Agricultural Technologies and Bioproducts (Cluster Lead: Dr. Mahmoud)	
Poster #	**Title**
1	**Molecular control of flower sex determination in Cannabis sativa** *Ayelign M. Adal, Ketan Doshi, Larry Holbrook, Soheil S. Mahmoud* Medical cannabis and industrial hemp are economically important dioecious plants, with male and female reproductive organs in separate individuals. Flower sex in these plants is mainly determined by the genetic makeup of the plant, although environmental factors (e.g., including light, nutrients, and certain biochemical compounds) can affect floral sex as well. For example, exposure to silver nitrate causes female flowers to develop male organs. The molecular mechanism of this phenomenon is unknown. This study aims to identify the molecular elements responsible for male organ development in female flowers of C. sativa. We employed RNA Sequencing (RNA-Seq) to identify and clone transcription factors that control masculinization of female flowers (induced-male flowers) in cannabis plants. These regulatory genes provide valuable tools for improving flower size and density in C. sativa plants through targeted breeding and plant biotechnology.
2	**Project to Develop Novel Essential Oils from Breadfruit (Artocarpus altilis)** *Abisola Z. Kehinde, Ayelign Adal, Soheil S. Mahmoud, Susan J. Murch* Development of novel bioproducts requires understanding the underlying physiology, chemistry and molecular biology of the plant. Breadfruit (Artocarpus altilis) is a staple food crop originating from Pacific Islands. In traditional uses, breadfruit leaves are used for treatment of burns, insect bites, headaches, hypertension, insomnia and infections. The overall objective of this research is to identify useful novel bioproducts from breadfruit leaves and identify and clone the related biosynthetic genes. Specific objectives are (a) to determine the genetic composition of breadfruit trichomes, (b) to characterize and quantify the chemical composition of essential oils in breadfruit trichomes, and (c) to identify and clone bioactive terpenoid biosynthetic genes and other compounds in this plant. To achieve these, trichomes will be separated from leaf using the modified glass bead abrasion. Analysis of chemical composition of the trichomes will be done by gas chromatography mass spectrometry with comparison to the NIST database for compound identification. Total RNA will be sequenced using RNA-Seq. The sequencing information will be used to assemble a transcriptome for gene identification and cloning. The outcomes of this research will include development of methods for study of breadfruit trichomes and novel bioproducts from breadfruit leaves, and the cloning of related biosynthetic genes.
3	**Biocomposites as a replacement for plastics and petroleum-based polymers—A life cycle thinking based study** Ahmad, Hammad; Hewage, Kasun; Sadiq, Rehan; Milani, Abbas The continuous environmental degradation and resources depletion worldwide have opened gateways towards innovative research for improved sustainability. Numerous local and global organizations, including United Nations, have emphasized on reducing the environmental loads of products and processes. Petroleum based polymers/plastics have reigned supreme during the last century due to their extreme tailorability for a wide range of applications; however, the current studies have shed light on the high environmental footprint associated with these materials. Biocomposites and bio-based polymers have therefore emerged as sustainable alternatives due to incorporation of renewable and biodegradable ingredients. The rising interest in applications of these materials calls for more systematic studies to asses their environmental impacts throughout the life-cycle to ensure that adoption of these materials would indeed enhance sustainability over long term. This research project aims to address this need through a two-phase study: the first phase reviews the environmental problems associated with plastics along with the classifications and applications of natural fibers and degradable polymers, particularly as construction and building materials. The second phase discusses the life cycle assessment (LCA) of biocomposites in terms of environmental and economic performance. The proposed study is a first step along a path of research to develop a LCA model for a specific type of biocomposite that shows promising applications in the construction industry.
4	**Flax and hemp genetic mutants serving as a platform for next generation natural fiber biocomposite material** *Sahar Alousi, Michael Deyholos, Sepideh Pakpour* Along with the increasing global environmental concerns, sustainable and eco-friendly biocomposite materials are gaining more popularity as alternatives to synthetic fiber reinforced composites. Flax and hemp cell wall encoding genes dictates the biochemical composition of the stem's fibers. Varying proportions of the lignocellulosic cell wall materials within the fibers can directly alter their mechanical properties. Through harnessing the genome of flax and hemp we aim to produce fibers with superior mechanical performance, enriched fiber quantity, and increased fiber durability. A total of 6000 genetically mutated flax seeds were generated using Ethane Methyl-Sulphonate (EMS) method. Preliminary screens of flax seeds are being conducted to single out genetic mutants with SNPs in cell wall related genes. Using bioinformatics algorithms, proteins encoded by cell wall related genes were identified from the hemp genome. These set of identified proteins will serve as a platform for future targeted genome modification in hemp plants. At a later stage, fiber extraction will be carried out to perform mechanical assessment and test fiber resistance to composting conditions.
5	**Lignin and Poly(lactic acid) Graft Copolymers** *Diana Kim, Hyuk-Joon Jung, Love-Ese Chile, Addie Bahi, Frank Ko, Parisa Mehrkhodavandi* Lignin is the second most abundant bio-derived material on earth after cellulose and has been considered as a filler in various green composites. Nonetheless, this cheap and renewable material has been underutilized due to the complexity of its structure. In this study, we aim to functionalize lignin with controlled molecular weight and enantiopure biodegradable poly(lactic acid) (PLA). The prepared PLA is successfully grafted to lignin via graft-to synthetic strategy and a series of lignin-graft-PLA copolymers are synthesized by changing the amount of lignin or tacticity of PLA.
6	**Robust Potassium-Ion Batteries from Lignin: An Abundant, Renewable, and Low-cost Material** *Kris Wu, Jian Liu* Development of new battery technologies is essential for the deployment of electric vehicles and renewable energy, and the reduction of greenhouse gas emissions. Potassium-ion batteries (KIBs) are promising alternatives to Li-ion batteries, due to the abundance of potassium in Earth's crust, high energy density, and low cost. However, commercial graphite does not work properly as anode in KIBs, due to the large size of K ions. Herein, we used lignin as starting material to synthesize hard carbon (HC) by a solid-state method and applied it as an anode in KIBs for the first time.

	The HC exhibited excellent electrochemical performance in KIBs. The HC delivered a high reversible specific capacity of over 300 mAh g-1 at a current density of 50 mA g-1. Mechanistic study revealed a ternary K-ion storage mechanism, i.e. intercalation, pore-filling, and surface absorption, in HC. This work not only established HC as an anode for KIBs, but created new revenue for lignin, the second most abundant biomaterial in nature and readily available in BC, in the growing energy storage sector. This work also set a good example in building a circular economy by turning lignin recycled from wood waste into high-value-added carbon products in battery technology.
7	**Bioplastics vs. Synthetic Polymers: A comparative study of water absorption and its implications in sustainability** *Sakshi Khanna, Mahdi Takaffoli* The alarming environmental damage caused by plastic waste is highlighting the need to develop business and technological solutions to enhance sustainability with respect to these materials. Given that plastics play an important role in our current society and their tailorable structures offer a great deal of potential applications, there is a growing interest in replacing non-degradable plastic with sustainably produced, biodegradable plastics. This entails better understanding of their properties and performance in different service environments and possible end-of-life options for these materials. In collaboration with Pela, a manufacturer of bio-plastic products, the current project aims to evaluate the fungi resistance and water absorption of some commercialized bio-plastics and draw comparisons between their behavior and a synthetic polymer, such as silicone rubber. The fungi resistance study will be conducted according to ASTM G21-15 over a four-week period. At different intervals during the test, visual appearance, surface morphology and mechanical properties of samples will be characterized and changes will be identified. In addition, water absorption tests will be performed and the change in weight of the samples will be monitored over time. This study offers some basic understanding on the performance of these bio-plastics in different environments guiding future designs and applications.
9	**Laboratory and field scale biodegradability assessment for case products** *Hina Dilawar, Cigdem Eskicioglu* Several biodegradable plastics have been created as an alternative to conventional plastics that are difficult to degrade. The biodegradable plastics have had numerous studies conducted on them in laboratory composting (aerobic) conditions, that help certify them as compostable; however, only a few of those studies have also conducted field scale studies to assess how those bioplastics perform in the real world. Another option for the degradation of bioplastics can be through anaerobic digestion, as some bioplastics have shown good biodegradation under anaerobic conditions. The aim of this study was to determine the biodegradation of Pela cellphone cases, composed of a bioplastic elastomer and flax straw materials. The biodegradation and/or weight loss of Pela cellphone cases were conducted under laboratory scale aerobic and anaerobic conditions and field scale aerobic conditions. The laboratory scale aerobic assays were conducted according to ASTM D5338-15. The biodegradation of the cellphone cases under both mesophilic (35Â°C) and thermophilic (55Â°C) anaerobic conditions was determined by measuring biogas production. The results indicated that the cellphone cases had better degradation under thermophilic anaerobic conditions, than mesophilic anaerobic conditions. However, the aerobic assays had higher biodegradation than either of the anaerobic assays.
10	**Optimizing a plastination technique for preserving natural fiber composites** *Reeghan Osmond, Daanvir Dhir, Mahdi Takaffoli, Ron Ryde, Grant Bogyo, Kevin Golovin, Abbas Milani* Natural fibre-reinforced polymer composites (NFRPs) are highly sensitive to moisture. Exposure to water causes the fibres to swell and weakens their bond to the polymer matrix, thus deteriorating the composite's strength. Plastination is a new process that removes water from natural fibres and replaces it with a polymer improving their resistance to moisture degradation. The process steps include dehydration where the water is replaced with acetone, polymer impregnation where the acetone is replaced by a polymer, and polymer curing. It has been shown that this process can reduce the degradation in mechanical properties of bamboo after soaking in water. Although these results are promising, plastination is lengthy, complex, and in need of optimization. In this work, the methods used to optimize this process will be presented, along with experimental results. Both the polymer curing and dehydration steps have been improved by changing to a different polymer and using a higher process temperature, respectively. Future work will focus on improving the polymer impregnation step and comparing the mechanical properties of samples treated through the previous and optimized processes. Current research can reveal plastination's potential to improve the moisture degradation resistance of many other types of natural fibres used in NFRPs.
11	**The Role of Policies in Advancing Circular Economy: Comparing Policies in China, Europe, and Canada** *Anastasiya-Izabela Krahelskaya, Abbas Milani and Mahdi Takaffoli* Considering the finite resources available in the world and the increasing environmental risks of the exploitation of these resources, increasing resource efficiency is critical. A circular economy is an economic system that aims to get the highest value out of materials by keeping them in the economic cycle for as long as possible. This is achieved through a cyclical flow of materials and energy and an emphasis on reduce, reuse, recycle, and recover activities. While the concept of a circular economy is relatively vague, it has continuously gained exposure as evidenced by the increase of publications on the topic. This study will explain the circular economy concept and address its current limitations through a review of publications. It will then analyze and compare case studies of the various policies and regulations that are aiding countries with the transition to a circular economy. These case studies will focus heavily on European countries and China and explain how their policies can influence and impact the decisions made in Canada. The study of these policies will identify which policies have been significantly successful, why, and what role they have played in advancing the circular economy concept.
Community Health (Cluster Leads: Drs. Martin Ginis and Jung)	
12	**We're in this together: Co-developing a community-university workplan for diabetes care in the B.C. Southern Interior** *Locke, S.R., Jung, M.E., Little, J.P., Dix, G. U., Dinwoodie, M., Te Hiwi, B., Oelke, N., Rush, K., Berg, S., Kurtz, D. L., & Martin Ginis, K. A.* Background: One focus of the Community Health Research Cluster is diabetes care in the B.C. Southern Interior. Stronger community-university collaborations are necessary to allow meaningful research to be conducted that is eagerly uptaken by the community. A community-university meeting was held to strengthen community-university

	collaborations and co-develop a research workplan to identify projects to pursue together to address diabetes care gaps or priorities in the B.C. Southern Interior. Method: 25 university and community members working or volunteering in diabetes care settings from across the B.C. Southern Interior attended a 4-hour meeting to (1) brainstorm potential research initiatives, (2) select and refine key ideas, and (3) assess the feasibility and impact of key ideas to collaboratively pursue. Results: The meeting produced a local research workplan and two key collaborative projects were formulated: (1) the development of a diabetes patient journey map and (2) development of a diabetes service hub with navigators for patients.
13	**What's in a website? Determining evidence-based components of exercise programs for diabetes management** *Miranda G. Dinwoodie, Sean R. Locke, Mary E. Jung, & Kathleen A. Martin Ginis* Introduction: Physical activity is effective for diabetes prevention and management. Evidence-based interventions enhance behaviour change efficacy. The internet is popularly searched for health-related information, yet website quality for diabetes exercise programs remains unclear. The purposes of this research were to evaluate websites providing exercise programs regarding a) behaviour change techniques (BCTs), b) theoretical domains, and c) technical quality of resources provided. Methods: A grey-literature internet search was conducted to identify exercise programs for diabetes management in the Okanagan. Program descriptions were inductively coded for (1) Theoretical Domains Framework (TDF), (2) Behaviour Change Techniques Taxonomy (BCTTv1), and (3) website technical quality using the Journal of the American Medical Association (JAMA) criteria. Results: 7 exercise programs for diabetes care were identified. 5/7 programs referred to the TDF and BCTTv1. 7/14 TDFs were referenced across the 5 program descriptions. Frequently mentioned TDFs were behavioural regulation and social influences. 12/93 BCTs were addressed. Social support (practical and unspecified), and goal setting (behaviour) were frequently mentioned BCTs. One website satisfied all 6 JAMA criteria; the mean score was 4. Conclusion: A portion of exercise programs utilized evidence-based interventions. Future research should interview service providers to more comprehensively understand BCTs and theoretical rationale utilized in programs.
14	**Identifying service delivery strengths and gaps for diabetes care in the B.C. Southern Interior: A community-informed perspective** *Dix, G. U., Locke, S. R., Te Hiwi, B., Oelke, N., Little, J. P., Rush, K., Berg, S., Dinwoodie, M., Kurtz, D. L., Jung, M. E., Martin Ginis, K.* Background: Diabetes rates in the British Columbia (B.C.) Interior are rising more rapidly compared to the rest of Canada while diabetes service provision is limited within this region. In order to create a comprehensive picture of service delivery strengths and gaps in this region, semi-structured interviews were conducted with key community members. The purpose of this research was to identify characteristics of diabetes service delivery, namely priorities, barriers, benefits, and gaps in service provision, in the B.C. Southern Interior. Methods: Ten community members working or volunteering in diabetes organizations participated in semi-structured telephone interviews pertaining to service access, priorities, barriers, benefits, and gaps. Responses were inductively content analyzed by two coders. Results: Although numerous strengths and weaknesses were identified, interviewees reported that one of the greatest strengths of service delivery was the capability to provide services for those with the highest risk, such as those with type 1 or gestational diabetes. However, this strength resulted in reduced capacity and resources to deliver preventative programming to people with prediabetes or obesity. Similar findings were reported for rural and urban diabetes services, however, rural services reported greater resource limitations. Conclusion: Interview findings provided the foundation for a community-university agenda-setting meeting.
Enhancing Ecosystem Sustainability (Cluster Leads: Drs. Armstrong and Parrott)	
15	**Enhancing Ecosystem Sustainability: A community-based project to understand vulnerability and resiliency of black huckleberry (Vaccinium membranaceum) populations in the Okanagan** *Lauren Erland, Bonny Lynn Donovan, Jeannette Armstrong, Susan Murch* In recent years, Syilx harvesters and Syilx Traditional Ecological Knowledge holders have noted that black huckleberry (Vaccinium membranaceum) patches are declining in number, health and berry size. Black huckleberry is important as a traditional food for the Syilx people, and a nutrient dense food for grizzly bears, particularly young cubs. Human activity, increased commercial harvest, changes in land management and/or fire suppression, heat stress and changes in floral timing have been observed and reported by Syilx people and may play a role in decline. A collaborative project is being developed involving UBC researchers, the En'owkin Centre and the Women's Black Huckleberry Protectors groups through a process of community consultation to identify priorities and objectives. Our proposed objectives may include (1) Understanding factors that affect seed germination and viability rates; (2) Understanding factors that affect berry size; (3) Determining the nutrient composition and the effects of changing berry size; and (4) Identifying possible physiological or local environmental factors that impact the crop. We hope to understand basic ecology, physiology and nutritional aspects of black huckleberry in order to inform further studies to understand important factors underlying these changes and to ensure healthy populations in the BC Interior and other ecosystems.
16	**Ecoliteracy in the Early Learning Years: A Land education study with Syilx/Okanagan four and five year olds** *Bonny Lynn Donovan, Jeannette Armstrong, Leyton Schnellert* In 2005 Richard Louv coined the phrase "nature-deficit disorder" to bring attention to an alarming trend: the loss of connection between children and the natural world. Since then, educators have become increasingly interested in pedagogies such as place-based learning, place-conscious learning, and outdoor learning as a way to address this problem. As an educator, I too am alarmed by this loss of connection. Therefore, in 2022, I will conduct a Land education study with Syilx/Okanagan preschool and Kindergarten students, for the purpose of identifying ways to support early learners' ecoliteracy. My aim is to undertake a decolonizing study that privileges the Syilx/Okanagan conceptualization of Land and the voices of early Syilx/Okanagan learners and their first teachers (i.e. primary caregivers, extended family members, Elders, and Early Childhood Educators). My mixed-methods approach will include Indigenous autoethnography, narrative inquiry, and participatory action research. The significance of this Syilx/Okanagan ecoliteracy study is that it will have implications across Early Childhood, Indigenous, and Land education.

17	**Socio-ecological complexities coupled with grizzly bears/huckleberry habitat requirements and legislated forest practices through the lens of Indigenous and western science methodologies** *Simmons, E., Armstrong, J.C., Parrott, L.* The foundation of British Columbia's tactical forest planning framework is grounded in economics where social and environmental requirements are largely informed by western science. While there is some obligatory input from Indigenous People, there is a lack of fundamental inclusivity at the landscape planning levels as related to forest planning. Indigenous People's approaches to research and forest practices are unique to place and time, providing an essential element of planning that requires consideration and implementation. The focus of this research will be to develop a better understanding of the complexities around socio-ecological systems specific to forest legislation as it relates to grizzly bears and huckleberry habitat in the Okanagan region of British Columbia. The research will contribute to a collaborative research-based model between Indigenous and western science academic communities that will build an inclusive, integrative, holistic, place based process (that embeds UNDRIP & FPIC) that will create a collaborative paradigm shift forward.
18	**Identification and Selection of Performance Indicators for Indoor Swimming Pools using Fuzzy Based Methods** *Sana Saleem, Husnain Haider, Guangji Hu, Kasun Hewage, Rehan Sadiq* The population of cold climatic regions prefers to spend 90% of their time indoors; consequently, shifting a trend towards the indoor recreational facilities such as indoor pools. The indoor pool comprises of several components, which are vital for user satisfaction and need to perform reliably over the long-term period. This study aims to develop performance indicators to assess and improve the pool performance, consequently sustainability. Eighty-one performance indicators were identified under seven performance criteria through a comprehensive review to ensures health and safety, provide social comfort and economic prosperity, minimize environmental impacts, and improve operational and maintenances practices. Further, for the selection of indicators, expert opinions were collected through a questionnaire using three selection criteria i.e., importance, understandability, and measurability. Subsequently, weights for performance indicators were generated through the expert's opinion and fuzzy AHP technique. These weights were introduced into fuzzy clustering for the final selection. The selected performance indicators will assists managers in monitoring, benchmarking and improving performance globally.
Green Infrastructure (Cluster Lead: Dr. Alam)	
19	**Performance-Based Seismic Design of Bridge Piers Reinforced with High-Strength Steel: Development of Performance-Based Damage States** *Saif Aldabagh, Shahria Alam* Performance-based seismic design aims to identify the structural performance in a predetermined fashion given the possible seismic hazard scenarios the structure is likely to experience. Identifying the damage states and their associated criteria in terms of engineering parameters such as drift and material strain is an integral part of performance-based design framework. The mechanical properties of high-strength steel (HSS) significantly differ from that of conventional steel, hence making the available performance criteria in design codes inapplicable when designing bridge piers reinforced with HSS. This study aims to develop performance-based damage states for bridge piers reinforced with three types of HSS; namely, ASTM 706 Grade 690, ASTM A615 Grade 690, and ASTM A1035 Grade 690. The proposed damage states, i.e. minor, moderate, major, and local collapse, were probabilistically related to drift and reinforcing steel tensile strains. Noticeable differences in the drifts at the onset of each damage state were observed between the three types of HSS. Also, significant discrepancies were observed between the performance criteria in the supplement to the Canadian Highway Bridge Design Code (CHBDC) document and the proposed performance criteria for HSS. Utilizing the performance criteria of the supplement to the CHBDC to design bridge piers reinfrcoed with HSS can be misleading, and hence would result in unsafe design. The proposed performance criteria in this study serve as initiative to create performance criteria library for bridge piers reinfrcoed with HSS.
20	**A semi-active SMA-MRF structural stability element for seismic control in civil structures** *Shahin Zareie, M. Shahria Alam, Rudolf J. Seethaler, Abolghassem Zabihollah* The stability and integrity of structures under indeterminant external loadings, particularly earthquakes, is a vital issue for the design and safe operation of civil infrastructures. To improve structural stability in the time domain as well as a frequency domain, the Shape memory alloys (SMAs) and Magnetorheological fluid (MRF)-based structural control system is developed.
21	**Financial Incentives for Green Buildings-A Scientometric Analysis** *Anber Rana, Shahria Alam, Kasun Hewage, Rehan Sadiq* Buildings are responsible for a high percentage of greenhouse gas emissions that are needed to be addressed to meet climate mitigation goals. Green buildings (GBs) can be a solution to environmental challenges and high resource consumption problems associated with conventional buildings. Financial incentives by government and utility providers can play an important role in making building stock greener. This study reviews the literature on financial incentives related to green buildings. The VOSviewer software was used to perform scientometric review on a sample of articles, obtained from the Web of Science database. Co-citation analysis coupled with content analysis of the most cited articles identified that policy, energy efficiency, renewable energy, performance and household are the most common aspects explored in studies. This review showed that documents by "International Energy Agency" are most co-cited and majority of research has been done in USA, China, and England. This study contributes to a deeper understanding of the research trends in the field of financial incentives related to green buildings.
22	**Measurement-based Optimal Dispatch of Distributed Energy Resources in Power Distribution Systems** *Severin Nowak, Liwei Wang, Christine Chen, Wilson Eberle* The proliferation of distributed energy resources(DERs) such as solar-photovoltaic, wind, and battery-storage systems across power distribution networks requires new monitoring and control schemes to ensure power availability and quality, and avoid costly infrastructure investments. Concurrently, recent advances in sensor technologies, such as smart metres and micro phasor measurement units, offer ample measurement data of key attributes in the distribution system. Conventionally, DER control schemes use accurate network models with topology and line parameter information to optimally operate distribution systems. However, the offline network models may not be accurate and

	lead to computational challenges in obtaining optimal DER setpoints due to nonlinear optimization problems. As a result, optimal distribution system operation can be compromised. In this research project, we propose a measurement-based approach to control DERs, which does not rely on any prior knowledge of the network topology. The key benefits of the proposed method are that it (i) eliminates the need for an accurate offline network model, (ii) adapts to online network-topology and operating-point changes, and (iii) requires modest computational and communication resources. Ultimately, this method helps to allow higher penetration levels of renewable generation in distribution systems before existing power grids need to be retrofitted.
23	**Fuzzy TOPSIS for ranking carbon capturing technologies for community energy systems** *Ravihari Kotagoda Hetti, Don Rukmal Liyanage, Kasun Hewage, Rehan Sadiq* Integrating fossil fuel based energy systems with carbon capturing (CC) has become an emerging area of research to achieve zero carbon communities. It requires an integrated assessment of technical and economic aspects to select the most applicable CC strategy for different fossil fuel based energy systems. The study explores the technical feasibility and economic viability of retrofitting carbon capturing in community energy systems. The energy system scenarios: post combustion and oxy-fuel combustion capture with coal power and natural gas combined cycle (NGCC) plant, pre combustion capture with integrated gasification combined cycle plant were investigated and compared. Technical feasibility was assessed in terms of the capture potential, technology maturity, abatement efficiency, and energy penalty. The levelized cost of electricity, cost of CO2 captured and avoided were used to investigate the economic viability. The selection of a suitable CC integration scenario involves conflicting criteria and uncertainties. Hence, a fuzzy multi-criteria decision-making (Fuzzy TOPSIS) was employed for scenario ranking. Amongst the chosen integration scenarios, NGCC plant combined with post combustion capture ranks the first. The findings from the study is expected to provide municipalities and investors with informed decisions during the pre project planning phase in CC projects.
24	**Development and Evaluation of a New Alkalinization Additive for Road Subgrade Stabilization** *Nurmunira Muhammad, Sumi Siddiqua* Road pavement is fundamental for public land commute and industrial (economic) transportation. The problematic subgrade soil is usually removed in order to minimize the thickness of the sub-base and the base layers of the flexible pavement. Thus, the stabilization of problematic soils with chemical additives has become a popular practice globally. However, the mechanical and microstructural characterization of subgrade materials stabilized by alkalinization of raw silty sand, a common soil in British Columbia, Canada, have not yet been studied. This study introduced the novel concept of using an alkaline activator, along with magnesium chloride (MgCl2) and local calcium bentonite to stabilize the silty sand. Compaction and unconfined compressive strength (UCS) tests were used to assess the mechanical properties of the stabilized soil. The mechanisms that have contributed to the stabilization process are discussed based on microstructural analysis using X-ray powder diffraction (XRD), field emission scanning electron microscopy (FESEM), Energy Dispersive Spectroscopy (EDS), and Fourier transform infrared spectroscopy (FTIR). Two curing types: unheated and heated at 60Â°C for 24 hours, were observed at 7, 14, 28 and 60 days in ambient temperature. Overall, it was found that the chemical additive improved the compressive strength of the soil and the heated curing tests showed significant strength improvement. The mechanical and physicochemical results revealed an optimum mix to improve silty sand strength using the addition of 40% bentonite with an alkaline activator (SS/SH) ratio of 0.5, an alkaline activator-to-MgCl2 (L/S) ratio of 0.7, and 3% MgCl2 by dry weight of the soil under heated curing condition at 60Â°C for 24 hours. The microstructure analysis confirmed the formation of the cementitious products, such as calcium aluminum silicate hydrate (C-(A)-S-H) and magnesium silicate hydrate (M-S-H) in the treated sample.
Medical Physics and Data Analytics (Cluster Lead: Dr. Jirasek)	
25	**Monitor ionizing radiation-induced cellular responses with Raman spectroscopy, non-negative matrix factorization, and non-negative least squares** *Xinchen Deng, Ramie Ali-Adeeb, Jeffrey L. Andrews, Phillip Shreeves, Julian J. Lum, Alexandre Brolo, Andrew Jirasek* Radiation therapy (RT) is one of the most commonly prescribed cancer treatments. New tools that can accurately monitor and evaluate individual patient responses would be a major advantage and lend to the implementation of personalized treatment plans. In this study, Raman spectroscopy (RS) was applied to examine radiation-induced cellular responses in H460, MC47, and LNCaP cancer cell lines across different dose levels and times post-irradiation. In the current studies, non-negative matrix factorization (NMF) uncovered glycogen-like and lipids-like component bases. A further lipid phenotype investigation was also attempted by applying non-negative least squares (NNLS) to the lipid-like bases decomposed individually from three cell lines. Qualitative differences found in lipids weights for each lipid-like basis suggest the lipid phenotypes differences in the three tested cancer cell lines. Collectively, this study demonstrates the application of NMF and NNLS on Raman spectroscopy data analysis to monitor ionizing radiation-induced cellular responses.
26	**A Linear Model to Predict Implant Uncertainty for Permanent Breast Seed Implant Brachytherapy** *Claire Zhang, Michelle Hilts, Deidre Batchelar, Jeff Andrews, Elizabeth Watt, Juanita Crook* Permanent breast seed implant is a novel brachytherapy technique for early-stage breast cancer. Radioactive Pd-103 seeds are preloaded in needles and implanted in and around the seroma cavity to deliver the prescribed radiation dose. The accuracy of implantation is critical to treatment efficacy and safety. In this study, we present the implant displacement of 734 seeds for 10 patients treated in BC Cancer Kelowna and build a linear model to predict implant uncertainty. Pd-103 seed locations are identified and extracted in both pre-planning and post-surgical CT images and the surgical displacement of each seed was quantified using an algorithm developed by Watt et al. (Okolo Health, Calgary AB). For each patient, seroma size, breast size, skin to seroma distance, number of seeds, and maximum needle insertion length were recorded as predictors for linear regression analysis. All predictors except seroma size showed p-value<0.05, and the linear model showed an R^2 of 0.239. Data from a larger cohort will be collected and more complex models with more clinical related factors will be considered for modeling in future studies. Reference: Watt E et al, J Contemp Brachytherapy. 2019;11(1):61-68.

27	**Enhancing Prediction Accuracy Through Different Variable Selection Methods** *Wang Yue, John W Braun, Hua Shen* Variable selection is a significant area of studying in statistical analysis. It is an essential technique which facilitates the identification of a good model. To select the important variables, we can either use stepwise procedures based on significant testing or criterion-based procedures. In this research, we will focus our studying on LASSO and expert opinions method. The model we used to conduct the study is multiple linear regression model and thus the simulation data was generated from Multivariate Normal Distribution. We will then compare the accuracy of LASSO, one expert opinion and five expert's opinion methods through simulation studies under different study designs. In the end, we will have a better idea about which method to apply under different circumstances.
Neurobiology (Cluster Lead: Dr. Menard)	
28	**Design of DNA based Force Sensor to study the Receptor Pair Interactions at Neural Synapses** *Omkar Kulkarni, Frederic Menard, and Isaac Li* In a healthy neurological system, there are a myriad of protein and receptors operating in a synchronized harmony. The symphony of numerous biochemical reactions occurring at junctions of neurons, known as synapses, are responsible for the proper functioning of the neurological system. It is well known that neural synapse degeneration occurs at the onset of variety of neurodegenerative diseases such as Parkinson's Disease, Alzheimer's Disease, etc. It is also known that the mechanical strength of the synapse and the forces exerted at the cell junctions also play a vital role in synapse robustness. What remains unknown at this stage is which pair of receptor interaction is broken (and/or is weakened) at the beginning of any neurodegenerative disease. These perturbations could arise from biochemical or mechanical factors. Our study involves designing a DNA based sensor which would be used for tagging specific receptor pairs on pre and post synaptic neurons. With the introduction of appropriate biomarker or mechanical disturbance the sensor would provide invaluable information helping in understanding the neurodegeneration process occurring at the receptor level. Along with that, it would also enable us to characterize the physical strength of the neural synapse.
29	**Molecular Probes to Track and Control Proteins in Neurons** *Zhenlin Tian, Frederic Menard* Kainate receptors play important roles in the central nervous system. However, investigating their role in physiology is hampered by the current lack of tools to study them in dynamic cellular contexts. Here, we designed molecular probes to monitor and control kainate receptors in neurobiology.
Wine & Grapes (Cluster Lead: Cluster Lead: Dr. Zandberg)	
30	**Indigenous Saccharomyces strains produce unique flavour profiles during controlled Chardonnay fermentations** *Sarah Lyons, Stephanie McCann, Samantha Sanderson, Daniel M. Durall, Wesley Zandberg* Each wine growing region hosts unique communities of indigenous yeasts, which contribute to the flavor profile of wines. Winemakers are increasingly interested in harnessing the winemaking potential of these indigenous yeasts as they are able to produce unique aroma- and flavour-active secondary metabolites that improve the complexity wines, as well as produce a wine that can be considered truly local. Currently, the only method of introducing these yeasts to fermentations is by allowing grape musts to ferment uninoculated. However, at most wineries, commercial yeast strains dominate the winery environment and quickly out-compete any indigenous yeasts in the fermentation. In the Okanagan Valley, indigenous strains of Saccharomyces cerevisiae and Saccharomyces uvarum have been isolated from spontaneous fermentations at commercial wineries. We selected 4 of these previously isolated Saccharomyces strains and conducted laboratory-scale fermentations of Chardonnay juice at both 15 ï‚°C and 25 ï‚°C to observe any differences in fermentation performance by these strains at lower temperatures. We monitored fermentation kinetics and sampled throughout fermentation for the production of flavour-active compounds by these yeasts. The flavour profiles produced by each yeast was measured by gas chromatography mass spectrometry (GC-MS).
31	**Effect of protective sprays on smoke-exposed grape vines and in an off-vine model** *Ieva Zigg, James W. Favell, Osei Boakye Fordwour, Sydney C. Morgan, Wesley F. Zandberg* The increasing frequency of wildfires has a negative impact on the wine industry, especially in fire-prone regions such as Australia or the Okanagan valley. Smoke-exposed grapes accumulate volatile phenols (VPs), compounds that are stored as imperceptible (by smell) sugar-bound analogues in berries that are broken down during fermentation to yield unpleasant aromas in the resulting wine. This work expands on a low-powered pilot study examining the effect of commercially-available agro-sprays on blocking the uptake of VPs into smoke-exposed berries. The experiment was carried out in two parts. First, bunches of table grapes were treated with protective sprays and exposed to smoke from pine fuel inside a purpose-built tent. Additionally, the treatments were repeated at predetermined time intervals on wine grapes at three Okanagan vineyards. Furthermore, the treated wine grapes were fermented to demonstrate protective effects on the wine. Both free and sugar-bound VP levels were measured using gas chromatography mass spectrometry. Differences in chemical composition of agro-spray treated and untreated samples were demonstrated in both table and wine grapes as well as in wine. In addition to evaluating protective options for smoke taint reduction, this work develops an off-vine model to accommodate continued grape research during off-season months.
32	**Aromatic and Phenotypic Characterization of Torulaspora delbrueckii Isolated from Okanagan Valley Vineyards** *Yuritzel Moreno, Vivien Measday* Non-Saccharomyces yeasts are gaining distinction for their ability to improve wine complexity. Certain strains of the non-Saccharomyces yeast Torulaspora delbrueckii are already sold commercially and have been characterized as producing lower amounts of acetic acid and ethyl acetate, as well as increasing dried fruit aromas. Vineyard-associated non-Saccharomyces yeasts from the Okanagan Valley, British Columbia have yet to be extensively studied. This project aims to determine aromatic profiles for two T. delbrueckii yeast strains isolated from Okanagan Valley vineyards. Gas chromatography-mass spectrometry will be utilized to identify and quantify volatile compounds produced by these isolates of T. delbrueckii in fermentations using Gewürztraminer grape juice and compared to the aromatic profiles of commercial T. delbrueckii strains. Ester and thiol production are of particular interest given their impact on the fruity aromas found in wine. Phenotypes of enological significance, such as sulfite tolerance and copper resistance, will also be investigated. This analysis will broaden understanding of the role T. delbrueckii yeast play in wine fermentation and help elucidate their contribution to the unique terroir of Okanagan Valley wines.