



# **GRADUATE STUDENT CONFERENCE PROGRAM**



**THE UNIVERSITY OF BRITISH COLUMBIA  
Faculty of Land and Food Systems**



**MARCH 15, 2021  
8:30 AM - 3:30 PM**



# SCHEDULE



## WELCOME AND KEYNOTE ADDRESS

8:30 - 9:15 am

## ORAL SESSION 1

9:15 - 10:00 am

Speaker list: Sammy Blair, Cayla Boycott, Thomas Brenner

## COFFEE + STRETCH BREAK

10:00 - 10:30 am



## ORAL SESSION 2

10:30 - 11:45 am

Speaker list: Maria Chen, Jordie Fischer, Jordan Kersey, Flona Lamb, Tebogo Leepile

## LUNCH + POSTER SESSION

11:45 am - 13:15 pm



## ORAL SESSION 3

13:15 - 14:15 pm

Speaker list: Lexis H. Ly, Kathryn McLellan, Paula Resque Porto, Patrick Pow

## COFFEE + STRETCH BREAK

14:15 - 14:30 pm

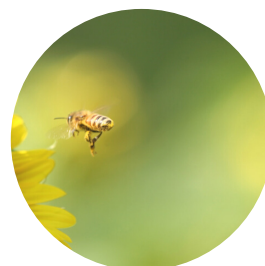
## ORAL SESSION 4

14:30 - 15:15 pm

Speaker list: Anna Ratuski, Kehan Sheng, Jens Ulrich

## TRIVIA, AWARDS, AND CLOSING REMARKS

15:15 - 15:40 pm



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# MESSAGE FROM THE DEAN

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*On behalf of the Faculty of Land and Food Systems, I'm pleased to welcome you to the 2021 Graduate Student Conference.*

*The LFS Graduate Student Conference is always one of my favourite events, as we have the chance to see the high calibre of research taking place in our Faculty.*



*Our graduate students are working on some innovative projects that can help address critical local and global issues surrounding food safety and security, nutrition and health, animal welfare and how to safeguard our natural resources.*

*During this unique time, it's exciting to see the Graduate Student Council come together and host this conference; I'm sure the council has faced extra challenges this year. The council has put a lot of time and effort into organizing this conference and I'm extremely proud of their initiative.*

*Thank you for taking the time to learn more about the research taking place in LFS. And best wishes to our graduate students presenting today.*

*Cheers,*

***Rickey Yada***

*Professor and Dean*

*Faculty of Land and Food Systems*

# MESSAGE FROM GSC COORDINATORS

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## ***Welcome to the 8th Annual Land and Food Systems Graduate Student Conference!***

This year the LFS graduate student conference will be hosting 15 oral presentations and 18 poster presentations. We will hear from students in research programs at LFS such as: Integrated Studies in Land and Food Systems, Applied Animal Biology, Food Science, Human Nutrition, Plant Science, and Soil Science.

The goals of this conference include bringing together all the disciplines of research in our faculty. Showcasing the diversity of research in LFS gives us the opportunity to share ideas, view different perspectives, and facilitate connections and collaborations between the various programs. Additionally, this conference gives us the opportunity to educate ourselves and celebrate our hard-working graduate students. Finally, we hope you enjoy the conference and find it a valuable experience.

Please enjoy the presentations prepared by our outstanding graduate students.

***Enjoy the day!***

***The 2021 LFS Graduate Student Conference Planning Committee***

# 2021 GSC ORGANIZING COMMITTEE

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Yu Tong Linda Lu, MSc Student, Food Science

Katie Koralesky, PhD Student, Animal Welfare

Lennie Cheung, PhD Student, Food Science

Amelie Zhang, MSc Student, Food Science

Jennifer Lipka, MSc Student, Integrated Studies

Trish Hanuszak, MSc Student, Soil Science

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# PRESENTER SCHEDULE

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## **ORAL SESSION 1**

*9:15 – 10:00 am*

*Speaker list: Sammy Blair, Cayla Boycott, Thomas Brenner*

## **ORAL SESSION 2**

*10.30 – 11:45 am*

*Speaker list: Maria Chen, Jordie Fischer, Jordan Kersey, Fiona Lamb, Tebogo Leepile*

## **POSTER SESSION**

*12:00 – 13:00 pm*

## **ORAL SESSION 3**

*13:15 – 14:15 pm*

*Speaker list: Lexis H. Ly, Kathryn McLellan, Paula Resque Porto, Patrick Pow*

## **ORAL SESSION 4**

*14:30 – 15:15 pm*

*Speaker list: Anna Ratuski, Kehan Sheng, Jens Ulrich*

# ORAL PRESENTATION SESSION 1

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## **A narrative literature review of 'school farms' in British Columbia's secondary schools and the connection of food literacy as an evolving framework for food education.**

Sammy Blair (1)

(1) Integrated Studies in Land and Food Systems, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Secondary schools in British Columbia generally have less opportunities, programming, or compulsory classes teaching food education. This is problematic because research shows educating adolescents about food will have positive impacts on their health and on society. In recent years, food literacy has grown into a more inclusive and critical framework for teaching food education. As the food literacy movement builds momentum, schools in B.C. have introduced food education to secondary schools through a "new" form of programming known as 'school farms'. The aim of this review is to situate the undefined idea of 'school farms' amidst the food education movement and understand how 'school farms' may fill gaps in school food education. Based on the literature review, there are congruences in the conceptual framework of food literacy and the thematic focuses and goals of B.C.'s farm to school movement and school farms. Through further research defining school farms and gathering stakeholders' knowledge of food literacy, we can understand better how 'school farm' programming could fill knowledge and research gaps in secondary school food education. This research will support a broader social movement to promote food system knowledge and food sovereignty in local communities.

*Supported by Dr. Annalijn Conklin's lab*

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## **The impact of dietary polyphenols on the responsiveness of leukemia cells to an anti-cancer demethylating agent, decitabine**

Cayla Boycott (1), Barbara Stefanska (1)

(1) Food Nutrition and Health Program, Faculty of Land and Food Systems, The University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Aberrant DNA methylation patterns that promote silencing of tumor suppressor genes (TSGs) is a type of epigenetic modification that takes place in cancers. Decitabine (DAC) is a DNA hypomethylating drug that has been shown to be potent towards leukemia through re-expression of TSGs. However, many patients develop resistance to the drug and approaches to overcome this remain to be elucidated. Clinical data have previously revealed *MLL5* to be a prominent gene that is often downregulated in DAC-resistant patients while greater *MLL5* expression is associated with greater responsiveness to DAC-induced DNA demethylation. Remarkably, dietary bioactive compounds such as pterostilbene (PTS) have previously been shown to re-establish homeostasis in epigenetic marks and expression of genes often dysregulated during carcinogenesis. Thus, PTS could alter gene expression, subsequently inducing sensitivity of leukemia cells to DAC. Here we test the impact of PTS to augment genes involved in the responsiveness of low-dose DAC in acute myeloid leukemia cells. Pre-exposure to PTS before DAC treatment was used to assess cell growth and expression of *MLL5*. Compared to control, growth of cells treated with DAC alone decreased by about 37%, while cells pre-exposed with PTS followed by DAC treatment was further reduced growth with increasing PTS concentrations. There was no significant difference in *MLL5* expression between control cells and cells treated with DAC alone, while *MLL5* expression was shown to significantly increase compared to both in PTS pre-exposed cells treated with DAC ( $p > 0.01$ ). In conclusion, pre-exposure to PTS upregulated *MLL5* and increased sensitivity of cells to DAC.

*Supported by: 'VP Academic Award' UBC and Canadian Foundation for Innovation (CFI) John R. Evans Leaders Fund and the British Columbia Knowledge Development Fund'*



# ORAL PRESENTATION SESSION 1

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## **Formulating a broad-spectrum bacteriophage cocktail against pervasive poultry-associated *salmonella enterica* serovars**

Thomas Brenner (1), Karen Fong (1), Spencer Lee (1), and Siyun Wang (1)

1. Food, Nutrition and Health, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Illness caused by *Salmonella*, known as salmonellosis, is primarily linked to the consumption of poultry products with annual fiscal losses in North America estimated in the billions of dollars. However, excessive antibiotic usage in agriculture has been linked to increased antimicrobial resistance to important human antibiotics which has resulted in complete and partial bans of antibiotics in livestock feed in Europe and North America, respectively. Bacteriophages are natural bacterial predators which have shown promise as alternative antimicrobials due to their safety, ubiquity, and target specificity. The purpose of this research was to formulate a phage cocktail with antimicrobial efficacy across poultry-associated *Salmonella* isolates from a *Salmonella* phage library. Fifty pervasive *S. enterica* isolates across seven serovars were procured from various environmental and diagnostic poultry sources by the BC Ministry of Agriculture. A library of 78 phages isolated from various BC environments were evaluated against these *Salmonella* strains using agar- and broth-based screening methods. Host range testing revealed 18 phage candidates that were effective across the representative *Salmonella* isolates at high concentrations. Further screening by relative host efficiency narrowed the candidates down to the six best phages for cocktail formulation. A broad-spectrum cocktail containing three of these phages was successfully produced with high killing efficacy across all 50 poultry-associated *Salmonella* isolates *in vitro*. This research indicates the promise of rapid, semi-quantitative methods applied for identifying useful phage combinations. Such methodologies may prove useful across food industries where antibiotic treatments are being progressively limited.

Supported by 'Canada-BC Agri-Innovation Program'.

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# ORAL PRESENTATION SESSION 2

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## **'Cattle welfare is basically human welfare': workers' perceptions of animal welfare on two dairies in China**

Maria Chen (1)

1. Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

'Animal welfare' (动物福利) is a foreign term introduced to China, and stakeholder interpretation of this concept can affect their receptiveness to improving animal welfare. My aim was to explore workers' perceptions of 'animal welfare' on two dairies in China. I used a mini-ethnographic case study design, living for 38 days on one farm and 23 days on a second. I conducted interviews and participant observations with farm workers ranging from farm management to animal care staff. I used template analysis to generate key themes from the ethnographic data. Overall, responses reveal a deep connection between human and animal welfare. Workers saw human welfare as a prerequisite to animal welfare, and cattle welfare as potentially mutually beneficial to the workers. Some workers also saw an ethical obligation towards providing good welfare. Though some workers were unfamiliar with the term 'animal welfare', in daily practice, caring for cattle inevitably leads all farmworkers to ponder, prioritize, and make decisions relevant to specific aspects of 'animal welfare' such as lameness, morbidity, reproduction, nutrition. Many workers were pragmatic and workers, especially those in management positions, appeared to embrace evidence-based animal care improvements which were perceived to benefit them and the cattle. Based on my findings, I suggest future animal welfare initiatives should 1. Consider worker welfare, 2. Involve clear communication, 3. Identify mutual benefits, and 4. Provide pragmatic, evidence-based strategies to improve animal welfare in an economically sustainable way.

*Supported by 'Open Philanthropy', 'Good Ventures', and 'Social Sciences and Humanities Research Council of Canada'.*

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## **Fecal calprotectin does not differ following 12 weeks supplementation with 60 mg ferrous sulfate and 18 mg ferrous bisglycinate in Cambodian women**

Jordie Fischer (1,2), David Goldfarb (2,3), Arianne Albert (4) Rajavel Elango (2,5), Kroeun Hou (6), and Crystal Karakochuk (1,2)

1 Food, Nutrition and Health, University of British Columbia, 2 British Columbia Children's Hospital Research Institute, 3 Department of Pathology and Laboratory Medicine, University of British Columbia, 4 Biostatistics, Women's Health Research Institute, 5 Pediatrics, University of British Columbia, 6 Helen Keller International, Phnom Penh, Cambodia

The WHO recommends 12 weeks of 60mg daily iron supplementation for women where anemia prevalence is >40%, such as in Cambodia. However, in women who do not need it, excess iron could be harmful, as unabsorbed iron can pass into the colon and increase susceptibility to pathogen growth. I aimed to assess the effect of a newer, highly bioavailable iron (ferrous bisglycinate) and the standard, commonly used form of iron (60mg ferrous sulfate) on fecal calprotectin concentrations (an indicator of gut inflammation) in Cambodian women, as compared to placebo. A double-blind, three-arm, randomized controlled trial was conducted in Kampong Thom, Cambodia. A total of 480 non-pregnant women (18-45 years) were randomized to receive 60mg elemental iron as ferrous sulfate, 18mg elemental iron as ferrous bisglycinate, or placebo for 12 weeks. Fecal calprotectin was measured by ELISA (BÜHLMANN fCAL®). A generalized linear model was used to assess the effect of the iron interventions on fecal calprotectin concentrations at 12 weeks. A total of 480 women were enrolled, with 95% (n=456) providing stool samples at baseline and 90% (n=434) at endline. Marginal mean (95% CI) fecal calprotectin levels at 12 weeks were similar across groups: 153 (96, 210), 137 (76, 197) and 135 (76, 193) µg/g, for ferrous sulfate, ferrous bisglycinate and placebo groups, respectively. There was no evidence of increased gut inflammation in either iron intervention compared to placebo. Further research is warranted to determine if these forms and doses of iron have any impact on gut enteropathogens or the microbiome.

*The research project was funded by a Canadian Institutes of Health Research Project Grant.*

# ORAL PRESENTATION SESSION 2

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## **Too much too little: climate resilient vegetable farming- influence of tile drainage and amendment application timing in poorly drained soils of Delta, BC**

Jordan Kersey, Carson Li, Sean Smukler

Soil Science, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Organic vegetable farmers in areas of the Fraser River Valley (FRV) confront many challenges when it comes to water management and how to maintain soil health and crop production despite the potential for changes in precipitation regimes, due to climate change. Installation of tile drainage may help to moderate soil moisture and increase shoulder-season workability but may also have negative effects on soil organic matter (SOM). The timing of amendment application is another potential strategy, as fall amendment application reduces the number of spring operations, when soil workability may be limited. The objective of this study is to investigate the interactions between amendment application timing and tile drainage spacing to provide growers with potential beneficial management practices to aid in climate change adaptation. A two-factor randomized complete block design was established to compare two tile-drainage spacing treatments (15-ft and 30ft-spacing) and three nutrient timing treatments (fall compost, spring compost, control). Amendment application timing had no impact on soil health metrics (volumetric water content or electrical conductivity (EC)), while 30-ft tile drainage spacing had significantly greater EC and fresh weight corn ear and stalk biomass and counts. These results indicate there may be no effect of amendment application timing on soil-plant and health metrics, or that another management factor is masking the effect. Further research at this site will enable greater understanding of the influence of amendment application timing and tile drainage on in-field water management.

*Funding for the project has been provided through the Organic Science Cluster 3 under the AgriScience program of Agriculture and Agri-Food Canada, and British Columbia under the Canadian Agricultural Partnership, a federal-provincial-territorial initiative as well as by a generous gift from an anonymous donor.*

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## **The role of online photo backgrounds of shelter/foster dogs on the perception of sociability in dogs**

Fiona Lamb (1), A Andrukonis (2), A Protopopova (1)

(1) Animal Welfare Program, University of British Columbia, Vancouver, B.C., Canada

(2) Texas Tech University, Lubbock, Texas, USA

With the increase in the prevalence of technology, the internet is often the first step for potential pet owners searching for an adoptable dog. However, best practices for the online portrayal of shelter and foster dogs remain unclear. Different online photo backgrounds appearing on adoption websites for shelter dogs may impact adoption speed by influencing viewer interest. Human-directed sociability, broadly defined, has been previously linked to increased adoption likelihood. Therefore, the primary objective of this study was to determine the relationship between photo backgrounds of shelter dogs and their perceived human-directed sociability. In an online survey, 680 participants were asked to rank the sociability and friendliness of 4 different adoptable dogs on a scale from 0-10. The photo background of each dog was digitally altered and randomly assigned to assess 4 experimental background conditions: 1) plain colored, 2) home indoor, 3) in-kennel indoor, and 4) outdoor. Additionally, adoption interest in each dog was assessed by presenting a link to the dog's adoption profile and recording the clicking behaviour of participants on this link. A logistic regression model suggests that background does not generally seem to influence perceptions of sociability nor link-clicking behaviour of participants. The results demonstrate the importance of empirical data in making marketing decisions in animal shelters. Understanding which aspects of online marketing materials impact viewer interest will provide guidance for both animal shelter personnel and foster families to improve speed of adoption of the animals in their care.

# ORAL PRESENTATION SESSION 2

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## **Hemoglobin adjustments to determine anemia prevalence among San women and young children in rural Botswana.**

Tebogo Leepile (1), Jennifer Black (1,2), Eduardo Jovel (1), Crystal Karakochuk (2)

1. Integrated Studies in Land and Food Systems, University of British Columbia, Vancouver, Canada

2. Food, Nutrition and Health, University of British Columbia, Vancouver, Canada

Nutrition health data on the San People an Indigenous minority group that primarily resides in Ghanzi District in Botswana are scarce. We assessed anemia prevalence by analyzing hemoglobin (Hb) concentrations of 367 mother-child dyads using a portable HemoCue device. As per global recommendations, Hb values were adjusted for altitude, ethnicity, smoking (among those women who self-reported to smoke), and pregnancy status. Overall, we found that anemia ranged widely based on these Hb adjustment factors, from 7-26% in all women, 6-26% in non-pregnant women, 22-30% in pregnant women, and 35-68% in children which presented varied public health significance. Mild and moderate anemia was more prevalent in pregnant women (13% mild and 13% moderate) and children (22% mild and 19% moderate). There were no severe anemia cases in pregnant women, while 1% of the children were affected. Although there is a global consensus for adjusting Hb values for altitude and smoking, whether or not the adjustment for ethnicity is warranted remains controversial. Regardless of the adjustments, anemia prevalence was high and of concern among children. These findings are crucial to inform future targeted nutrition and policies for the San People.

*Supported by IDRC & PSI (UBC)*

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# ORAL PRESENTATION SESSION 3

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## Exploring the relationship between human social deprivation and animal surrender to shelters in British Columbia, Canada

Lexis Ly (1), Emilia Gordon (2), Alexandra Protopopova (1)

1. Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada, 2. The British Columbia Society for the Prevention of Cruelty to Animals, Vancouver, BC, Canada

The close relationship of humans and companion animals means the two populations often share similar physical and social conditions. Owner-related issues (e.g. cost and housing) are common reasons for relinquishment of pets to animal shelters. It is likely that the burden of surrendering for owner-related reasons falls on those who are socially vulnerable (e.g. low income, unemployed); however, few studies have assessed social determinants as a predictor of animal relinquishment. The present study used the Canadian Index of Multiple Deprivation (CIMD), which uses four factors of social vulnerability (Ethnocultural Composition, Economic Dependency, Residential Instability, and Situational Vulnerability) to predict risk of surrender for various reasons, species and breeds, and health statuses across British Columbia (n=29,236). Results show that these factors predicted increased risk of surrender across many shelter variables. The present study also analyzed two areas: Metro Vancouver (n=3,445) and Kamloops (n=2,665), and plotted these relationships on a geospatial scale. While some relationships were similar between areas, there were some differences in predictors of animal surrender variables, suggesting that animal servicing for vulnerable groups is specific to location. For example, while Ethnocultural Composition predicted increased risk of owner surrender for owner-related reasons in Metro Vancouver, these same surrender reasons were predicted by Residential Instability in Kamloops, indicating demographic differences that affect animal shelter servicing. The results of this research justify the use of geospatial analysis to understand relationships between human vulnerability and animal welfare, but also argue the need for further interventions in marginalized populations to increase retention of animals.

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## Effects of free-choice pasture access on lameness recovery and behaviour in dairy cattle

Kathryn McLellan, Daniel Weary and Marina von Keyserlingk

Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, Canada

Lameness is a painful condition in dairy cows, with higher prevalence rates for cows housed indoors. Lameness in dairy cows housed indoors may benefit from temporary access to pasture, as grass provides a softer and more comfortable standing surface. However, the effects of free-choice access to pasture on lameness has not been studied. The objective of this study was to evaluate whether a 6-week period of free-choice pasture access would improve lameness recovery in dairy cows. A total of 54 lactating Holstein cows, all lame upon enrollment and housed indoors, were randomly allocated into one of two treatments: free-choice access to pasture (n = 27; pasture) or indoor housing only (n = 27; indoors). All cows were gait scored weekly using a 5-point numerical rating system (NRS 1= sound, NRS 5 = severely lame), with hoof inspections at the start and end of the experimental period. Lying and standing behaviours were assessed continuously using leg-mounted accelerometers and time spent on pasture was recorded. Preliminary results indicate that pasture cows spent on average 15 ± 1.9% (0 - 38%) of their time on pasture. Descriptively, the proportion of cows identified as sound (2 consecutive NRS ≤ 2) by the end of the experimental period was greater for pasture cows than indoor cows (29.6% vs 7.4%). Analysis is ongoing, but the results are expected to provide insight into management options for improving lameness recovery on dairy farms.

*Supported by NSERC Industrial Research Chair in Animal Welfare*

# ORAL PRESENTATION SESSION 3

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## **The effects of drainage strategy on soil greenhouse gas emissions (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) from blueberry fields in Delta, B.C.**

Paula Resque Porto, Andy Black, Maja Krzic, Zoran Nestic, Paul Jassal and Sean Smukler

Applied Biology, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Artificial soil drainage is crucial for crop production in humid climates, especially in soils with poor natural drainage. Soil water content is an important predictor of soil emissions, however, the impact of artificial drainage practices has not been extensively studied. An observational study was conducted in 9 fields planted with highbush blueberries (*Vaccinium corymbosum*) on silt loam Gleysols in Delta, British Columbia. Each field belonged to one of the following drainage management systems: i) undrained, ii) drained with subsurface tiles, or iii) drained with tiles and pumps. Carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>) fluxes were measured bimonthly from July 2017 to May 2019 in order to quantify emissions from each group. After two years, drainage type had no significant effect on net cumulative fluxes. Nevertheless, large variability in the spatiotemporal patterns of greenhouse fluxes was observed, both among and within fields. For the undrained system, peak N<sub>2</sub>O and CH<sub>4</sub> emissions took place in the winter months, with  $275 \pm 115$  g N<sub>2</sub>O ha<sup>-1</sup> day<sup>-1</sup> in 2018 and  $772 \pm 775$  g CH<sub>4</sub> ha<sup>-1</sup> day<sup>-1</sup> in 2019. In comparison, for the drained system, peak fluxes were observed in the spring with  $210 \pm 82$  g N<sub>2</sub>O ha<sup>-1</sup> day<sup>-1</sup> in 2018 and  $65 \pm 57$  g CH<sub>4</sub> ha<sup>-1</sup> day<sup>-1</sup> in 2019. More research is needed to inform how best to minimize global warming impacts of artificial soil drainage.

*Supported by Agriculture and Agri-Food Canada Agricultural Greenhouse Gases Program*

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## **Measurements of greenhouse gas exchange above a conventionally managed forage field in the Lower Fraser Valley, BC, Canada**

Patrick Pow, Andrew Black, Rachhpal Jassal, Zoran Nestic, Sean Smukler, Maja Krzic

Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Agricultural soils are a significant source of greenhouse gas (GHG) emissions, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), and are of concern for climate change. Recent advances in instrumentation have allowed for measurements of non-CO<sub>2</sub> fluxes like N<sub>2</sub>O and CH<sub>4</sub> using the eddy-covariance (EC) method. In Canada, N<sub>2</sub>O emissions from croplands comprise an increasing proportion of agricultural GHG emissions, recently surpassing CH<sub>4</sub> emissions from livestock due to increases in nitrogen fertilizer application. Recent studies have measured GHG emissions from a variety of agricultural systems, but are limited to Ontario, Quebec and the Prairies. Few continuous measurements of GHG emissions are available in British Columbia, especially for regionally important cropping systems including forage for dairy cattle feed. The objective of this study was to quantify year-round measurements of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O exchange from a forage field in the Lower Fraser Valley and evaluate its global warming potential in CO<sub>2</sub> equivalents (CO<sub>2</sub>e) using EC. Annually the net ecosystem exchange of carbon was almost neutral at  $-15$  g CO<sub>2</sub> m<sup>-2</sup> year<sup>-1</sup>. Emissions from N<sub>2</sub>O and CH<sub>4</sub> were  $635$  g CO<sub>2</sub>e m<sup>-2</sup> year<sup>-1</sup> and  $347$  g CO<sub>2</sub>e m<sup>-2</sup> year<sup>-1</sup>, respectively. Increased N<sub>2</sub>O emissions were associated with manure application and fall precipitation. Field management including the timing of manure spreading, forage cutting, and harvesting was associated with substantial changes in GHG exchange, suggesting that these management strategies could be targeted for GHG mitigation, especially for CO<sub>2</sub> and N<sub>2</sub>O emissions.

*Supported by 'Agricultural Greenhouse Gas Program (AGGP II)' and 'NSERC PGS-D'*

# ORAL PRESENTATION SESSION 4

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## Use of a get-away loft by lactating laboratory rats: Do rat moms need a break from their pups?

Anna Ratuski, Dan Weary

Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada

Rats bred for research are typically confined with their litters for three weeks until pups are abruptly weaned, however when given the opportunity, rats will naturally wean pups by spending time away. We aimed to assess how rat welfare is affected by the inability to control contact with pups. Rat dams ( $n=16$ ) and their litters were housed with or without an elevated get-away loft. We predicted that dams with lofts would use them increasingly as pups aged, while dams without lofts would spend more time passively nursing (i.e. initiated by pups), and would show evidence of more negative affective states through increased anticipatory behaviour. Dams with lofts spent (mean  $\pm$  SE)  $27 \pm 5$  % of their time in the loft in week 1, increasing to  $52 \pm 5$  % at 3 weeks. When pups were three weeks old, dams with lofts spent less time passively nursing ( $10 \pm 2$  % of time versus  $27 \pm 4$  % for dams without lofts) and less time nursing overall ( $36 \pm 4$  % of time versus  $59 \pm 2$  % for dams without lofts). Rats without loft access showed an increase in anticipatory behaviour indicative of negative affect ( $18.8 \pm 1.0$  behaviours per minute in week 1 compared to  $24.5 \pm 1.8$  in week 3). We conclude that rats spend increasing time away from their pups when provided the opportunity, particularly later in lactation, and the inability to get away from pups is associated with increased passive nursing and negative affect.

*Supported by NSERC CGS-D Award*

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## Cyborg lameness assessment: creating a machine-person tool for terminating cow lameness

Kehan Sheng, J Gardenier, M von Keyserlingk, C Clark, D Weary

University of British Columbia, University of Sydney

Lameness impacts the health and welfare of dairy cows, whilst reducing productivity. Lameness is typically assessed visually by humans by scoring gait using a 4 - or 5 - point scale based on a number of traits. However, these assessments are subjective, time-consuming and error-prone, especially when applied infrequently as cow gait changes over time. Here we describe our cyborg methodology, combining human and automated methods of lameness scoring, based upon the hypothesis that relative assessments (which of these two cows is more lame) are more reliable than absolute scores. Our algorithm automatically assigns dairy cows into paired video clips showing these animals walking in a controlled environment, which is then provided to human click workers (accessed via Amazon Mechanical Turk) for relative assessment. Video clips are shown to multiple assessors, and on multiple occasions to the same observer to determine inter and intra observer reliability. Relative dairy cow lameness assessments are compared with absolute lameness scores generated by trained lameness assessors and with data on hoof health for validation purposes. Our cyborg lameness assessor will now be evaluated as a tool for dairy cow lameness assessments and termination.

*Supported by NSERC Industrial Research Chairs Grants awarded to MvK and DMW; Dairy Australia*

# ORAL PRESENTATION SESSION 4

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## **The abundance and diversity of wild bees increases in urban parks with reduced management.**

Jens Ulrich (1), Risa Sargent (1)

1. Department of Applied Biology, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

There is rising concern that bees and other pollinators are experiencing worldwide declines. These declines may have negative impacts, including destabilization of urban ecosystem services. With the explicit goal of conserving urban pollinators, including wild bees, the City of Vancouver has implemented an experimental management strategy of reduced mowing frequency in a subset of Vancouver city parks. To determine whether this reduced management approach increased the availability of floral resources in parks, I surveyed flowering plant communities in reduced management parks and conventionally managed parks using a systematic quadrat sampling method. Additionally, to explore whether pollinator communities were influenced by the park management approach, I surveyed bees and other pollinating insects at these parks using a pan-trap sampling approach. I found that flower abundance and flowering species richness was significantly higher in reduced management parks, although this effect diminished at the end of the summer. Furthermore, I found that wild bee abundance and species richness and syrphid fly abundance was significantly higher in reduced management parks. Flower abundance at the date of sampling is a strong predictor of observed bee abundance, demonstrating a mechanistic link between park management and bee abundance. My study approach cannot determine whether increased abundance and diversity of wild bees stems from aggregation of individuals at the flower-rich reduced management park sites or from increased reproductive output at these flower-rich reduced management park sites. Future work will seek to disentangle these two pathways, which have different implications for the long-term stability of bee populations.

*Supported by an NSERC Discovery grant to RDS.*

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# POSTER PRESENTATION SESSION

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## **Human casualties are the dominant cost of human-wildlife conflict in India**

Sumeet Gulati(1), Krithi K. Karanth(2,3), Nguyet Anh Le(1), Frederik Noack(1).

Wildlife and Conservation Economics Laboratory, and Food and Resource Economics, 2357 Main Mall, The University of British Columbia, Vancouver, Canada., 2The Centre for Wildlife Studies, Bangalore, India., 3.The Nicholas School of Environment, Duke University.

Reducing the costs from human-wildlife conflict, mostly borne by marginal rural households, is a priority for conservation. We estimate the mean species-specific cost for households suffering damages from one of 15 major species of wildlife in India. Our data is from a survey of 5,196 households living near 11 wildlife reserves in India, and self-reported annual costs include crop and livestock losses, and human casualties (injuries and death). By employing conservative estimates from the literature on the value of a statistical life (VSL), we find that costs from human casualties overwhelm crop and livestock damages for all species associated with fatalities. Farmers experiencing a negative interaction with an elephant over the last year incur damages on average that are 600 and 900 times those incurred by farmers with negative interactions with the next most costly herbivore: the pig and the nilgai. Similarly, farmers experiencing a negative interaction with a tiger over the last year incur damage that is on average three times that inflicted by a leopard, and 100 times from a wolf. These cost differences are largely driven by differences in the incidence of human death and casualties. Our estimate of costs fluctuates across reserves, mostly due to a variation of human casualties. Understanding the drivers of human casualties and reducing their incidence is crucial to reducing the costs from human-wildlife conflict.

*Supported by the Social Sciences and Humanities Research Council of Canada, by Oracle, the National Geographic Society, Columbia University, Duke University, and DST Ramanujan Fellowship.*

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## **What do robots playing soccer and cat welfare research have in common? Validation of the use of computer vision for automatic behaviour monitoring in an animal shelter**

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Monitoring cat behaviour in an animal shelter is critical for ensuring the health and welfare of the cats in care. Additionally, collecting behavioural data is an essential component of most shelter-based research. Both shelter staff and researchers typically collect data in-person or through video monitoring to record maintenance behaviours such as food and water intake and litter box use, as well as exploratory and hiding behaviour. These approaches can be time-consuming and involve trained observers, which may prove a barrier to needed data collection. An alternative approach may be to utilize computer vision technology to automatically monitor the behaviour of cats in shelters. Cats (n=4) housed at the BC SPCA in pair housing, were enrolled in the study. We used the OpenCV fiducial tag library ArUco to generate 16-bit 2d unique identifiers printed on a customized lightweight cotton sleeve attached to a standard breakaway cat collar, which created identifiers automatically recognized in video data. Two cameras were placed around the room, including next to litter boxes and food bowls and recorded continuously for 48 hours. The video streams were subjected to code which captured individual IDs and timestamps. Two trained observers also coded the videos. This automated method's validity will be presented, as evidenced by high accuracy with human-coded behavioural data from the video output. Computer vision technology may be an accessible and low-cost behavioural data collection method for research and animal care applications within animal shelters.

*Supported by Natural Sciences and Engineering Research Council of Canada Industrial Research Chairs Grants*

# POSTER PRESENTATION SESSION

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## **Effects of overwinter plastic tarping on soil moisture, available nutrients, and crop yield on organic vegetable farms in British Columbia**

Raelani Kesler, Soil Science M.Sc. Candidate, Sustainable Agricultural Landscapes Lab

Changes in precipitation due to climate change present many challenges for organic growers in British Columbia. Increased rainfall during the shoulder seasons (spring and fall) are predicted to further hinder the establishment of overwintering cover crops. Without cover during the winter months, fields are liable to erode and leach nutrients under the influence of heavy precipitation. In response, some producers have begun utilizing plastic tarps as a physical barrier to protect soils over the winter, however, little is known about the effects of these tarps on soil processes and crop yield. This study aims to quantify the short-term effects of overwintering tarps on soil chemical and biological processes in the spring after their removal, as well as impact on crop yield. The preliminary results from the first year of study elucidate differences in available nitrogen, electrical conductivity, and soil moisture content with the use of overwintered tarps.

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## ***In silico* screening for natural inhibitors of SARS-CoV-2 main protease**

Lennie Cheung, Rickey Yada

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In response to the ongoing and devastating coronavirus disease 2019 (COVID-19) pandemic, scientists across the globe are conducting multidisciplinary research in an urgent effort to develop antiviral inhibitors of its virulent culprit, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Of the various potential drug targets currently being assessed, SARS-CoV-2 main protease (M<sub>pro</sub>), an enzyme essential for coronavirus replication and transcription cycles, has been identified as a promising target and is actively being studied for this application. The *in silico* screening of natural M<sub>pro</sub> inhibitors employs molecular docking, a technique that uses computer simulation to predict receptor-ligand binding affinity in two steps: (1) sampling numerous conformations of a ligand-docked complex and (2) scoring these complexes based on their free energy of binding. Using molecular docking, various natural compounds have been predicted to have potent M<sub>pro</sub> inhibitory activity including vitamin B<sub>2</sub>; certain phytochemicals from herbs, spices, teas, and vegetables; two phlorotannins of edible seaweed, and several peptides of digested fish protein. All of these compounds are predicted to interact with amino acid residues located within the M<sub>pro</sub> binding cavity, notably the catalytic residues His41 and Cys145, with some compounds even predicted to have binding affinities exceeding those of known and candidate drug inhibitors. Although the experimental and clinical efficacy of the predicted natural inhibitors will need to be established in subsequent *in vitro* and *in vivo* studies, molecular docking allows for the rapid screening of vast amounts of natural ligands for potential health benefits and therapeutic activity against COVID-19.

# POSTER PRESENTATION SESSION

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## Decomposition of extracellular H<sub>2</sub>O<sub>2</sub> by catalase inhibits RAW 264.7 cell proliferation

Yu-Hsuan Liao, Kaiwen Mu, David Kitts

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Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), a reactive oxygen species (ROS), is an important signaling molecule that is essential for cell metabolism, proliferation and survival. Recent studies have shown that an alteration in extracellular H<sub>2</sub>O<sub>2</sub> will disrupt intracellular redox homeostasis, which in turn influences cell proliferation activity. To understand this relationship, we used macrophage, RAW 264.7 cells that were treated with catalase and the extracellular H<sub>2</sub>O<sub>2</sub> concentrations were measured over time. Cell proliferation activity was measured using 5-bromo-2'-deoxyuridine (BrdU). The intracellular GSH to GSSG ratio was determined to analyze the intracellular oxidation state. Results showed a concentration-response relationship between catalase treatment and the magnitude of decrease in extracellular H<sub>2</sub>O<sub>2</sub>. After 30 minutes, a restoration in extracellular H<sub>2</sub>O<sub>2</sub> concentration was observed, likely caused by an induced influx of intracellular H<sub>2</sub>O<sub>2</sub> in RAW 264.7 cells. By 240 minutes, the extracellular H<sub>2</sub>O<sub>2</sub> concentration had returned to the initial level and remained constant for up to 1440 minutes. A decrease in cell proliferation was observed upon the addition of catalase. Glutathione results were inconclusive; however, our study showed that altering extracellular catalase was sufficient to change cell proliferation of RAW 267.7 cells. Future studies will focus on the cell signalling mechanisms that trigger the change in cell proliferation.

Supported by 'Work Learn International Undergraduate Research Award' UBC

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## Characterization and application of bacteriophages for biocontrol of Shiga toxin producing *Escherichia coli*

Yu Tong Linda Lu(1) and Siyun Wang(1)

1.Food, Nutrition and Health, Faculty of Land and Food Systems, University of British Columbia, Vancouver, Canada

Shiga-toxin-producing *Escherichia coli* (STEC) remains an economic and health burden despite recent advances. Currently, there are no effective approaches to eradicate STEC O157 on fresh produce post-harvest—representing a need for alternatives. Phages, viruses that specifically target and utilize bacterial hosts for replication, are a sustainable, natural, and cost-effective method to control contamination in the food industry. Three previously isolated phages capable of lysing O157 were selected for further analysis. Whole-genome sequencing was employed to probe their lytic abilities and potential pathogenic genes. Their individual abilities to suppress four O157 strains *in vitro* were assessed at a multiplicity of infection of 100 PFU/CFU at 10°C over a 72-hour period. Enumeration of STEC was completed using spread plating techniques on Tryptic Soy Agar, while phage populations were enumerated using a soft-agar bacterial overlay. Phage genome annotations revealed a lack of integrase genes, indicating their putatively lytic nature. All three phages showed a lack of resistance and virulence genes. *In vitro* examination revealed phages achieved up to a 5-log CFU reduction in STEC populations when compared to the positive control (P<0.05). Overall, treatment of all STEC strains resulted in the maintenance of phage populations in the range of 5.62–7.39 log PFU/mL (P>0.05). These bacteriophages demonstrated potential for biocontrol, which will be further explored by determining STEC susceptibility to phages on Romaine lettuce. This research signifies contribution to the emerging field of phage therapy in food safety control in Canada which will combat STEC contamination and reduce economic and health burden.

Supported by BC Ministry of Agriculture and NSERC CGS-M

# POSTER PRESENTATION SESSION

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## **Does adherence to dietary approaches to stop hypertension reduce the risk of chronic kidney disease: A systematic review and meta-analysis**

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Dietary Approaches to Stop Hypertension (DASH) diet is negatively linked to hypertension, a key risk factor associated with development of chronic kidney disease (CKD). However, the protective role of DASH diet in development of CKD, as measured by estimated glomerular filtration rate (eGFR), is inconsistent in the literature. This review aimed to quantify the potential association between DASH diet and the risk of CKD. A comprehensive literature search was done in MEDLINE, EMBASE, Web of Sciences, and Scopus. Pooled risk estimates (RE) and 95% confidence intervals (CI) were obtained using random-effects model and inter-study heterogeneity was traced using subgroups analysis. Out of 475 studies identified for screening, 7 were eligible for systematic review and 6 for meta-analysis. All studies had high quality. The total sample size was 568,213 participants including 16,694 cases of CKD. Greater adherence to DASH diet was negatively linked to the risk of CKD (RE: 0.77 [95% CI 0.63-0.94];  $p= 0.01$ ). This association remained statistically significant in all subgroup analyses based on geographical region, exposure assessment tool, and adjustment for energy intake and body mass index (RE range: 0.68-0.87). However, when the analysis was stratified based on study design and DASH scoring system, the association was only significant in cohort studies (RE: 0.79 [95% CI 0.61-1.01];  $p= 0.05$ ) and DASH measured by nutrients, not food groups (RE: 0.78 [95% CI 0.63-0.97];  $p= 0.02$ ). Adherence to the DASH dietary pattern might have protective effects against CKD development. Future studies should include different DASH diet scoring systems for comparison purposes.

*Supported by Students' Scientific Research Center (SSRC), TUMS*

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## **Western Canadian dairy producer attitudes towards calf rearing**

Elizabeth Russell(1), Marina von Keyserlingk(1) and Daniel Weary(1)

1. Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z4, Canada

Calf rearing is integral to dairy farming. The calf rearing phase, from birth to weaning, has received considerable attention. There is a large body of biological research on housing and feeding, including the best practices to transition calves from milk to solid feed (weaning). Despite this body of research, there is tremendous variation in calf management practices during this period. Little research has examined how dairy producers view calf rearing. Therefore, the aim of this study was to investigate the attitudes and perceptions of Western Canadian dairy producers toward calf rearing, with a focus on calf weaning. Eighteen participants were interviewed from British Columbia, Manitoba, and Alberta; most participants (n=15) were identified as the farm manager or owner and the remainder as primary calf caretakers. Interviews were semi-structured; participants were asked what they viewed as successes and challenges in rearing and weaning calves, and their perceptions of the future of calf rearing. A thematic analysis is in progress, which will result in a codebook and the identification of major themes. This study will provide insight to how dairy producers in Western Canada view calf rearing and help identify areas for future research and outreach concerning these practices.

*Supported by NSERC Industrial Research Chair in Cattle Welfare*

# POSTER PRESENTATION SESSION

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## Humane pest control? Non-target interactions with a captive bolt trap for commensal rodents

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Alternatives to rodenticides are desirable to pest control customers and operators concerned with the environment and animal welfare, but there are few practical alternatives to handle rodent infestations. The Goodnature® A24 automatic rat trap is a self-resetting captive bolt trap powered by pressurized CO<sub>2</sub>, designed with the objective of instantly crushing the skull. This study aimed to identify potential risks to non-target animals, and conduct a humaneness evaluation of the traps. Nine traps were deployed at UBC's In-Vessel Compost Facility and each trap was paired with a motion-activated video camera. A total of 2,282 animals across 34 different species were observed. Rodents were the most common mammalian visitor (n=566), followed by squirrels (n=302), and other mammals (raccoons, skunk, shrew, n=92). Birds were the most frequently observed (n=1,312), but had the fewest interactions with the trap itself - only 1 bird was observed entering the trap body (with no blocker equipped), while the remaining interactions involved no interaction (n=1,087), investigating the trap (n=147) or perching on the trap (n=97). A small number of unidentifiable animals (n=10) were observed, but did not interact with the trap. 36 raccoons and squirrels were observed either entering the trap or inserting limbs in the trap when there was no blocker in place, however this number was reduced to 0 with a blocker in place. This trap is a promising tool as an alternative to rodenticide poisons, however the researchers recommend the use of a blocker in outdoor settings where other non-target animals are present.

*Supported by 'Aboriginal Graduate Fellowship, British Columbia Graduate Scholarship' UBC*

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## Impacts of semi-natural habitat restoration in agroecosystems on pest and beneficial insect biodiversity

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Semi-natural habitat restoration is a potential tool for growers to support the biodiversity of beneficial insects. These insects provide sustainable population control of numerous pest insect species important to agriculture. One pest of particular interest in British Columbia is the spotted wing *Drosophila*, an invasive fruit fly that causes extensive damage to berries and soft fruits in the region. Recently, two species of exotic parasitoid wasp that target the spotted wing *Drosophila* were found to have established in British Columbia. Understanding the effects of these parasitoids on spotted wing *Drosophila* will be important to their population management in the coming years. We studied the effects of habitat enhancements, like grassland set-asides and hedgerows, on pest and beneficial insect biodiversity, with a focus on spotted wing *Drosophila* and its parasitoids, on 28 field sites in Delta, British Columbia, Canada. Sampling was conducted during the summer of 2020 and will continue into 2021. Vegetation surveys were also conducted on study sites to control for plant composition effects. Insect samples from the 2020 season are in the process of being identified and will subsequently be analyzed for trends in biodiversity and abundance. Initial findings indicate that spotted wing *Drosophila* makes use of wild blackberries as a host on farmlands, and that at least one of the two exotic parasitoid species has established in the Delta region.

*Supported by MITACS and the Delta Farmland and Wildlife Trust*

# POSTER PRESENTATION SESSION

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## Investigation into owner-reported differences between foreign- and Canadian-sourced dogs

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Local animal rescue leaders estimate that thousands of dogs are imported into Canada from foreign countries each year and are concerned about the health and temperament of these dogs. Currently, few studies have investigated how the source location of dogs influence the owner-dog relationship. An online survey was distributed to n = 803 dog owners in British Columbia, Canada, containing questions on various aspects of the owner-dog relationship, including questions from the Lexington Attachment to Pets Scale, Canine Behavioral Assessment and Research Questionnaire, Human Animal Bond questionnaire, Monash Dog Owner Relationship Scale, and constructed questions about source, training practices, expectation, and health. Approximately 7% of respondents reported owning a foreign-sourced dog, with majority of these dogs coming from the United States. Multivariate regression models were used to predict whether the source of the dog, while taking into account other investigated variables, had an effect on owners' responses. We found no evidence of a poorer human-dog relationship in foreign-sourced dogs. In fact, owners of Canadian-sourced dogs used aversive training methods more frequently and had higher expectations for their dog. Although our findings suggest that foreign-sourced dogs may not have a worse human-dog relationship. Future research can investigate the experiences of the foreign dogs as they travel and habituate to their new Canadian environments.

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## Humane pigeon population management at TransLink SkyTrain® stations using contraceptive Ovocontrol P®

Nadia (Konstantina) Xenakis (3), Sara Dubois (1), Ronaldo Cerri (2)

1. BC SPCA; 2. Applied Biology UBC; 3. Animal Welfare Program UBC

The purpose of this study is to assess whether avian contraceptive Ovocontrol P® is effective at managing abundant pigeon populations at various TransLink SkyTrain® stations across the lower mainland of British Columbia, Canada. An overabundance of pigeon populations is undesirable due to the large maintenance cost associated with cleaning excrement and leftover food; as well as the pigeons ability to trigger track alarms which require maintenance crews to investigate the cause of the alarm. This requires that stations be shut down for periods of time, resulting in a loss of revenue and frustration from customers. Current population management methods include spiking, netting, the use of electric strips, and lethal control, none of which have been proven completely effective. Ovocontrol P® consists of Nicarbazine 0.5% which interferes with egg hatchability in egg laying species which impedes the formation of viable embryos. The effects of Ovocontrol P® are fully reversible if not consumed, and do not pose a risk to secondary consumers. It is non-toxic towards humans and the environment. To assess the efficacy of Ovocontrol P®, 8 stations will be set up with feeders, 4 of which will release Ovocontrol P® and 4 that will act as control stations and release cracked corn. Trail cameras will monitor feeding activity and provide rough population counts to assess the effect on population size in addition to track alarm trigger data for each of the 8 stations and customer complaints related to pigeon activity.

*Supported by TransLink® in partnership with the MITACS Accelerate Fellowship Program*

# POSTER PRESENTATION SESSION

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## Blueberry transpirational water loss is affected by cuticular waxes and scar size

Yifan Yan (1), Anubhav Pratap Singh (2), Simone Castellarin (1)

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Fruit water loss is one of the major concerns to growers and breeders during blueberry postharvest storage, which may be through different routes such as the cuticle and the stem scar. Cuticular waxes are major compositions of the cuticle layer, which play important roles in preventing water loss. In this study, cuticular waxes have been characterized in six blueberry varieties (i.e., Duke, Bluecrop, Draper, Calypso, Elliott, and Last Call) during four-week postharvest storage at 0.5 °C. Total wax content ranged from 40.22–79.12 µg/cm<sup>2</sup> at harvest, with around 80% of the waxes being attributed to triterpenoid and diketone groups in all varieties. Either oleanolic acid or ursolic acid was the most abundant wax compound in the varieties considered. Total wax content increased during postharvest storage, due mostly to an increase of triterpenoids. Transpirational water loss have been monitored in the same varieties stored at 20 °C, under control, scar sealing, and wax removal conditions. Scar sealing strongly inhibited the transpirational water loss while wax removal showed minor effects. A positive correlation has been observed between stem scar size and transpirational water loss rate. On the other hand, an increased proportion of oleanolic acid was found to reduce the transpirational water loss, whereas an increased proportion of ursolic acid enhanced the water loss. This study provides new knowledge on postharvest transpirational water loss and its potential regulation in blueberries with different genetic backgrounds. This knowledge can benefit blueberry breeding programs that aim to select new varieties based on their postharvest performance.

Supported by Mitacs, BC Blueberry Council, Investment Agriculture Foundation of British Columbia, China Scholarship Council

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## Control of *Salmonella enterica* by repeated application of a bacteriophage cocktail to sprouting alfalfa seed

Catherine Wong (1), Siyun Wang (1)

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*Salmonella enterica* (*S. enterica*) has caused multiple outbreaks associated with sprouted vegetables, notably alfalfa sprouts. Prior research has shown that bacteriophages can reduce *S. enterica* on growing alfalfa sprouts, but population resurgence after initial treatment can occur. This study was conducted to determine the effect of repeated bacteriophage applications on populations of two *S. enterica* strains during sprouting of alfalfa seed. Two Alfalfa seed lots were separately inoculated with two *S. enterica* strains (*S. Enteritidis* S5-415, *S. Enteritidis* S5-483). Two-thirds of the seeds were irrigated with a cocktail of five lytic bacteriophages one day after *S. enterica* inoculation. Irrigation with bacteriophage or water was repeated daily on one-third or two-thirds of the sprouts respectively. Surviving *S. enterica* populations were measured on Xylose Lysine Deoxycholate (XLD) agar. Populations of both strains increased by  $\geq 3$  log CFU/g on untreated alfalfa sprouts after 3 days at 21°C. Bacteriophage irrigation reduced *S. enterica* populations irrespective of treatment but effects were strain-specific. Populations of S5-415 were immediately reduced by 1 log CFU/g ( $P < 0.05$ ), but S5-483 populations were not affected. Daily bacteriophage treatment further reduced S5-415 populations by 1 log CFU/g on day 3, and the reduction was maintained until day 7. In contrast, daily bacteriophage treatment reduced S5-483 populations by 4 log CFU/g by day 3, although populations also remained significantly lower (2 log CFU/g,  $P < 0.05$ ) on sprouts that received bacteriophage only at day 1. The results suggest that repeated irrigation with bacteriophage can lessen renewed growth of *S. enterica* on sprouting alfalfa seed.

Supported by British Columbia Ministry of Agriculture

# POSTER PRESENTATION SESSION

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## Depletion of a novel polyphenol-targeted gene, *BRUNOL5*, remodels gene expression profiles and exerts anti-cancer effects in liver cancer cells

Tony Yang (1), Cayla Boycott (1), Katarzyna Lubecka (2), Barbara Stefanska (1)

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Primary liver cancer has the highest rising incidence rate across North America and only a 18% 5-year survival rate. In the Stefanska lab, it was discovered that in a population with liver cirrhosis, the patients that develop primary liver cancer show decreased promoter methylation of a novel gene, *BRUNOL5*, compared to the patients that do not develop liver cancer within the same timeframe. Decreased promoter methylation was associated with increased *BRUNOL5* expression which suggests an oncogenic role of *BRUNOL5*. In the present study, we showed that bioactive polyphenols, resveratrol (RSV) and pterostilbene (PTS), down-regulate *BRUNOL5* in liver cancer cells, which coincides with *BRUNOL5* promoter hypermethylation. This effect on *BRUNOL5* transcriptional regulation was associated with decreased cell growth, & anchorage independent growth and invasiveness. Interestingly, depletion of *BRUNOL5* in HepG2 liver cancer cells mimicked polyphenols' anti-cancer action. Further investigation using RNA-sequencing in *BRUNOL5*-depleted HepG2 cells established gene targets potentially regulated by *BRUNOL5*. We found 4,406 genes significantly differentially expressed in response to *BRUNOL5* knockdown. The top downregulated genes included cancer-promoting genes such as *FAIM2*, *AMOTL1*, and *MMP2*; whereas tumor suppressor genes such as *MTIG*, *CADH1*, and *ALDH1L1* were among genes with the highest upregulation. Our present findings demonstrate that *BRUNOL5* is a novel target of polyphenols and acts as an oncogene in liver cancer. Thus, RSV and PTS may exert their anti-cancer effects, at least partially, through *BRUNOL5* downregulation. Since *BRUNOL5* belongs to the CELF family regulating mRNA processing, polyphenols that silence *BRUNOL5* may regulate gene expression through mRNA processing-dependent mechanisms.

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## The gender differences in the prevalence of sugar-sweetened beverage consumption in British Columbia adolescents

Kexin Zhang

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Sugar-sweetened beverages (SSBs), such as soda, sweetened coffee and tea, and energy drinks, have been identified as threats to our physical and mental health. Numerous negative impacts from SSB consumption were found including obesity, type 2 diabetes, hypertension, and dental caries. Adolescents, who undergo important pubertal maturation stages, may be more vulnerable to these conditions. The frequency of SSB consumption may also differ by gender. In this study, we examined the prevalence of SSB consumption in British Columbia (BC) adolescents (N= 1031, age 13-17 years) and evaluated the gender patterns using a self-reported weekly SSB consumption question from a population-based dataset. Six response options, from 'Never' to '2+ times per day', were available to participants. Frequencies and percentages were calculated, and chi-square test was used for obtaining p-values. Three different SSB intake measures were constructed to assess daily, gender-specific median, and any intakes (versus never). Overall, about half of the cohort consumed SSBs less than once per week or never. About 10% of boys consumed SSBs on a daily basis compared to 4% for girls (p-value: <0.001). The gender-specific median intake was 'less than once per week' for girls and was '1-2 times per week' for boys. More girls (19%) reported that they never consumed SSBs than boys (13%) (p-value: 0.015). Results showed that among BC adolescents, girls tend to drink SSBs less frequently per week than boys, but 84% of teens drink some SSB than not. Continuous effort to limit SSB consumption in adolescents, particularly in boys, is considered.

Supported by Dr. Annalijn Conklin's lab



# POSTER PRESENTATION SESSION

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## Tail chalk improves estrous detection when using automated activity monitors

Jéssica Marques (1), Tracy Burnett (1), Augusto Madureira (1), Ronaldo Cerri (1)

(1) Applied Animal Biology, Faculty of Land and Food Systems, University of British Columbia, Vancouver

The aim of this study was to determine the association between physical activity, mounting behaviour and milk production in spontaneous estrus. A total of 1,127 estrus events from 376 Holstein cows were recorded. Activity was monitored continuously by an automated activity monitor (AAM) and mounting behaviour was monitored twice daily using tail chalk (TC) scores (1 to 3 scale, 3 was considered an alert). Ovarian ultrasonography was performed on the event day and 7d post-AI to determine true estrus alerts. Pregnancy was diagnosed at 30±3d post artificial insemination (AI). Milk production was recorded, and cows were classified as low(L) or high(H) producers using the median (Primiparous=31.5 kg/d; Multiparous=45.5 kg/d). Activity was classified as High and Low by the median (230 heat indicator; AfiActII, Afimilk). The proportion of animals that showed mounting behaviour, increase in activity, or both were not different between H or L producers (P=0.27) or parity (P=0.75). A higher proportion of cows were in true estrus when both tools alerted (AAM=65.3; TC=32.3; AAM+TC=88.6%; P<0.001). Cows classified as High activity showed a greater proportion of TC alerts (1=30.2; 2=12.6; 3=57.2%; P=0.04) than cows classified as Low activity (1=61.9; 2=15.0; 3=23.1%; P=0.04). Cows with TC alerts tended to have a greater pregnancy/AI compared with cows that were only alerted on the AAM (AAM+TC=44.0±2.9; TC=41.0±7.3; AAM=37.0±2.9%; P=0.06). In conclusion, estrous behaviour detected by TC or AAM was not impacted by milk production. The use of TC along with AAM increased true alerts and cows with TC alerts had higher pregnancy/AI than those that did not display standing to be mounting behaviour.

*Supported by NSERC and Dairy Farmers of Canada*

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## Evaluation of methyl-nutrients in pregnancy following supplementation with synthetic folic acid or natural folate (5-MTHF)

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Requirement for folate and other methyl-nutrients (choline, betaine) increase during pregnancy to support accelerated growth. Both folate (as 5-methyltetrahydrofolate; 5-MTHF) and betaine are methyl donors for the remethylation of homocysteine to methionine. Folic acid (synthetic folate) is recommended during pregnancy, but the body's capacity to metabolize it is limited. Thus, it has been hypothesized that high intakes of folic acid may result in greater use of betaine for remethylation (and enhanced decline in plasma betaine levels). Whether folate form (synthetic folic acid vs. natural 5-MTHF) consumed during pregnancy alters plasma concentrations of free choline and its metabolites (betaine and dimethylglycine) is unknown. Pregnant women (n=30) were randomized to 0.6mg/day folic acid or 5-MTHF, starting at 8–21 weeks gestation, for ~16-weeks. At baseline and endline, 3-hr fasting blood was collected and plasma free choline, betaine, and dimethylglycine were quantified by HPLC-MSMS. Linear regression, adjusting for baseline values, weeks gestation, and duration of supplementation, was used to predict marginal means (95% CI) for endline concentrations of plasma biomarkers in each group. These analyses are part of an ongoing trial, thus folate groups are presented as "A" and "B". Marginal means (95% CI) at endline in group "A" and "B" were: free choline 9.8 (8.5–11.0) and 10.1 (8.8–11.4) µmol/L; betaine 14.7 (13.1–16.3) and 14.7 (13.0–16.4) µmol/L; and dimethylglycine 1.4 (1.2–1.6) and 1.5 (1.3–1.7) µmol/L, respectively, and were not different between groups (P>0.05). In this exploratory analysis among 30 Canadian pregnant women, folate form did not differentially alter maternal plasma concentrations of these methyl-nutrients.

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