of signaling factors during cell development. A targeted proteomic screen in mice lacking expression of the *Sirt2* gene identified numerous proteins in cortical brain tissue with different acetylation patterns in *Sirt2*<sup>-/-</sup> mice compared to control (C57Bl/6) mice. These include proteins involved in gene expression at the early stages of development, and proteins involved in cell morphogenesis at later stages of development. My objective is to identify Sirt2 deacetylase binding partners in the brain using co-immunoprecipitation methods. I hypothesize that Sirt2 is influencing proper oligodendrocyte differentiation by direct interaction with multiple deacetylation targets involved at early and later stages of development. I have established a co-immunoprecipitation protocol to validate proteins from the proteomics study as direct binding partners of Sirt2. Upon successful capture of Sirt2 with affinity chromatography, co-immunoprecipitated proteins were identified by western blot. This research will identify targets of Sirt2 in neural tissue, potentially identifying novel therapeutic targets to facilitate remyelination. Further characterization of the molecular function of Sirt2 may lead to more selective therapeutic approaches for myelin repair in neurodegenerative diseases.

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**10:00am–11:00am**

**FISSSH Research Showcase: The Scholarship of Teaching and Learning**

**Zoom link:**

<https://unbc.zoom.us/j/65481019184?pwd=bytVd1lGbmGxZTlTQVI0Y3ZkZ2hjdz09>

**Passcode: 426356**

### **Photo Voice as Feminist Pedagogy in Political Science**

*Dr. Fiona MacDonald, Assistant Professor, Department of Political Science*

One of the most fulfilling and impactful ways to practice feminism in political science is in the classroom. My approach to feminist pedagogy has developed both intuitively and strategically throughout my career and is rooted in a vision that challenges the traditional ways in which expertise, evidence, objectivity, and power inform and circulate in the classroom. This vision is consistent with theories of feminist pedagogy that conceptualize the classroom as a community of learning, care, and connection. While care is often positioned in our society as a set of practices free from contest or criticism, feminist approaches to pedagogy are founded on the knowledge that empowerment and liberation are cultivated through a process of critical engagement in a context free of shame and domination. Photo voice is a powerful tool through which this context can be created. It also facilitates an understanding of the classroom as a community in which everyone's presence is acknowledged and valued. This paper draws on a dialogue with six former students to demonstrate the impact(s) of photo voice methodology in the classroom and beyond.

### **Motivating JSL students in a COVID 19 necessitated online environment**

*Ami Hagiwara, Senior Instructor II, Department of Global and International Studies*

*Dr. Peter D. MacMillan, Associate Professor (Retired), School of Education and School of Health Sciences*

Distance learning in an online environment has always had challenges in student motivation and support, challenges likely increased in online environments mandated by Covid-19 restrictions. Second language learning presents further hurdles beyond what might be expected in another classroom setting. This ongoing research explores motivation and support strategies in Japanese language classes in this mandated setting.

Communication has many variations: linguistic communication, such as oral practice during lab, and social communication within class. Face-to-face classes are effective especially for those non-English-first-language students. Language learning aims to master linguistic communication, but requires social communication for a quality learning environment.

Both types of communication, may be reduced dramatically in online courses. If we can strengthen social and linguistic communication with online tools or activities, we can increase the efficacy of language courses. Social interaction is key to producing spontaneous speech in a language class. Time needed to acquaint students with new technologies detracts from language learning time.

Beginning in the 2020 fall semester, the first researcher (instructor) prepared six different types of online activities in courses, INTS 121 to 322. Students were surveyed as to the effectiveness of these activities to increase communication and motivation. We identified the more effective online activities, modified others and implemented them in later classes. We regard the findings as useful for other language instructors, even instructors in general. Integration of these activities into face to face or blended settings is another expected benefit.

## **Indigenous University Student Interaction with Faculty: Influence of Traditional Cultural Understandings About Elders**

*Cheri Brown, Master of Arts candidate, Department of First Nations Studies*

Research on post-secondary education attainment for Indigenous students in North America has established several common barriers that impact low degree persistence and high attrition rates, including low quality and infrequent student-faculty interaction. Little research, however, has focused on the causes of these underdeveloped relationships between students and faculty members. This paper argues that undergraduate university faculty-student interactions and relationship building are influenced by students' Indigenous cultural background and values, specifically their conception of professors as elders. In my ethnographic observation and engagement with Indigenous students at "Pacific Northwest University," students repeatedly position faculty as elders, or honorary elders, based on their authority and wisdom. Instructors, at times unaware of this positioning, either uphold this status and fit within elder frameworks of engagement or misread their positionality and fail to connect with students. Presence or absence of approachability, trustworthiness, cultural awareness and respect, plus willingness to adapt to a hands-on learning approach on the part of faculty were key determinants toward students responding favorably or unfavorably to particular instructors. The present study will help expand existing intellectual conversations regarding faculty-student interaction as a barrier or asset to Indigenous education attainment. It pinpoints some of the distinct needs of students and how to serve those needs and should be part of the design of programs and initiatives aimed at the advancement of Indigenous university students.

## **Modeling the Undivided Life in the Classroom: Parker Palmer's New Professional and the "Pathology of Speech" in King Lear**

*Dr. Lisa Dickson, Professor, Department of English*

In this presentation, I explore the intersection of Parker Palmer's concept of the "New Professional" (The Courage to Teach), and my experience of teaching King Lear. For Palmer, the division of heart from head is in many ways a product of and is reinforced by the institutional bias toward objective knowledge that "distrusts and devalues inner reality" (19): "In this culture, the pathology of speech disconnected from the self is regarded, and rewarded, as a virtue" (18). The result for academics is "the pain of dismemberment" that "comes from being disconnected from our own truth, from the passions that took us into teaching, from the heart that is the source of all good work" (21). I turn to Shakespeare's Lear, particularly the proliferation of oxymorons and the "pathology of speech" to explore the dramatized consequences of an institutional context that valorizes objectivity, authority and control in specific ways, and that cements both students and teachers into non-reciprocal relationships of voice and voicelessness. In taking seriously Palmer's call for a "New Professional" who can advocate for and build into the disciplinary practice the value an undivided life, I explore feeling as a legitimately critical means of finding and creating meaning. I seek to acknowledge a broader responsibility to cultural change that can arise only when we challenge the trust gap generated by Ira Shor calls "faux learning," an "unauthentic discourse... a kind of theater of manipulative discourse where students play at postures they think will help them get by" (When Students Have Power). What would a classroom look like if it were designed to promote "the undivided life?"

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**11:30am–11:45am Break**

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**11:45am–12:45pm**

**Presentations – Mine tailings, Venezuelan immigrants, tobacco-related cancer, and neutrosophic statistics**

**Zoom link:**

<https://unbc.zoom.us/j/69218092235?pwd=bUhpNTg2endrWjlNL3p1cjBWWmx1Zz09>

**Passcode: 258615**

**Effects of Mount Polley mine spill tailings on impacted lakes' phosphorus and chlorophyll-a concentrations**

*Gabrielle Lint, MSc student, Geography, Earth and Environmental Sciences*

On August 4, 2014, the tailings pond at the Mount Polley Mine in the Cariboo region of British Columbia breached and released ~25 M m<sup>3</sup> of liquid and solid tailings into surrounding terrestrial and aquatic environments. The flow of tailings and overburden first entered nearby Polley Lake, which eventually dammed, forcing the flow down Hazeltine Creek and into the west basin of Quesnel Lake. In the following years, sediment analyses have revealed that the surface of the settled tailings is unconsolidated and are resuspended during seasonal turnover events. Concerns that the unconsolidated sediments could be releasing phosphorus into the ecosystems of Polley and Quesnel Lake have been mounted by both scientists and the local community. Sampling was undertaken in summers 2020 and 2021 to investigate whether differences exist between locations that directly received tailings deposits and those that did not. Early results have revealed differences in these paired sites such as higher concentrations of chlorophyll-a in the surface water at sites over the deposited tailings than their unaffected paired sites, suggesting a biological response to an increased availability of phosphorus at these locations.

**Re-casting Colonial Codes of Difference: An Examination of the Lived Experiences of Venezuelan Immigrants in Trinidad & Tobago**

*Dr. Shiva S. Mohan, Assistant Professor, Geography*

The “Venezuela Crisis” has prompted an unprecedented level of emigration of its nationals. The neighbouring twin-island nation, Trinidad & Tobago (T&T), has been identified as recipient to the largest number of Venezuelan migrants in the Southern Caribbean. This paper explores the everyday lived experiences of Venezuelan immigrants in T&T. The reception and treatment of Venezuelan migrants on the island can be characterized as discriminatory, exclusionary and inherently violent. Based on in-depth, semi-structured interviews with these migrants, and framed by precepts of the “Changing Migrations-Continuities of Racism” categorization of Erel, Murji and Nahaboo’s (2016) “race-immigration nexus”, this interrogation exposes the deeply seated anti-immigrant character of the post-

colonial island. The experiences of the Venezuelan immigrants are fashioned by domestic restrictionist legislation and rhetoric, that compounds already pervasive anti-immigrant sentiment across the island. I assert that racialization and the differential readings of the immigrant body are re-scriptings of colonial codes of difference, that have been re-casted onto the “outsider”. Tangible markers, through corporeal and cultural dissimilarities between the local population and Venezuelan immigrants, in particular, perceived physical variances and language difference, remain material considerations in the construction of hierarchies. These are representations of colonial readings of the Caribbean body, re-casted. Of note, the paper underscores the especially challenging circumstances that female Venezuelan immigrants live, as they are subjected to layered and gendered processes of “othering”. This example of Venezuelan immigrants’ experiences in T&T is a rich case study that demonstrates contemporary manifestations of difference informed by racialized gazes in post-colonial Caribbean societies.

### **Identification of tobacco-related cancer diagnoses among individuals with psychiatric disorders**

*Dr. Robert Olson, Affiliate Associate Professor, Division of Medical Sciences*

Individuals with psychiatric disorders (PD) have a high prevalence of tobacco use. We therefore assessed the hazard of receiving a tobacco-related (TR) cancer diagnoses among individuals with PD. Methods: Several population-based provincial databases were used to identify individuals in BC diagnosed with depression, schizophrenia, bipolar disorder, anxiety disorders, or multiple PD between 1990 and 2013. A primary population-proxy comparison group (appendicitis) was also identified and matched to the psychiatric cohort on age at cohort entry, gender, year of cohort entry and postal code. We linked individuals in the cohort and comparison group with the BC Cancer Registry. Using a competing-risks approach, we estimated the effect of having a PD on the risk of receiving a TR cancer diagnosis, in light of the competing risk of mortality. Results: 165,289 patients were included. Individuals with depression (HR=0.81;  $p < 0.01$ ; 95% CI: 0.73-0.91), anxiety disorders (HR=0.84;  $p = 0.02$ ; 95% CI: 0.73-0.97) or multiple PD (HR=0.74;  $p < 0.01$ ; 95% CI: 0.66-0.83) had a statistically significant lower risk of a TR cancer diagnosis compared to the comparison group. Individuals with schizophrenia (HR=0.86;  $p = 0.40$ ; 95% CI: 0.62-1.21) or bipolar disorder (HR=0.58;  $p = 0.12$ ; 95% CI: 0.29-1.14), however, showed no evidence of a statistically significant difference from the comparison group. Interpretation: We found individuals with depression, anxiety disorders or multiple PD diagnoses had a significantly reduced risk of receiving a tobacco related cancer diagnosis. These results were unexpected, and could be explained by individuals with a PD having barriers to a cancer diagnosis, rather a true decreased incidence.

### **Neutrosophic Statistics: Understanding and Analyzing Imprecise Data**

*Dr. Pranesh Kumar, Professor, Mathematics and Statistics*

Neutrosophic statistics is an extension of the classical statistics. In the classical statistics, we deal with the precise data numbers. In neutrosophic statistics, we replace numbers and parameters (like mean, proportion, standard deviation) that are indeterminate (imprecise, unsure, unknown) with the sets. We will talk about the importance of neutrosophic measures (like, measures of central tendency, dispersion, correlation and regression) with simple data examples.

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**12:45pm–1:00pm**

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**1:00pm–2:00pm**

**FISSSH Research Showcase: Competing Conceptions of Modernization in British Columbia, 1950s-1990s**

**Zoom link:**

<https://unbc.zoom.us/j/62813823314?pwd=N2paSFVwaG1QUitNa1pGZjg3dFU4Zz09>

**Passcode: 328661**

**“That Stink is the Smell of Money”: The Response of the People of Prince George to Industrial Growth of Pulp Mills in Their City, 1961-1968**

*Claudette Gouger, Master of Arts candidate, Department of History*

Within a three year span the City of Prince George had three fully operational kraft pulp and paper mega projects introduced into the region’s geographical footprint. In 1966 Prince George Pulp and Paper, (PG Pulp) Prince George’s first kraft pulp mill was commissioned. Two years later, Intercontinental Pulp (Intercon), Prince George Pulp’s sister mill, and Northwood Pulp, were added to British Columbia’s producing pulp and paper mills.

On 18 March 1964, more than two years before the first kraft pulp mill went into operation in Prince George, British Columbia, that city’s newspaper reported cautiously that “with the advent of two pulp mills in the immediate vicinity of Prince George, the problem of air pollution becomes increasingly important in the minds of health authorities.”<sup>1</sup> An editorial published less than a month later, the same newspaper acknowledged that “those not so worried about the gases, smells and substances that befoul the air say: ‘That stink is the smell of money. It’s the odour of our economy and we should not complain about it.’”<sup>2</sup> Obviously then, even before the kraft pulp mills went into operation in Prince George, there was a lively public debate over the effects that the production of kraft pulp would have on air quality in the city. Surprisingly, there is no historical literature to help us understand how the people of Prince George (including politicians and health officials) responded to the news that pulp mills were going to be built in their city, or how they responded once the mills were built. This presentation, using a sensory history approach, examines the nature of public debate in Prince George relating to air quality before, during, and after the pulp mills were established in the city.

<sup>1</sup> Tony Skae, “Air Pollution Comes with Industry’s Growth and it Could Get Worse” *Prince George Citizen*, 18 March 1964, 8.

<sup>2</sup> “A Breath of Fresh Air,” (editorial) *Prince George Citizen*, 17 April 1964, 9.

**Fruitleggers, Black Market Fruit, and Agrarian Resistance on the Margins of BC’s Orchard Industry, 1940-1975**

*Dr. Ben Bradley, Assistant Professor, Department of History*

This presentation traces the emergence, proliferation, and abrupt termination of a black market in orchard fruit in BC during the period 1940-1975. While the agricultural history of mountainous,

glaciated, heavily forested BC is an underdeveloped field, one well-cultivated section is the history of its somewhat implausible orchard industry, which was (and remains) concentrated in the hot, arid Okanagan Valley. Early BC orchardists faced disparate challenges in the late 19th and early 20th centuries, largely due to their position at the northernmost periphery of the North American market. In their struggle to achieve socio-economic stability, growers reached an agreement with the provincial government in the late 1930s whereby all fruit grown in the Interior would be sold by a marketing board called the BC Fruit Board. This system brought a modicum of stability to the orchard industry, and most histories of the industry identify it as a big success. However, not all orchardists were amenable to its illiberal principles and policies. Discontent in sections of the growing community led to the development of a secretive black market, in which growers and truckers smuggled fruit to distant population centres like Vancouver and Calgary under cover of darkness. Using archival, newspaper, and oral sources, this paper traces the rise and fall of this “fruitlegging” activity, as well as efforts by the BC Tree Fruits inspection force (the “Fruit Police”) to stamp it out.

### **The Logic of Hydroelectric Development: Provincial Responses to Dam Building in the Postwar Period**

*Dr. Daniel Sims, Associate Professor, Department of First Nations Studies*

Following the Second World War numerous hydroelectric dams were constructed around British Columbia. Part of a larger global infatuation with megaprojects at the time, it is often easy to see advent of the modern environmental moment as stemming from local peoples facing the reality of what these developments did to the environment. After all, as Minister of Lands, Forests, and Water Resources told The Province in 1970, “Quite frankly, I didn’t know what the word ecology meant for a long time, and I don’t think too many other people did either back in those days.” This statement is misleading a number of reasons, but two most relevant ones to this examination of the period are that it reduces concerns about the environment to a noun, and that taken together with the rest of the interview it suggests many of the complaints about hydroelectric were a posteriori. Nothing could be further from the truth. This paper will examine the opposition to hydroelectric development in British Columbia during the postwar period. In it I will argue that although they might not have used the same words we use today to articulate their concerns, those who opposed the dams then shared similar concerns to those who opposed dams now. And in a similar vein it is the province and those who embrace the logic of hydroelectric development that ensured who made sure the dams were built then and now.

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**2:00pm–3:30pm**

### **Visual Research Methods Panel and Showcase**

**Zoom link:**

<https://unbc.zoom.us/j/63711383096?pwd=bjFtc1RFSDRKakllb1hheFBZZlBlcz09>

**Passcode: 192412**

This panel and showcase features UNBC researchers and students engaged in qualitative research using visual strategies and technologies for participant engagement, data collection, and research communication. Presenters and projects include:

**Learnings from editing material for a short ethnographic film**

*Dr. Marieka Sax, Adjunct Professor, Department of Anthropology and Instructor, GEES*  
*Jessica Froese, undergraduate student and RA*  
*Cyan LeMoal, undergraduate student and RA*

**On using Creative Analytic Practice, Collective Storytelling, Visual Storytelling, and Photovoice**

*Penina Sara-Lynn Harding, PhD Candidate and Instructor – NRES*

**Collage Inquiry as a Visual Research Method to Elucidate Social Work Students Experiences of Mahavakyam Meditation**

*Dr. Indrani Margolin, Associate Professor, School of Social Work*

**Artists' Books as Primary Resources on Health Research**

*Dr. Darian Goldin Stahl, PhD MFA, Banting Postdoctoral Fellow, UNBC Northern Health Program and Health Arts Research Centre*

**Digital storytelling with the Environment, Community, Health Observatory (ECHO) Network**

*Makayla Skrlac, Researcher and Program Assistant, ECHO Network*

*Dr. Margot Parkes, Professor, Professor, School of Health Sciences and Northern Medical Program & ECHO Network*

**Visual methods for the rapid assessment of human rights abuses among Rohingya refugees in Bangladesh**

*Dr. Catherine Nolin, Professor and Chair, Department of Geography, Earth, and Environmental Sciences*

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**3:30pm–5:00pm**

**Faculty of Science and Engineering PhD Student Presentations**

*Join us for this exciting session of presentations from the Faculty of Science and Engineering, with a cash prize for the best PhD student presentation!*

**Zoom link:**

<https://unbc.zoom.us/j/65404831657?pwd=NHBXQkNSbFFKUmpOK2IDamZLZ2R5dz09>

**Passcode: 852708**

**Reduction of Local Scour at Bridge Abutment by Application of Spur Dike under Ice-Cover**

*Rahim Jafari, PhD student, Natural Resources and Environmental Studies*

Bridges are one of the most important structures which connect roads, reduce traffic, and make transportation much easier. Because of the broad range of bridge usage, their safety is crucial. Hence, a bridge collapse can be one of the most dangerous types of structural failures. There have been more

than 1000 bridge failures in the last five decades all over the world, of which 60% were due to a phenomenon called scour.

Scour is an engineering term for a specific form of erosion around bridge piers and abutments in riverbeds. It refers to a removal process of soil around the abutments and piers of the bridges. US Federal Highway Administration reported scour-related bridge failures to cost almost \$30 million per year. In this research, a novel method is proposed to protect piers by using a special kind of wall called a spur dike.

Spur dikes are well-known structures that have a wide range of usage in rivers and coastal regions. Depending on their types, sizes, and angular orientations, spur dikes can substantially change flow characteristics. They can be installed on the upstream side of bridge piers, redirect the water flow and prevent or reduce scour around a bridge pier. The goal of this experimental study is to find the optimum distance between a dike and the pier and the best angle of a spur dike toward the pier, to have the lowest amount of scouring possible.

### **Experiment study of the creep behaviour of rock by micro-indentation tests**

*Huan Yu, PhD student, School of Engineering*

Rock creep behaviours are time-dependent deformations under a constant load due to the rheological properties of rock minerals, which play a vital role in various engineering problems, including rock mass deformation around tunnels, rock slope stability, and reservoir production problems. For example, the recovery rate of shale gas from tight rock formation decreases dramatically with time, and a major contributing factor is the rock creep behaviour that significantly reduces the hydraulic fracture conductivity.

Laboratory testing is a common way to study the mechanism of creep behaviours of rock. Conventional experiments, such as uniaxial and triaxial compression tests, are both cost expensive and time-consuming due to the difficulty of drilling cores from the several kilometres depth and preparing into inch size cylindrical samples to be tested in an extended long load-holding duration. The indentation test has shown great potential in reproducing the creep behaviour by small-size samples within a short period compared with conventional experiments. In recent years, this method has been used to analyze the time-dependent behaviours of rock, and the result is consistent with the actual situation.

The micro-indentation test was used in our research to investigate the viscoelastic properties of Montney rock at the microscale and determine the mechanical properties of the hardness, elastic modulus, and fracture toughness. This presentation will give a detailed introduction to the research of the creep behaviour of rock and focus on the importance and mechanism of creep behaviour and the development of methodologies on creep tests.

### **The role of Introns in *Cyanidioschyzon merolae***

*Maryam Ghaffarzadeh, PhD student, Health Sciences*

Background: Eukaryotic precursor mRNAs (pre-mRNAs) contain introns, intervening sequences that interrupt protein-coding regions and must be excised before mRNA export to the cytoplasm for translation into proteins. A large RNA-protein complex (RNP) known as the spliceosome catalyzes the

accurate removal of introns and ligation of exons. While there are a number of hypotheses for the purpose of introns in eukaryotes, not enough evidence has yet been accumulated to allow a definitive, universal role for introns.

**Research Objectives:** In light of the complexity of the human spliceosome, a tractable system with fewer components is of considerable interest for investigating the function of introns. The red alga *Cyanidioschyzon merolae* (*C. merolae*) genome sequence revealed only 38 introns and 69 splicing proteins, indicating it could be a powerful system for splicing research.

**Experimental Approach:** In the first phase of my thesis, I'm trying to remove introns from *C. merolae* individually by means of homologous recombination. I will also begin to implement the powerful CRISPR gene editing technique to accelerate the intron deletion process and allow an intronless strain to be generated in a practical amount of time.

**Significance:** My experiments will investigate how many introns can be deleted simultaneously, which will ultimately limit how long it takes to create an intronless strain. No organism has ever had all of its introns removed, and such a strain will allow us to address fundamental questions about the biological importance of splicing and the machinery that is responsible for carrying it out.

### **Application of particle-based methods in simulating fluid flow in porous media**

*Mohammadhassan Ahmadian, PhD student, Natural Resources and Environmental Studies*

The porous medium has a broad range of applications in engineering. A material is porous when it consists of many pores with various irregular sizes. In this regard, many natural and man-made substances such as soil, rocks, cement, or even biological tissues are considered porous materials. Porous media usually consist of two phases: the solid phase of materials and the fluid phase that permeates through the pores. The literature clearly shows that most studies conducted regarding porous medium focus on either simulating or analyzing fluid flow within the porous structure. While there are a couple of methods for flow simulation inside the porous matrix, recent studies are more concerned with accuracy and simulating flow at the pore scale, in which particle-based methods are one of the best choices for this matter. Therefore, this presentation focuses on applying two well-known particle-based methods named the Direct Simulation Monte Carlo (DSMC) and the Lattice Boltzmann Method (LBM) and their application in calculating properties of porous media such as permeability. For this purpose, in an attempt to simulate flow in shale gas reservoirs, the DSMC method is applied to simulate gas flow in a 2D microporous channel. Then the influence of the morphology along with rarefaction and gas type on the apparent permeability is investigated. In addition, to further demonstrate the capability of the particle-based method, the application of LBM in simulating natural hazards in geotechnical engineering such as internal erosion will be explained.

### **Local Scouring around Submerged Spur Dikes under an Ice-covered Condition**

*Guowei Li, PhD student, Natural Resources and Environmental Studies*

A spur dike is a construction extending outward from a stream bank to deflect the water away and protect the bank from erosion. As an engineering structure protruding into the natural channel, spur dikes could trigger a scouring process that causes a localized lowering of the channel bed due to the

imbalance of sediment transport. Results of previous studies indicate that the presence of an ice cover in rivers can cause complicated flow structures around non-submerged spur dikes. In this project, I propose an experimental study to investigate the impacts of ice cover on the evolution of a local scour around fully submerged spur dikes. The spur dike models will be set up at the three angles of orientation:  $45^\circ$ ,  $60^\circ$ , and  $90^\circ$ . Results of the experiments will reveal the impacts of changes in dike angles and boundary conditions (i.e., open channel, smooth ice cover, and rough ice cover) on the velocity distribution around the scour holes formed in the vicinity of the spur dikes. The findings of this study will benefit spur dike designers and foster a more comprehensive understanding of the ice cover boundary conditions for the academic community, allying with other institutions to create heterogeneous hydraulic analysis datasets.