General Information
The Organizing Committee is pleased to present the OVC’s annual Graduate Student Research Symposium. Research achievements of current graduate students will be showcased at this annual symposium through oral and poster presentations. The goal of this symposium is threefold: 1) to share students’ research findings, 2) to practice presentation skills and 3) to celebrate research in the OVC community.

Additionally, we are honoured to have Dr. John Hogenesch PhD, Professor in the Department of Pediatrics and Deputy Director of the Center for Chronobiology at the University of Cincinnati, present the Chappel Memorial Lecture this year. The Chappel Memorial Lecture was established in 1988 through an endowment by Dr. Clifford Chappel. Since that time, internationally renowned researchers have been invited to the University of Guelph to summarize their research and career progression to inspire those engaged in, or considering, graduate studies in biomedical research. Dr. Hogenesch will be presenting on the topic of “building circadian medicine in a pediatric hospital”

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The Graduate Student Research Symposium Organizing Committee

- Dr. Gordon Kirby, Associate Dean, Research and Innovation
- Elizabeth Lowenger, Manager, Student Affairs
- Daf Summers, Research Assistant
- Simran Bhullar, Department of Biomedical Sciences
- Ashley Cormier, Department of Pathobiology
- Emily Craig, Department of Biomedical Sciences
- Paul Del Rio, Department of Biomedical Sciences
- Rebecca Fung, Department of Population Medicine
- Shahnaza Hamidullah, Department of Biomedical Sciences
- Bryan Jenkins, Department of Biomedical Sciences
- Jessica Joshua, Department of Pathobiology
- Sydney Pearce, Department of Population Medicine
- Ann Ram, Department of Clinical Studies
- Jyoti Sharma, Department of Biomedical Sciences
- Deirdre Stuart, Department of Biomedical Sciences
- Carol Tinga, Department of Population Medicine
- (Wendy) Xiao Xie, Department of Population Medicine
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1. Isolation of extended-spectrum cephalosporin resistant Enterobacteriaceae from dairy manure in Southern Ontario
Rebecca Anderson¹, Gabhan Chalmers¹, Roger Murray², Ed Topp², Patrick Boerlin¹
¹Department of Pathobiology, University of Guelph
²Agriculture and Agri-Food Canada

The majority of antibiotics are used in the farming industry, which has led to a significant prevalence of antimicrobial resistance in manure and in the environment. This study is part of a larger project determining the effect of a variety of manure treatments on antimicrobial resistance. Its goal is to investigate the presence of extended-spectrum cephalosporin (ESC) resistance determinants in Enterobacteriaceae from manure samples taken from raw and anaerobically digested manure. Dairy cow manure samples were collected from six different farms across Southern Ontario. Enrichment cultures and selective media containing ESCs were used to isolate Enterobacteriaceae resistant to these antibiotics. Isolates were identified by MALDI-TOF and screened by PCR for the presence of the ESC resistance genes blaCTX-M, blaCMY and blaSHV. A total of 238 isolates were obtained from 26 raw manure samples and 165 isolates were obtained from 26 digested manure samples. When comparing the isolates found in raw and digested manure, 23.9% and 21.2%; 19.7% and 26.7%; 3.8% and 3.0% harboured blaCTX-M, blaCMY and blaSHV, respectively. The blaCTX-M, blaCMY and blaSHV genes were found in bacteria from 65.4% and 50.0%; 69.2% and 57.7%; 19.2% and 19.2% of samples from raw and digested manure, respectively. To date, there are no statistically significant differences between the prevalence of resistant Enterobacteriaceae carrying these genes in raw manure compared to digested manure. Results show that resistant bacteria remain present in the manure post treatment, and additional treatment beyond anaerobic digestion may be necessary to reduce the number of resistant bacteria entering the environment.

2. Feline tissue and cell expression of SAMHD1 and the role in FIV restriction
Peyman Asadian, Dorothee Bienzle
¹Department of Pathobiology, University of Guelph

Background: Sterile Î± motif (SAM) and histidine-aspartate domain 1 is an enzyme with viral restriction functions. The deoxynucleoside triphosphate triphosphohydrolase and 3’→ 5’ exonuclease activity of SAMHD1 restricts retroviruses replication. The SAMHD1 expression was evaluated by Tissue Microarray (TMA)-based immunohistochemistry using monoclonal antibodies combined with proportional and intensity scoring system. TMAs were constructed by acquiring 1.5 mm cylindrical biopsies from 16 different formalin-fixed paraffin-embedded tissues of 3 healthy male cats. SAMHD1 subcellular localization (western blotting) were evaluated in feline T cell line (FeTJ) as well. Results: By histomorphological criteria, SAMHD1 expression was identified in: macrophages and immature hematopoiective cells of bone marrow, lymphocytes of secondary lymphoid organs, hepatocytes, exocrine acini of pancreas, adrenal gland cells (more intense in zona granulosa), pneumocytes, epithelium of salivary gland ducts, exocrine acini of pancreas, kidney tubules, spermatogenic cells, Sertoli cells, Leydig cells, epithelium of the epididymis, keratinizing stratified epithelium of the skin and tongue, hair follicle cells, epithelial cells of the mucosa of the esophagus, stomach, small intestine, colon, trachea and bladder. Immunocytochemical staining identifies numerous nuclear and cytoplasmic SAMHD1 positive cells in the feline T cell line FeTJ. Discussion/Conclusions: This study is the first systematic description of SAMHD1 expression profile in domestic cats and indicates high expression of SAMHD1 in the retrovirus entry sites and sites of replication.
3. The effects of innate stimulation on the development of bovine respiratory disease
Laura Bassel, Jeff Caswell, Kaufman Emily, Sarah-Nicole Alsop, Carmo Co, Ksenia Vulikh, Laura Siracusa
1Department of Pathobiology, University of Guelph

Bovine respiratory disease affects newly arrived feedlot cattle. Stress and viruses are thought to inhibit innate immune defenses, predisposing cattle to bacterial pneumonia. We hypothesized that stimulating innate immune responses during this period would reduce the development of disease. In early experiments, administration of aerosolized bacterial lysate to calves induced innate responses, including elevated temperature and recruitment of neutrophils to the lungs. In a second experiment, 60 high-risk steers received either aerosolized lysate or saline on the day after arrival to the feedlot. These cattle were followed for 28 days. During this time, the lysate-treated cattle had an increased incidence of clinical disease (72% versus 53% in control steers), lower weight gains, increased serum haptoglobin and higher nasal loads of Mycoplasma bovis. Six of the lysate-treated steers died of M. bovis pneumonia, in comparison to one control steer. In a third experiment 10 clean-catch, colostrum-deprived calves were randomly assigned to receive either aerosolized bacterial lysate or saline prior to challenge with aerosolized Mannheimia haemolytica serotype 1. In contrast to the results seen in feedlot cattle, the lysate treatment had a mild protective effect, with lysate treated calves having a reduced proportion of pneumatic lung at post mortem examination. Together these studies suggest that pulmonary inflammation may predispose calves to M. bovis pneumonia and the increased risk of respiratory disease in on-arrival calves may not be due to immunosuppression, but rather immune dysregulation, where exaggerated inflammatory responses may contribute to pathogenesis.

4. N-acetyl cysteine as a potential treatment for persistent breeding-induced endometritis
Michelle Caissie1, Tracey Chenier1, Cathy Gartley1, Elizabeth Scholtz1, Joanne Hewson2, Ronald Johnson3, Dorothee Bienzle4
1Department of Population Medicine, University of Guelph
2Clinical Studies, Ontario Veterinary College, University of Guelph
3Department of Biomedical Sciences, Ontario Veterinary College, University of Guelph
4Department of Pathobiology, Ontario Veterinary College, University of Guelph

Persistent breeding induced endometritis (PBIE) is a major cause of infertility in mares. Transient uterine inflammation is a normal response to breeding, however PBIE susceptible mares do not clear this inflammation in a timely fashion, leading to infertility. N-acetyl cysteine (NAC), a mucolytic used to treat endometritis in mares, has anti-inflammatory properties, affects inflammatory cytokines and is a mild inhibitor of nitric oxide synthase. Increased nitric oxide (NO) causing smooth muscle relaxation, and alterations in cytokines have been documented in PBIE mares. The objective of our study was to determine if NAC treatment would lower nitric oxide and inflammatory cytokine levels, thereby resolving PBIE. A randomized, blinded, cross-over design clinical trial was performed utilizing PBIE susceptible mares (n=10). Intrauterine infusion of 3.3% NAC was performed 12 hours prior to insemination, when a follicle > 35 mm was present. Mares were sampled for endometrial cytology and endometrial fluid to determine cytokine (ELISA) and nitric oxide (Colorimetric assay) levels, and endometrial biopsies (gene expression for inflammatory cytokines by qPCR) were taken on day 1 and day 3 post-insemination. Clinical signs of endometrial edema and fluid depths were assessed at 12 hours and then every 24 hours post breeding. Uterine inflammation (p=0.0006), and interleukin 6 (p=0.0047) levels were highest on day 1, uterine edema was greatest on day 1 and 2 (p=0.02) and uterine fluid volumes were highest on day 2 (p=0.02). In this clinical trial, pre-breeding intrauterine treatment with NAC did not affect NO levels, cytokine gene expression, nor clinical signs of PBIE.
5. Development of a histological grading scheme for broiler breast myopathies in Ontario, Canada

Sunoh Che¹, Leonardo Susta¹, Shai Barbut², Chaoyue Wang², Christian Fuchs³
¹Department of Pathobiology, University of Guelph
²Food Science, Ontario Agricultural College
³Food Safety & Quality Assurance Team, Maple Leaf Foods

Wooden breast (WB), spaghetti meat (SM), and white striation (WS) are emerging disease of the breast muscle in intensively reared broilers. Although not a public health concern, these myopathies can cause severe economic losses in the poultry sector because of poor meat processability and reduced consumer preference. In the USA, WS and WB prevalence soared up to 92% and 42%, respectively, with conservative estimated economic losses of $200M per year. Although a precise aetiology has not been identified, lesions have been associated with fast-growth rates and the large size of pectoral muscles. Macroscopically, affected breast fillets show bulging, pale areas and hardened consistency (WB), white striations parallel to muscle fibres (WS), or separation of muscle fibres (SM). Histologically, these myopathies show overlapping characteristics: myodegeneration, replacement with fibro-fatty tissue, and variable inflammation. Due to the high in-line speed at the processing plant, macroscopic detection of WB, SM, and WS is difficult and is mainly based on subjective visual examination and palpation of the breast fillets. The prevalence of broiler myopathies has not been reported in Canada. Here, we established a histological grading scheme to assess the severity of these myopathies, to be used as a gold-standard to inform future in-line detection tests. Specifically, the histological grading was compared to macroscopic variables (e.g., fillet height, weight), and the best descriptive categories for classification were determined using correlation analysis. The refined macroscopic grading scheme will be used to evaluate the prevalence of myopathies in Canadian processing plants.

6. Development of diagnostic reasoning and problem solving skills: perceptions of recent veterinary graduates

Tavleen Dhinsa¹, Tracey Chenier¹, Deep Khosa¹, Joanne Hewson²
¹Department of Population Medicine, University of Guelph
²Clinical Studies, Ontario Veterinary College

Recent veterinary graduates enter clinical practice with a comprehensive knowledge base and technical skill set gained through various learning opportunities. Despite this, graduates report low confidence in clinical problem solving. To elucidate the reasons behind their low confidence, we conducted E-surveys and semi-structured interviews with 2014-2018 DVM program graduates (n=81 E-surveys; n=10 interviews). Questions explored how the process of clinical problem solving changes over time as recent graduates gain experience, and assessed how graduates felt the approaches to diagnostic reasoning taught during their veterinary program prepared them for clinical practice. Survey respondents indicated that their initial problem solving experience was "moderately challenging" (difficulty rating of 3.35 out of 5), with 39.6% of respondents citing "making a differential diagnosis list" as the most challenging aspect of clinical reasoning. Tools that assisted graduates in problem solving included consultation with a senior veterinarian (93.8%), utilizing the POVMR (Problem-oriented veterinary medical record) approach (65.4%), and the DAMNIT mnemonic (58%). Interview participants identified content overload during the program, case overload during practice, and a fear of making diagnostic errors as significant factors contributing to low confidence and perceived lack of proficiency in their diagnostic reasoning abilities. The study provided unique insight into how recent veterinary graduates viewed their diagnostic reasoning and clinical problem solving skills development during the veterinary program, and improvement in confidence following practice experience post-graduation.
7. Epidemiology of heartworm in companion dogs in relation to weather parameters
Russell Forrest¹, Olaf Berke¹, Andrew Peregrine²
¹Department of Population Medicine, University of Guelph
²Department of Pathobiology, University of Guelph
Heartworm infection in companion dogs is emerging (infections are occurring in new geographic areas as well as a temporal increase in disease frequency) and has been linked to climate change in the literature. It is thus important to revisit the relationship between the occurrence of companion dog heartworm in time and space in relation to weather parameters. The objectives of this research are to study the prevalence of heartworm in companion dogs in Ontario over time using a time series of monthly prevalence estimates from 2012-2018 and study the geographic variation of heartworm prevalence across Canada and the USA for the year 2018. Monthly heartworm prevalence data were collected from the Companion Animal Parasite Council (CAPC) website at the provincial and state level from 2012-2018. CAPC receives data from IDEXX Laboratories and ANTECH Diagnostics and serves as a strong representation of heartworm activity in North America (excluding Mexico). Using a time series analysis, we expect to identify an upward trend in heartworm prevalence over the past seven years supporting that heartworm is emerging in Ontario. Furthermore, we expect to identify weather parameters which explain this trend. We will then assess the ability of our time series to forecast heartworm prevalence in Ontario up to 12 months in advance. A spatial analysis will be conducted to examine if variations in heartworm prevalence at the provincial/state level across North America can be explained through variations in weather parameters and determine what parameters best predict heartworm prevalence.

8. Baylisascaris procyonis infection prevalence in raccoon latrines in Southern Ontario
Shannon French¹, Thornton Grace¹, Avula Jacob², Jardine Claire¹
¹Department of Pathobiology, University of Guelph
²Animal Health Laboratory, Ontario Veterinary College, University of Guelph
The raccoon roundworm, Baylisascaris procyonis is carried by raccoons throughout North America. Infection with the larval stage of this parasite can cause severe neurological disease in humans, as well as more than 150 species of birds and mammals. Raccoons typically utilize latrines, which are common areas of defecation, creating the potential for concentrated sites of environmental contamination. To investigate the infection prevalence of B. procyonis in raccoon latrines, we identified and sampled 30 raccoon latrines found in local conservation areas in the summer of 2018. Using the Cornell-Wisconsin centrifugal flotation technique, we identified ascarid eggs morphologically consistent with B. procyonis in 23% of the latrines sampled. Examining raccoon latrines provides the best indicator of environmental contamination; as such, larger studies conducted at a broader scale will provide a better estimate of the prevalence of B. procyonis in the environment. Nonetheless, positive latrines were found in conservation areas frequently visited by people, indicating the potential for transmission of B. procyonis to humans utilizing these environments, an important finding for the development of risk management protocols.
9. Understanding the impact of managed intake as part of capacity for care
Samantha Hobson¹, Shane Bateman¹, Jason Coe², Lisa Veit³, Michelle Oblak¹
¹Department of Clinical Studies, University of Guelph
²Department of Population Medicine, University of Guelph
³Guelph Humane Society
Capacity for Care (C4C) is a shelter management strategy that improves cat welfare in a shelter by managing intake to operate at an optimal capacity. C4C aims to improve conditions for animals in shelter facilities however, shelter practices have an impact on the welfare of the entire companion animal community. The aim of this research was to describe the outcomes for cats who were waitlisted or diverted as part of managed intake and to understand the impact of C4C on the community beyond the shelter. Data were collected from the Guelph Humane Society (GHS) from owners who contacted the shelter to discuss issues that may potentially have led to the decision to surrender their cat (n=298). Data included cat demographic information, surrender reasons, surrender wait periods, rehoming options considered by owners when they contacted GHS, and outcomes for the cats. Outcome categories were kept, re-homed, surrendered and unknown. Considered rehoming options were predictive of each cat outcome (p<0.03). Surrendered cats had a shorter wait time vs. cats in the unknown outcome category (p<0.01). There was an association between surrender reason and outcome when cat medical (p<0.01) or owner health (p<0.02) issues were reported as the reason for surrender. A qualitative study is being conducted to examine 1) the relationship between cats and owners while on a waitlist to surrender their cat and 2) the impact of managed intake on cats and their owners. This research provides an evaluation of the impact of C4C beyond the shelter system, which may have implications for how shelters can better support community members and their cats while using managed intake.

10. Examining the impact of person-person transmission on verotoxigenic Escherichia coli outbreaks in Ontario
Roksolana Hovdey¹, Jan M. Sargeant¹, David Fisman², Amy Greer¹
¹Department of Population Medicine, University of Guelph
²Department of Epidemiology, Dalla Lana School of Public Health
Cases of human verotoxigenic Escherichia coli (VTEC) infection in an outbreak arise from a combination of point-source (e.g. contaminated food or water) and person-person (PP) transmission. While PP transmission likely attributes to a smaller proportion of cases, it is not always possible to ascertain the source of each case. It is important to understand the relative contribution of different transmission routes. The objectives of this study were to estimate the average basic reproductive number (RO) for outbreaks of VTEC and to examine the impact of reducing PP transmission on final outbreak size for a large VTEC outbreak in Ontario. Outbreak data were obtained from Public Health Ontario. Outbreaks were included in the study if the outbreak ID was assigned to two or more lab confirmed cases of VTEC. From January 1st, 2005 to December 31st, 2013, there were 45 reported outbreaks of VTEC in Ontario with an average of 8.10 cases per outbreak (range: 2 - 48 cases). Maximum likelihood estimation was used to estimate the average RO of all outbreaks included in the study. Under an assumption that 80% of cases in each outbreak arose from a primary exposure and did not cause further secondary transmission, the estimated average RO across all outbreaks was 0.64. To build on our preliminary analysis, we are constructing a mathematical model simulating a VTEC outbreak using data from a large outbreak in Ontario. The model will be used to investigate how public health interventions aimed at reducing PP transmission affects the overall outbreak size.
11. The effects of nidogen-1 on proliferation and migration in claudin-low mammary tumor cells
Rebecca Jagroop, Roger Moorehead

1Department of Biomedical Sciences, University of Guelph

Breast cancer is the most common type of cancer among women, with one subset of the triple-negative subtype, claudin-low, known to be aggressive and metastatic. For invasion and metastasis to occur, cancer cells must cross basement membranes (BM), which contain structural proteins such as laminin and collagen IV and linking proteins such as perlecan and nidogen, and colonize on distant BMs. Nidogen is a glycoprotein that makes up 2-3% of basement membranes and has two types: nidogen-1 (NID1) and nidogen-2 (NID2). There are limited studies on NID1 and cancer, with results demonstrating decreased invasiveness and metastatic capabilities in Nid1 silenced cells of various cancer types. Through previous work, a murine cell line representative of the claudin-low subtype, known as RJ423, was developed; it demonstrated a 5000 fold increase in Nid1 expression compared to the luminal subtypes. To test whether high Nid1 expression contributes to the metastatic nature of claudin-low tumors, Nid1 levels were knocked down in RJ423 cells and proliferation and migratory capabilities were assessed. Immunofluorescence using a phospho-histone H3 antibody demonstrated that suppressing NID1 reduced RJ423 cell proliferation significantly. Additionally, apoptosis was assessed through flow cytometry to detect annexin V levels; however, no significant differences. Furthermore, invasion assays demonstrated a reduction in migration of collagen IV coated wells in NID1 suppressed cells. Currently, qPCR is being used to assess EMT gene expression levels. Thus, this may provide a new area of NID1 targeted therapies to lessen the metastasis of claudin-low breast cancer.

12. Chronotherapy with angiotensin converting enzyme inhibitors at sleep-time improves heart attack
Tarak Khatua, Cristine Reitz, Elena Tsimakouridze, Faisal Alibhai, Mina Rasouli, Tami Martino

1Department of Biomedical Sciences, University of Guelph

Introduction: The circadian system regulates our daily physiology including the renin-angiotensin-aldosterone system (RAAS). Timing drug treatments (chronotherapy) targeting RAAS is a promising new approach to benefit patients with cardiovascular disease - our leading cause of death.

Hypothesis: Chronotherapy following heart attacks will improve outcomes and reduce progression to heart failure. Methods and Results: To investigate chronotherapy in a rodent heart model relevant to humans, mice are subjected to myocardial ischemia reperfusion (I/R), then administered the short-acting ACEi captopril daily at either sleep or wake time. Sleep time ACEi better preserves cardiovascular structure and function, whereas wake time is not much different than no drug at all (e.g. %EF; sleep, 62.21% ± 1.10%, wake 55.70% ± 1.72%, placebo 55.94% ± 1.40%). Next, to examine the role of the circadian mechanism, ACEi I/R chronotherapy is investigated using ClockΔ19Δ/19 mice. Finally, to validate improved outcomes we use a preclinical diurnal porcine I/R model and state-of-the-art imaging (echocardiography, cardiac magnetic resonance imaging) as is used clinically for humans. Conclusion: Administering ACEi at a time of day when targets are high is much more effective than when targets are low. Since the half-life for most ACEi are <24 hours, ensuring sleep time coverage can benefit patients, leading to longer, healthier lives.
13. What did the first coccidia look like? Resolving the phylogenetics of basal lineages of eimeriorinid parasites
Perryn Kruth, John Barta
Department of Pathobiology, University of Guelph
The family Eimeriidae includes a wide range of coccidian parasites of varied impacts to human and animal health. Morphological traits of exogenous stages have long been the basis of coccidian phylogeny. Many taxonomic descriptions lack molecular sequences and details of endogenous development. As accessible and routine sequencing allowed the construction of ever expanding DNA sequence databases, it became clear that many coccidia have been classified erroneously taxonomically. Polyphyly of a number of eimeriid genera has been widely acknowledged but debate and uncertainty surrounding the resolution of the phylogenetic relationships among these taxa remain. It was recently acknowledged that one group of coccidia, classically belonging to the Eimeriidae sensu stricto, lack several important diagnostic features shared by members of the Eimeriidae and thus cannot belong to this family. Despite their potential impact to wildlife health and conservation, these non-eimeriid coccidia have been studied inadequately; sequence data are unavailable for most species. Branching basally from the Eimeriidae sensu stricto, the phylogenetic position of this clade may provide opportunity for improving understandings of evolutionary patterns among coccidia. We are generating molecular data for representative species within this clade to improve phylogenetic resolution. Associated biological characterisation of these parasites will guide identification of reliable molecular or morphometric characters for generation of robust coccidian phylogenies, and to better understand the potential impacts of these under-researched parasites, both within a single host and more widely at ecological level.

14. Toward climate-responsive evaluation of food security initiative: An assessment of UN evaluation reports from 2014 to 2018
Steven Lam
Department of Population Medicine, University of Guelph
The widely used Development Assistance Committee (DAC) evaluation criteria is being revisited in light of the 2030 Agenda for Sustainable Development. Considering the current and future impacts of climate change on sustainable development, scholars and practitioners have called for consideration of climate change in all international development evaluations. As such, our goal is to determine how climate change is considered in evaluations within the context of United Nations food security efforts. Specifically, our objectives are to: 1) identify and synthesize United Nations food security evaluation reports; and, 2) assess the extent to which climate change is integrated into evaluations. We search for evaluation reports using the United Nations Evaluation Group database and assess relevant reports using a climate change index. We reflect on how evaluations have engaged with stakeholders in considering climate change, and through this, provide insights to improve future evaluations.
15. Validation of primary turkey hepatocyte monolayer culture systems for the evaluation of potential interactions in drug combinations
Samantha Lyster, Ron Johnson, Gord Kirby, Tami Martino, Xiaoying Zhang, Saad Enouri, Yu Gu

1Department of Biomedical Sciences, University of Guelph

Primary hepatocyte cultures have been used successfully for development of models to assess drug metabolism in various species, including rats, pigs, and humans. However, data on hepatocyte culture systems in poultry are extremely limited. The objective of this study was to establish and validate primary turkey hepatocyte monolayer culture systems for the eventual screening for potential interactions of drug combinations commonly used in the poultry industry. Hepatocytes were isolated from the livers of five to nine-week-old male grower turkeys and cultured on collagen-coated plates. The functional activity of cultured turkey hepatocytes was assessed by daily monitoring of albumin concentrations by ELISA in culture media and by assessing gene expression of cytochrome P450 (CYP450) enzymes predominantly involved in drug metabolism. Over a five-day period, albumin levels peaked on the third day, with an average concentration range of 34.29 ng/ml to 232.72 ng/ml. RT-qPCR analysis of CYP1A4/5, CYP2C23a, CYP2C45, and CYP3A37 mRNA levels revealed that CYP2C23a is the most abundant, and CYP1A4 is the least abundant isoform. Further validation will involve assessing inducibility of CYP450s in hepatocytes treated with rifampicin, phenobarbital, and 3-methocholanthrene and enzyme inhibition following treatment with arsenite, alpha-naphthoflavone, and ketoconazole. Future studies will focus on using the validated culture systems to conduct drug-drug interaction experiments with various poultry pharmaceuticals.

16. A systematic review and meta-analysis of the health and healthcare system burden due to resistant Escherichia coli infections in humans
Melissa MacKinnon1, Jan Sargeant2, David Pearl3, Richard Reid-Smith2, Jane Parmley5, Scott McEwen6

1Department of Population Medicine, University of Guelph

The objectives were to evaluate whether the measures of health or healthcare system burden increase in humans with E. coli infections that are resistant to third/fourth/fifth generation cephalosporins or quinolones, or are multidrug resistant when compared to those with susceptible infections. The protocol was registered with PROSPERO (CRD42018111197). The population of interest was humans with confirmed E. coli infections. Resistance to third/fourth/fifth generation cephalosporins or quinolones, or multidrug resistance were the exposures of interest. Included studies had a comparator group without the exposure of interest. The outcomes of interest for health burden were mortality and treatment failure, and for healthcare system burden were length of hospital stay (LOS) and costs. Included studies were analytic observational study designs. The literature search retrieved 26,038 articles and after duplicates were removed there were 14,759 articles for primary screening. There were 543 articles for secondary screening and 74 articles were included in the systematic review: 57 articles addressed resistance to third/fourth/fifth generation cephalosporins, 20 articles addressed resistance to quinolones, and 8 articles addressed multidrug resistance. The meta-analysis demonstrated that quinolone-resistant E. coli infections significantly increase the odds of dying within 30 days after infection compared to quinolone-susceptible E. coli infections (OR 1.44; 95% CI 1.26-1.64). The meta-analysis for the impact of third/fourth/fifth generation cephalosporin-resistance on 30-day mortality demonstrated moderate heterogeneity.
17. Mortality syndrome in ricordea yuma
Zachary Millar¹, Paul Huber¹, Ryan Horricks¹, Cheryl Woodley², John Lumsden¹
¹Department of Pathobiology, University of Guelph
²Coral Health & Disease Program, U.S. National Oceanic and Atmospheric Administration
Coral diseases are increasingly reported globally and combined with environmental changes place significant stress on coral reef health. Corallimorpharia are an order of corals that, morphologically and phylogenetically fall between hard (Scleractinia) and soft corals (Octocorallia). The cause of the mortality events, colloquially known as 'melting', is unknown and there are no scientific descriptions of this syndrome from corals in captivity or in nature. This phenomenon has been described in the 'grey literature' focusing on captive corals, however a detailed description is lacking. A mortality event recently occurred in the Hagen Aqualab, University of Guelph, that was isolated to eight Ricordea yuma. Our hypothesis is that the cause is an infectious agent. Samples were collected from morphologically normal and affected corals for bacteriology, electron microscopy (TEM), histology, proteomics and virome analysis. Twelve pure bacterial cultures were obtained using marine agar and 16S rDNA sequencing revealed high similarity to seven different species. No inclusion bodies or viruses were noted using TEM. Histology revealed diffuse necrosis affecting multiple cell types in diseased corals, compared to healthy specimens, and few bacteria were seen. There was also a noticeable decrease in zooxanthellae present in the gastrodermis. Proteomics and virome analysis are underway.

18. Influencing dairy veterinarian antimicrobial-use decision-making
Sydney Pearce, Jan Sargeant, Charlotte Winder, David Kelton
Department of Population Medicine, University of Guelph
With increasing scrutiny of antibiotic usage, the dairy industry has increasing responsibility to improve antimicrobial-use (AMU) practices. Two recent systematic reviews (SRs) completed at the University of Guelph address the most common cause for dairy AMU by identifying the efficacy of long-lasting antibiotics and internal teat sealants (non-antibiotic alternative) for the prevention of intramammary infections during the dry period. The SRs have potential to improve AMU decision-making by increasing utilization of effective antimicrobials, effective antimicrobial alternatives, and reducing use of antimicrobials important to humans - important components of antimicrobial stewardship and preventing antimicrobial resistance. To access this potential, best methods of translating SR results to AMU decision-makers must be determined. Dairy veterinarians will be enrolled and assessed via questionnaire for antimicrobial prescription decision-making before and four months after a knowledge translation and transfer (KTT) tool intervention. Four KTT tools will be randomly distributed among participants, each incorporating one or more of the major human learning styles: visual, auditory, read/write, and kinesthetic. Tools include a paper copy of the published SRs, a website containing interactive features, a summarized audio file, and an educational, mobile gaming app. The study objectives will be to assess the potential impact SR research results have on Ontario veterinarian decision-making and to determine the best KTT methods to disseminate antibiotic and teat sealant efficacy research to veterinarians measured by changes in AMU and teat sealant decision-making.
19. Effect of rapamycin on canine mast cell cancer cell DNA damage responses following radiation
Morla Phan¹, Cosette Ayoub¹, Valerie Poirier², Brenda Coomber¹
¹Department of Biomedical Sciences, University of Guelph
²Clinical Studies, vpoirier@uoguelph.ca

Introduction: The mTOR pathway, highly activated in cancer cells, regulates several cell functions. Inhibition of mTOR can be achieved using Rapamycin, a cytostatic compound demonstrating radiosensitizing effects. We examined this in two canine mast cell cancer cell lines (MCT-1, MCT-2) derived from naturally occurring tumours in pet dogs. Experiments were performed to understand how altered mTOR signalling affects DNA strand break damage response. Preliminary work revealed that Rapamycin pre-treatment led to sustained DNA damage foci after radiation compared to untreated cells. Here we examine the kinetics of this response. Results: MCT-1 cells were pre-treated with Rapamycin for 24 or 48 hours before receiving radiation. MCT-1 and MCT-2 cells were treated with Rapamycin for 4 or 7 days post-radiation. Rapamycin doses were 50%, 100% and 150% of the plasma steady-state levels reported in canines: 5.5 nM, 11 nM and 16.5 nM respectively. Each Rapamycin dose was combined with 3 radiation doses: 3 Gy, 6 Gy and 10 Gy. Clonogenic survival of MCT-1 decreased after 4 and 7 days of Rapamycin treatment following 10 Gy. Western blots demonstrated a dose-dependent activation of S6K in MCT-1, while MCT-2 demonstrated a higher level of sensitivity. Radiation activates mTOR in MCT-1 in a dose-dependent manner, possibly by RNF168 upregulation. Preliminary results from the comet assay suggests that mTOR inhibition sustains DNA strand breaks following radiation. Conclusions: Rapamycin potentially radiosensitizes canine mast cell cancer. Furthering our understanding of altering cell signalling to enhance DNA damage in cancer provides insight into clinical applications and therapeutic avenues.

20. Risk factors of competitive tendencies and fearfulness in puppies
Quinn Rausch¹, Samantha White², Lee Niel¹
¹Department of Population Medicine, University of Guelph
²Animal Biosciences, University of Guelph

Canine aggression is a threat to human safety and canine welfare. Two types of canine aggression are resource guarding and stranger-directed aggression. Research suggests a link between fear and stranger-directed aggression. The objective of this research is to determine whether dog and management-related factors are associated with the development of competitive and fear behaviours in juvenile dogs. A total of 150 litters of six breeds with a high prevalence of these behaviours (Dachshunds, Cocker Spaniels, German Shepherds, Chihuahuas, Boxers and Rottweilers) will be used in a prospective cohort study from birth to six months of age. Enrollment will be conducted using responses to a survey of breeder demographics, standard management practices, feeding and training protocols. To assess early competitive tendencies, breeders will be asked to video-record nursing and feeding bouts, as well as littermate interaction around a play object. Fearfulness will be documented from video recordings of exposure to three novel stimuli and each puppy's response to a mock physical exam. Once dogs have been placed in a home, surveys will be sent out to owners at four and six months of age to evaluate owner demographics, management, feeding, training protocols and the prevalence of competitive and fear behaviours. Regression models will be built to assess which factors increase a dog’s risk of developing these behaviours. The results will determine how to best manage, train and socialize puppies while they are still with the breeder to prevent development of resource guarding and stranger-directed aggression.
21. Branched chain amino acid transaminase 1 in Claudin-low breast cancer
Lisa Reynen, Roger Moorehead, Rob Jones
Department of Biomedical Sciences, University of Guelph
Breast cancer, the most commonly diagnosed cancer in women, can be classified into five distinct subtypes. One subtype, claudin-low breast cancer, accounts for approximately 7% of the breast cancer cases and these tumors are notoriously aggressive. RNA sequencing of human claudin-low breast cancers by other groups and RNA sequencing of a murine claudin-low mammary tumor cell line by our group has revealed that Bcat1 is significantly up-regulated in this breast cancer subtype. Bcat1 regulates the metabolism of branched chain amino acids and has been linked to numerous pathologies. Based on this data we hypothesized that the expression of Bcat1 in claudin-low mammary tumors is driving the aggressive nature of this cancer subtype and disrupting Bcat1 will deter these features. Elevated expression of Bcat1 in the murine claudin-low cell line RJ423, compared to the murine luminal mammary tumor cell line RJ345, has been confirmed at the mRNA and protein level. Bcat1 has been transiently down-regulated ~70% in RJ423 cells using siRNA and this suppression of Bcat1, contrary to the anticipated result, showed no effect on proliferation based on phospho-histone H3 immunofluorescence or cell survival based on Annexin V staining. Cell cycle analysis using Bromodeoxyuridine and 7-AAD by flow cytometry was completed, however, no significant difference was observed. Further study analyzing the metabolic functions of Bcat1 in claudin-low breast cancer is currently underway. This study will determine whether further investigation into the effects of Bcat1 on claudin-low human breast cancer is prudent and if Bcat1 may be used as a therapeutic target.

22. Epigenetic effects of BPA and BPS during bovine oocyte maturation and early embryo development
Reem Sabry, Leanne Stalker, Mimi Nguyen, Jonathan LaMarre, Laura Favetta
Department of Biomedical Sciences, University of Guelph
The endocrine disrupting compounds bisphenol A (BPA) and bisphenol S (BPS) are prevalent chemicals with detrimental health effects. We have previously seen that BPA affects oocyte and embryo development; yet BPS effects remain unknown. Bisphenols’ mode of action at the epigenetic level are not well understood. MicroRNAs (miRNA) are crucial regulators of gene expression, with identified key miRNAs (miR-21, -34c, -155, -146a) during development. BPA alters miRNA expression, but little is known in a reproductive context. This study aims to examine key miRNAs in response to BPA or BPS during development. Bovine oocytes were treated and matured in vitro with BPA or BPS (0.05mg/ml). Cumulus-oocyte complexes (COCs), denuded oocytes and cumulus cells were collected, with parallel experiments on embryos at the 2-4, 8-16 cell and blastocyst stages. Results show that BPA significantly increases miR-21 in COCs and cumulus cells, suppresses miR-34c in cumulus cells, increases miR-155 in denuded oocytes and has no effect on miR-146a. No changes were observed in response to BPS. Results in embryos showed a significant increase in miR-34c at the 8-16 cell stage after BPA exposure. Experiments in bovine granulosa cells were performed to analyze downstream effects on epigenetic regulators, DNA methyltransferases (DNMTs), targets of miRNAs and BPA. Granulosa cells were treated as described above, showing similar miRNA expression as in oocytes. No changes in DNMT3A mRNA levels were noted, but a decrease in DNMT3A protein was observed by western blotting. These preliminary data suggest links between BPA, miRNAs and DNMTs, and potentially novel mechanisms of bisphenols in embryo development.
23. Spatial surveillance of Varroa destructor infestations in apiaries of Ontario
Kurtis Sobkowich, Olaf Berke, David Pearl, Theresa Bernardo
Department of Population Medicine, University of Guelph
By 2050, the global population is expected to surpass the carrying capacity of the current agricultural system unless food production can be doubled (Ray et al., 2013). Dependence on animal-pollinators varies by plant species, with approximately 68% of the leading 57 single crops relying on animal pollination (Cunningham et al., 2006). Pollinator censuses of farmland reveal Apis mellifera to be responsible for the majority of animal-pollination, primarily due to their use as a commercially managed species (Geslin et al., 2017). In 2018, the Canadian Association of Professional Apiculturists reported the highest colony loss since 2009, at 32.6% nationally (Ferland et al., 2018). Numerous factors contribute to overwinter colony losses, however, a high Varroa destructor load has been shown as the strongest risk factor (Van Der Zee et al., 2015). The modernization of beekeeping has allowed for a rapid spread of varroa through the mobilization of hives, queens and equipment. In 2018, Ontario Animal Health Network (OAHN) began a province-wide awareness campaign including a publicly available point map outlining varroa presence in 45 regions of Ontario. The goal of this project is to strengthen OHAN's varroa surveillance and provide apiarists with an online mapping tool to monitor the current varroa risk. This project will identify putative risk factors for varroa, as well as visualize the level of risk for varroa in a given area, and reveal clusters of infestation at a provincial level. To communicate the results to the public, and especially the apiarists, this project will use dynamic and interactive maps which can be updated in real-time over the Internet, via citizen science.

24. Exploring the potential for motivational interviewing in pet weight-management discussions between veterinarians and clients
Katja Sutherland¹, Jason Coe¹, Terri O'Sullivan¹, Jackie Parr²
¹Department of Population Medicine, University of Guelph
²Royal Canin Canada
Effective clinical communication has a well-established relationship with important health-care outcomes in veterinary medicine. Client satisfaction with the veterinary experience, as well as their understanding and compliance, are factors that may contribute to patient health outcomes. Obesity is a prevalent and concerning issue for companion animals, and animal weight and nutrition require sufficient attention during the veterinarian-client-patient interaction. Exploring and promoting changes to client behavioral risk factors for pet obesity within a reciprocal relationship may lead to improved owner management of animal body weight. Motivational interviewing (MI) is a style of communication with an emphasis on change-oriented language, where the goal is to strengthen the client's own resolve for change within a collaborative relationship. The aim of this project is to determine if there is a current opportunity for MI core skills to be effective in improving the outcomes of veterinarian-client interactions regarding companion animal weight management. The study consists of three components. The first is the analysis of an audio-video dataset of veterinarian-client-patient interactions to determine the appropriateness of implementing MI in these interactions. The second phase involves training small animal veterinarians in MI and evaluating their effectiveness in implementing MI core skills using simulated client appointments. Finally, an intervention study in practice with veterinarians and owners of overweight pets will inform our conclusions about the effectiveness of MI in weight management for overweight pets.
25. Elevated neoplastic cell expression of VEGFR2 in canine dermal mast cell cancer is associated with poor survival outcome
Shahzar Syed1, Britta Knight2, Rob Foster2, Geoff Wood2, Brenda Coomber1
1Department of Biomedical Sciences, University of Guelph
2Department of Pathobiology, University of Guelph
Canine mast cell tumours (MCTs) constitute up to 21% of all canine skin tumours, and are frequently driven by the receptor tyrosine kinase (RTK) KIT. Our previous studies demonstrated MCT cancer cell expression of other RTKs such as vascular endothelial growth factor receptor 2 (VEGFR2), and we hypothesize that neoplastic mast cell VEGFR2 expression is associated with MCT aggressiveness. To assess this, a tissue microarray (TMA) was constructed with 0.6mm cores taken from paraffin blocks of canine MCTs as well as control tissues. Immunohistochemistry for VEGFR2 was performed on the TMA and immunolabelled slides were scanned using the Digital Image Hub hosted by Vanderbilt University Medical Center. H-scores were generated for cores based on cytoplasmic VEGFR2 intensity. Cores were excluded from analysis due to loss, technical artifact, or less than 30% neoplastic cells. In total, 208 tumours (including 94 dermal, 94 subcutaneous, and 14 metastatic lesions) from 189 dogs were analyzed. Dermal tumours displayed significantly higher H-scores compared to subcutaneous or metastatic tumours, but there was no significant relationship between H-score and tumour grade or mitotic count for any group. Kaplan-Meier curves and log-rank analysis for disease free interval and overall survival showed a higher H-score was significantly associated with worse survival outcome, but only for dermal tumours. Our findings suggest that MCT cancer cell expression of VEGFR2 may impact aggressiveness of dermal MCTs. The RTK inhibitor toceranib (Palladia) is often prescribed to treat MCTs and is known to inhibit VEGFR2, thus our findings may support an additional therapeutic target for MCT.

26. Cardiovascular effects of increasing doses of norepinephrine on isoflurane-induced hypotension in healthy New Zealand white rabbits
Olivia Uccello, Andrea Sanchez, Alex Valverde, Hugues Beaufrère
Department of Clinical Studies, University of Guelph
Anesthetic-related hypotension is a frequent complication in rabbits. Norepinephrine (NE) is a sympathomimetic drug that functions as a potent vasoconstrictor and positive inotrope that has proven to be effective to treat hypotension in multiple species, however evidence in rabbits is very limited. The objective of this study was to characterize the cardiovascular effects of various dosages of NE on isoflurane-induced hypotension in healthy rabbits. Nine female-spayed New Zealand White rabbits were pre-medicated with intramuscular (IM) buprenorphine 0.05 mg/kg and midazolam 0.5 mg/kg. Anesthesia was induced with intravenous (IV) propofol, and maintained with isoflurane at 1.1x the minimum alveolar concentration to maintain a hypotensive state. Rabbits received NE infusions at 3 doses (Low dose (LD): 0.1 mcg/kg/min, Medium dose (MD): 0.5 mcg/kg/min, High dose (HD): 1 mcg/kg/min) for 10 minutes. Heart rate (HR), cardiac output (CO), invasive systolic (SAP), mean (MAP), and diastolic (DAP) arterial blood pressures, and other cardiopulmonary parameters were recorded at baseline, 10 minutes after the infusion of every NE dose, and 10 minutes after NE was discontinued. A linear mixed modeling and a Type III ANOVA, with a Tukey's post-hoc comparison was performed. Significant increases in SAP (28% and 90%), MAP (27% and 90%), and DAP (33% and 97%) were found with MD and HD treatments respectively (p<0.001) with no changes in CO. HR decreased significantly only in HD (17%, p<0.05), no arrhythmias were noticed with either dose. This study suggests that NE at doses of 0.5-1 mcg/kg/min is effective in treating isoflurane-related hypotension in healthy rabbits.
27. Waterfowl and the introduction of foodborne pathogens to agricultural environments in southern Ontario

Nadine Vogt\textsuperscript{1}, David Pearl\textsuperscript{1}, Eduardo Taboada\textsuperscript{2}, Nicol Janecko\textsuperscript{3}, Richard Reid-Smith\textsuperscript{1}, Claire Jardine\textsuperscript{4}

\textsuperscript{1}Department of Population Medicine, University of Guelph
\textsuperscript{2}Laboratory for Foodborne Zoonoses, Public Health Agency of Canada
\textsuperscript{3}Public Health Agency of Guelph
\textsuperscript{4}Department of Pathobiology, University of Guelph

Canada geese (Branta canadensis) have quickly become one of the most common waterfowl species in North America. There are concerns that Canada geese, being highly mobile, may transmit pathogens between agricultural and recreational areas. We performed an exploratory cross-sectional study to measure the carriage of antimicrobial resistant E. coli, Salmonella, and Campylobacter isolates obtained from goose fecal samples. A total of 418 samples were obtained from three different sources: hunter-caught birds, diagnostic specimens submitted to the Canadian Wildlife Health Cooperative, and fresh fecal samples. E. coli isolates were tested for susceptibility to 15 antimicrobials using the Canadian Integrated Program for Antimicrobial Resistance Surveillance panel. The following risk factors for prevalence of pathogens and associated antimicrobial resistance were examined: season, source-type, and bird demographics. The overall prevalence of Campylobacter, Salmonella, and E. coli were 11.7%, 0%, and 71.5%, respectively. No significant difference in prevalence of Campylobacter by season or source-type was found based on exact logistic regression (p>0.05). Season and source-type had a significant effect on the odds of recovering E. coli from a sample (p<0.001). Of the 111 E. coli isolates, 9.0% had reduced susceptibility to one or more antimicrobials, and 5.4% were multi-drug resistant. Isolating Campylobacter and antimicrobial resistant E. coli from Canada Geese suggests that these birds may play a role in disseminating these pathogens within the environment, and pose a threat to agricultural biosecurity and public health.

28. Seminal biomarkers of bovine fertility

Nick Werry\textsuperscript{1}, Mikayla Ross\textsuperscript{2}, Katie Hickey\textsuperscript{2}, Sarah Miller\textsuperscript{2}, Stewart Russell\textsuperscript{3}, Jonathan LaMarre\textsuperscript{1}

\textsuperscript{1}Department of Biomedical Sciences, University of Guelph
\textsuperscript{2}2Semex Canada
\textsuperscript{3}2CReATE Fertility Centre

Introduction: Bovine fertility is declining, an issue which many artificial insemination (AI) companies seek to address. However, current methods of identifying highly fertile sperm are imperfect. They rely on visible traits such as sperm morphology and motility, but these fail to fully reflect many of the underlying factors necessary for fertility. Small noncoding RNAs (sncRNAs) are effective biomarkers for many traits, and can be used to predict sperm motility. We seek to identify sncRNAs correlated with fertility to serve as biomarkers for bull fertility. This will be beneficial to both breeding companies and farmers, as identification of high quality, high fertility sperm will yield fewer failed inseminations. Methods: Total RNA has been isolated from the sperm of bulls exhibiting high or low fertility, based on field conception rate. All samples previously passed the standard industry quality control measures for motility and morphology. The RNA will be modified and reverse transcribed into libraries suitable for Illumina sequencing. The data generated will be used to identify candidate biomarkers by determining which sncRNAs are differentially expressed between groups. The candidates will then be verified independently by digital droplet PCR, to validate that the change is expression is consistent. Results: The protocol to isolate sperm, and extract RNA for library preparation has been optimized. The library preparation technique itself has been modified to improve results, but is still being investigated to maximize output. Conclusion: SncRNAs present in bovine sperm present an opportunity to improve semen sample selection and improve AI.
29. On the road to biomarkers: developing a robust system for miRNA evaluation in equine blood and synovial fluid

Joshua Antunes¹, Nathalie Cote², Marie-Soleil Dubois², Rames Salcedo², Judith Koenig², Thomas Koch¹
¹Department of Biomedical Sciences, University of Guelph
²Clinical Studies, University of Guelph

Background: Joint disease and OA are leading causes of lameness in horses. To date, there is no effective treatment of OA once it progresses. Biomarkers for OA are needed for the early detection of disease and to measure the response to available therapies. MiRNAs are small non-coding RNAs that regulate a variety of biological processes. They have also been identified as candidate biomarkers in a variety of diseases.

Hypothesis: miRNAs such as miR-132, miR-146a, miR-16, and miR-223 can readily be detected in equine blood plasma and synovial fluid. Isolated miRNAs from undiluted synovial fluid can be built into libraries for sequencing analysis in healthy vs disease joints.

Methods: Synovial fluid and blood was collected from horses undergoing joint arthroscopy with either OA or OC. MiRNA was extracted from plasma and synovial fluid using Serum/Plasma Advanced Kit and RT'd using LNA RT kit. qPCR analysis was done to assess spike-in controls (UniSp2, UniSp4, UniSp6, cel-miR-39) and miR-132, miR-146a, miR-16, miR-223. Isolated miRNA was used to prepare miRNA libraries for NGS using the QIAseq miRNA Library Kit. Resulting libraries underwent bioanalyzer analysis using a High Sensitivity DNA chip on an Agilent 2100 bioanalyzer and Qubit analysis.

Results: To date we have sampled synovial fluid and blood from 83 horses. One horse was randomly selected (n=3) to isolate miRNA from synovial fluid, diluted synovial fluid and plasma. Spike-in controls remained consistent between isolations. Three horses were randomly selected to assess patient variability in isolation efficiencies with some variability present. High quality libraries were achieved from undiluted samples.

30. Antimicrobial use indicators and their effect on relative ranking of grower-finisher herds

Angelina Bosman¹, Scott McEwen¹, Zvonimir Poljak¹, Anne Deckert², Carolee Carson², Richard Reid-Smith², David LÃ©ger²
¹Department of Population Medicine, University of Guelph
²Centre for Foodborne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada

Antimicrobial use (AMU) information can be analyzed using various indicators. Indicators are units of measurement adjusted by a denominator that represents the population at risk. We analysed AMU surveillance data collected between May 2017 and April 2018 from 23 grower-finisher sentinel pig herds in Ontario by the Public Health Agency of Canada’s Canadian Integrated Program for Antimicrobial Resistance Surveillance.

AMU data were collected by the farm veterinarians using questionnaires. Veterinarians visited each herd once near the end of a production cycle. Questionnaire data were analyzed using R 3.5.2. Denominators used were the population correction unit (PCU) and 1000 pig-days at risk, using an average weight at treatment of 65 kg. Indicators applied included milligrams of active ingredient per PCU (mg/kg pig), Canadian defined daily doses per PCU (DDDvetCA/pig) and Canadian defined daily doses per 1000 pig-days (DDDvetCA/1000 pig-days).

Twenty-three farms were sampled, ranging in size from 750 to 2400 pigs. Twenty-two (96%) of the herds were conventional; one herd was part of a raised without antibiotics program (RWA). Eight herds (35%) did not use antimicrobials during the grower-finisher period. One herd was consistently ranked the highest user and another herd the lowest as measured in mg/kg pig, DDDvetCA/pig and DDDvetCA/1000 animal-days. However, the relative ranking of other herds changed according to the indicator used; therefore, the indicator used must be borne in mind when interpreting AMU data. In addition, if a there
is a specific AMU target, the choice of indicator used may influence whether the herd's AMU falls above or below the target value.

31. Place-making in the research process: sewing, stories, and sense of place at a medical boarding home in Iqaluit, Nunavut, Canada
Laura Jane Brubacher¹, Naomi Tatty², Gwen K. Healey Akearok³, Cate E. Dewey⁴, Ashlee Cunsolo⁵, Sally Humphries⁶, Sherilee L. Harper⁷
¹Department of Population Medicine, University of Guelph
²Department of Health, Government of Nunavut
³Qaujigiartiit Health Research Centre
⁴Department of Population Medicine, University of Guelph
⁵Labrador Institute of Memorial University
⁶Sociology and Anthropology, University of Guelph
⁷School of Public Health, University of Alberta
INTRODUCTION: Arts-based research methodologies, such as sewing or crafting together, resonate with many Indigenous cultures. They engage Indigenous peoples in research processes that may connect them to culture and to one another. This poster discusses the use of an engaging sewing group methodology to facilitate storytelling and sharing of lived experiences among pregnant Inuit women currently away from their home communities for delivery. METHODS: Seven in-depth focus group discussions were conducted with pregnant Inuit women staying at a medical boarding home in Iqaluit, Nunavut, Canada. Each of these focus group discussions were formatted as a two-day sewing group. Women sewed sealskin baby slippers or mittens and shared stories of (1) their lived experiences of being away from home for delivery; (2) traditional pregnancy and birthing knowledge learned from parents, grandparents, and Elders in their communities; and (3) how they felt about the sewing groups. Stories were shared in both Inuktitut and English, and later interpreted and transcribed into English. RESULTS: This poster identifies and characterizes the successes and challenges of the sewing group methodology. Women reflected on the sewing groups as a welcome distraction from homesickness; a remedy for boredom; a purposeful form of work while they awaited birthing; a connection to their culture; and an opportunity to connect with one another. CONCLUSION: For Indigenous peoples disconnected from their home places – such as pregnant women required to fly out of communities for delivery - arts-based research approaches may facilitate a sense of place and well-being in the midst of medical evacuation.

32. Clustering of measurements of creatinine, SDMA and T4 in cats
Adam Campigotto¹, Theresa Bernardo¹, Zvonimir Poljak¹, Deborah Stacey², Elizabeth Stone³
¹Department of Population Medicine, University of Guelph
²Department of Computer Science, University of Guelph
³Clinic Studies, University of Guelph
Chronic kidney disease is a common concern in elder cats, whose detection can be complicated due to commorbidities such as hyperthyroidism. Using laboratory databases can help to identify patterns that may not be previously known in individuals with multiple diseases. This study aims to identify clusters in laboratory datasets to find relationships between T4, SDMA, creatinine and signalment. Selected blood work results were provided by IDEXX Laboratories regarding 1,048,575 feline individuals. Data regarding age, sex, breed, weight, T4, SDMA and creatinine were provided. Descriptive and clustering analysis was performed to find natural groupings. These groupings were then explored for differences in breed, sex, age and weight.
Between 3 and 6 clusters were found by each of 3 methods (random forest, K-Means, and DBSCAN). The clusters found correlated well with normal or pathological values. Databases from laboratory records can be used to identify clusters of like individuals within a population. These clusters may correspond to
individuals with a particular pathology or multiple pathologies. With larger numbers of variables, previously unknown subsets of individuals may be noted, especially if other data such as prognosis can be obtained through electronic medical records.

33. Exploring shade as a public health tool to prevent skin cancer and promote physical activity in Guelph, Ontario
Andrea Cimino, Jennifer McWhirter, Andrew Papadopoulos
Department of Population Medicine, University of Guelph
Skin cancer is the most common, yet one of the most preventable forms of cancer in Canada. As skin cancer rates rise, improved prevention is crucial. Skin cancer is caused by ultraviolet radiation. Shade helps to block ultraviolet radiation from the sun, and thus helps to prevent skin cancer. Shade may also play a role in promoting physical activity by making outdoor parks more attractive and comfortable. To maximize the benefits of shade, more research is needed. This research project aims to determine the amount of shade, via shade audits, at public outdoor parks in Guelph, ON. This will be done by visiting parks and collecting the following information: mean shade coverage, type of shade, ground surface, and site/shade usage patterns. The next objective is to determine what the general public and shade stakeholders think and know about shade. Interviews will be conducted to explore shade opinions, attitudes, awareness, and preferences. The last objective is to evaluate how the provision of shade impacts shade use behaviours. A pilot study will be conducted where one park will be randomly selected to receive a newly built shade sail and a second similar park will act as the control (no new shade sail). A pre-test/post-test assessment will determine if/how site and shade use patterns change after the provision of shade. Results from this research project will provide valuable information related to the availability, attitudes, and use of shade in Guelph, ON. This information may be useful to public health officials, urban planners, and policy makers as it will provide evidence about the impact of shade as a tool to prevent skin cancer and promote physical activity.

34. A study of food-animal veterinarian-producer interactions
Antonia DeGroot, Coe Jason, Kelton David, Miltenburg Cynthia, Duffield Todd
Department of Population Medicine, University of Guelph
BACKGROUND: Medical communication has been identified as a core clinical skill in both human and veterinary medicine. Evidence from human and veterinary medicine studies illustrates the benefits of effective communication. How we communicate is just as important as what we think and what we say. Process skills such as open-ended inquiry, reflective listening and empathy statements are important in effective communication. PURPOSE: To inform efforts to improve the outcomes of food-animal veterinarian-producer interactions. This study will investigate the current state of veterinarian-client-patient interactions in food-animal veterinary practices. METHODS: English speaking veterinarians in Ontario were targeted for participation. Producer-veterinarian interactions were audio/video recorded during regular on farm appointments. Veterinarian participants completed three surveys: 1) A demographics survey at the time of recruitment. 2) A post-interaction survey at the end of each interaction (including PPC). 3) An end of the day survey on the impact of the study on their performance. Producer participants completed one post-interaction survey on their perceptions and satisfaction. PILOT STUDY RESULTS: 50 interactions were recorded (10 veterinarians; 49 producers) for the pilot. Producers involved in the pilot were generally happy and felt engaged in conversations. Survey data shows many positives to veterinarian-producer interactions, with a few areas of opportunity, specifically conversations involving decision making and cost. NEXT STEPS: Continue recruitment of veterinarians for further data collection, with a goal of 250 more veterinarian-producer interactions.
35. Teaching of critical appraisal skills at AVMA/CVMA-accredited veterinary school
Antonius El-khoury1, Dale Lackeyram2, Jeni Spencer2, Jason Coe3, Brad Hanna1
1Department of Biomedical Sciences, University of Guelph
2Open Learning and Educational Support, University of Guelph
3Department of Population Medicine, University of Guelph
Randomized controlled trials (RCTs) and syntheses thereof are considered to be the highest-quality forms of medical evidence for determining efficacy. Quality assessments of published RCTs, however, show that more than half of published trials incorrectly perform procedures that are critical for minimizing bias or incorrectly report the procedures they used1-3. It is therefore important that the graduates of healthcare programs be equipped with skills to assess RCT quality prior to incorporating their findings into clinical practice. Unfortunately, medical programs and subsequent clinical training provide limited education on how to evaluate these studies4, and as a result, many MDs lack the ability to adequately evaluate the quality of the literature they read. The purpose of this study was to begin exploring whether the problems outlined above also apply to veterinary education and, if so, to explore practical solutions. Objectives: (1) survey DVM students regarding their confidence in assessing specific key aspects of RCT quality; (2) create and refine a survey for Associate Deans (Academic) at all fifty AVMA/CVMA-accredited schools regarding the teaching and learning of critical appraisal skills in DVM curricula, and launch the survey in May 2019.

36. An open source automated two-bottle choice test apparatus for rats
Jude Frie, Jibran Khokhar
Department of Biomedical Sciences, University of Guelph
Two-bottle choice tests are a widely used behavioural paradigm in rodents to determine preference between two liquids, with utility for testing animal models of addiction, depression and anhedonia. Here we describe an open-source 3D-printed, Arduino controlled two-bottle choice apparatus that automatically measures and records drinking behaviour in rats to allow for detailed analysis of their drinking microstructure. While commercial products exist that use lickometers, this design uniquely incorporates hydrostatic depth sensors to allow for real-time volumetric measurements in addition to traditional beam-break lick sensing. The goal of this design is to provide an open-source user friendly, affordable apparatus that can study complex behaviours without requiring the purchase of specialized scientific equipment or software. Its applications range from studying alcohol preference in addiction to sugar preference in motivational deficits and reward characterization. This design costs less than $180 CAD to build with decreased costs on each additional device. This design has been successfully tested for accuracy and validated using alcohol preference as an example. The apparatus showed consistency between drinking bouts and volume consumed and is shown to be accurate to 2.7% of the actual volume - an error much smaller than that associated with measuring bottles manually arising from spillage etc. This design makes using the two-bottle choice paradigm more accurate, while also making its data more robust by including both volume and licking incidence.
37. Clams as a potential source of Toxoplasma gondii in Iqaluit, Nunavut
Rebecca Fung1, Anna Manore1, Sherilee L. Harper2, Jan Sargeant1, Karen Shapiro3

1Department of Population Medicine, University of Guelph
2School of Public Health, University of Alberta
3Pathology, Microbiology & Immunology, University of California Davis

Toxoplasma gondii is a zoonotic, protozoan parasite. The prevalence of the Toxoplasma gondii exposure in Inuit communities in Northern Quebec, Canada is twice the global average. Accidental ingestion of T. gondii oocysts may cause toxoplasmosis. Toxoplasmosis can be facilitated by uptake and concentration of T. gondii oocysts in bivalve shellfish. Clams are an important part of the Inuit diet, both in terms of cultural continuity as well as an affordable and available form of sustenance; but, the prevalence of T. gondii in clams from Inuit Nunangat has yet to be investigated. This research examined whether Toxoplasma gondii was present in clams collected from Iqaluit, Nunavut. Clams (species: Mya truncata) were collected from harvesters, across nine sampling sites, over a one-week period in September 2016 in the Iqaluit region. DNA extraction and polymerase chain reaction targeting the 18S rRNA gene was performed on collected clam samples, and then T. gondii positive samples were confirmed by DNA sequencing. Results confirm 8 positive T. gondii clams out of 390 samples for a prevalence of 2.6%. As the first study to confirm the presence of T. gondii oocysts in clams harvested from Iqaluit, our insight provides a public health opportunity to address T. gondii transmission from shellfish to humans.

38. The impact of continuous birth rates on Streptococcus suis disease transmission and persistence in nursery swine
Elissa Giang, Benjamin Hetman, Jan Sargeant, Zvonimir Poljak, Amy Greer

Department of Population Medicine, University of Guelph

Streptococcus suis is one of the most important swine pathogens causing disease and mortality among nursery pigs and represents a significant economic burden to producers. The continuous introduction of new susceptible animals to the population directly influences the dynamics of many infectious diseases and is likely influential in endemic production-limiting swine diseases where turn-over of livestock is high. The impact of modifiable farrowing intervals (FI) as a potential control measure for the transmission of S. suis is not currently known. For this study, we developed a stochastic compartmental model that simulates S. suis disease transmission in the nursery and used it to address the following objectives: 1) to examine how patterns of S. suis disease incidence and disease persistence respond to changes in FI and 2) to estimate the ‘critical community size’ (CCS) by analysing the likelihood of pathogen-extinction as a function of herd size and the basic reproduction number (R0). Retrospective nursery outbreak data from an Ontario swine farm were used to estimate key transmission parameters for S. suis. Simulation models parameterized using Ontario herd-level data will evaluate several FI strategies and its efficacy in reducing disease burden in the nursery. Using mathematical models, our study will help to evaluate different intervention and control strategies surrounding FI to help enable producers to focus their decision-making efforts towards reducing the burden of this production-limiting disease in Ontario swine.
39. Is Bisphenol S is safe for the brain?
Akshara Gowder, Neil Maclusky

Department of Biomedical Sciences, University of Guelph
Bisphenol A (BPA) is a major endocrine disrupting chemical used in the production of epoxy resins, food, and beverage containers. Due to the adverse pharmacological effects of BPA, production of structural analogues such as Bisphenol S (BPS) has largely replaced BPA. As a result, BPS is a primary component of most so-called “BPA free” containers. However, the biological effects of BPS have not been systematically explored. As both BPA and BPS are estrogenic compounds, we hypothesized that BPS and BPA might act on the G-protein coupled estrogen receptor (GPER) and its functional signalling mechanisms in the hippocampus of the brain. To investigate this hypothesis, we have used in vitro immortalized hippocampal neurons to compare the effects of BPA and BPS treatment on activation of GPER. Western blotting was used to determine the effect of BPA and BPS on ERK and JNK signalling pathways by mouse hippocampal embryonic neuronal mHippoE-14 cell lines. Preliminary results suggest that BPA is in fact antagonist of the neuronal GPER signalling mechanism. Comparative studies on BPS are ongoing. Future studies will include in vivo rat models to compare the effects of BPA and BPS on hippocampal neuron morphology. Given that GPER has been shown to be involved in the mechanisms normally responsible for maintenance of hippocampal synaptic plasticity, these findings have important implications for the safety of bisphenol-derived products.

40. Neurosteroid modulation of nicotinic acetylcholine receptors during mouse postnatal development
Elizabeth Hewitson, Craig Bailey

1Department of Biomedical Sciences, University of Guelph
Progesterone-based neurosteroids influence brain biology. The predominant progesterone-based neurosteroid is allopregnanolone (ALLO). Although it is known that ALLO inhibits the function of nicotinic acetylcholine receptors (nAChRs) within the brain, the mechanism of action for this inhibition is not fully known. This study aims to test the hypothesis that ALLO is a direct negative allosteric modulator of nAChRs, and that the strength of this modulation changes during mouse postnatal developmental due to changes in receptor pharmacology. This hypothesis will be tested within the cerebral cortex of male and female CD1-strain mice sampled at postnatal day (P)15-20 and P80-120 (early adulthood). Whole-cell electrophysiology will be performed to measure effects of ALLO on nAChR function, and radioligand binding assays will be performed to determine the mechanism of action for ALLO effects at the nAChR. Parallel experiments using nicotine, a known desensitizing agent at the nAChR, will be performed in place of ALLO, and results will be compared with those using ALLO. Initial experiments using nicotine confirm that nAChR pharmacology changes during postnatal development. Nicotine decreased the acetylcholine-induced inward current response in all neurons tested, however this effect was more pronounced at P15-20 than at P80-120. Ongoing experiments aim to determine whether the ability of ALLO to inhibit acetylcholine activation of the nAChR also changes during postnatal development, and the mechanism of action for ALLO at the nAChR. This research will address these unresolved questions and contribute to the fundamental understanding of neurosteroid action within the brain.
41. Lasting decrease of corticostriatal coherence in rats after acute exposure to vapourized delta-9-tetrahydrocannabinol

Bryan Jenkins¹
Bryan Jenkins¹, Tapia Foute Nelong², Samantha Creighton³, Boyer Winters³, Melissa Perreault², Jibran Khokhar¹

¹Department of Biomedical Sciences, University of Guelph
²Department of Biomedical Sciences, Ontario Veterinary College, University of Guelph
³Department of Molecular and Cellular Biology, University of Guelph

Over 14% of Canadians use cannabis, with nearly 60% of these individuals reporting daily or weekly use. Little is known about the differential effects of varying routes and frequency of cannabis use on the brain. In this study, we assessed changes in neural circuit dynamics in rats exposed to vapourized Δ9-tetrahydrocannabinol (THC). We hypothesized that THC would reduce coherence between cortical and striatal brain regions. Sprague-Dawley rats were implanted with electrode arrays targeting the prefrontal cortex (PFC), orbitofrontal cortex (OFC), ventral hippocampus (vHIP), and dorsal striatum (dStr). Rats were administered THC using a Volcano® vapourizer and monitored in a plexiglass chamber. Decreased power was observed within the PFC, OFC, vHIP and dStr in the gamma range (30-100 Hz); specifically, a 20% to 35% decrease was observed in the low gamma frequency band, whereas a 40% to 50% decrease was observed in the high gamma frequency band. The changes in low gamma remained after one week, indicating that the effect of acutely administered, vapourized THC may be long-lasting. Vapourized THC exposure led to acute neurophysiological changes consistent with some of the known psychomimetic symptoms of cannabis use and schizophrenia.

42. Performance of the SNAP® 4Dx® Plus test for the detection of Dirofilaria immitis antigen and antibody to tick-borne pathogens in wild canids in southern Ontario

Jonathon Kotwa¹, Claire Jardine¹, David Pearl², Olaf Berke², Nicola Mercer³, Andrew Peregrine¹

¹Department of Pathobiology, University of Guelph
²Population Medicine, University of Guelph
³Wellington-Dufferin-Guelph Public Health

Population-level surveys for Dirofilaria immitis in wild canids typically rely on identification of the parasite at necropsy. This method is considered the gold standard for diagnosis of the parasite. More recently, some studies have used commercially available D. immitis antigen assays (e.g., the SNAPÂ® 4DxÂ® Plus test). However, such tests have not been extensively validated for use in wild canids. We therefore evaluated the performance of the SNAPÂ® 4DxÂ® Plus test for detection of D. immitis antigen in wild canids in southern Ontario. Overall, 199 wild canid carcasses were collected from across the region and assessed for the presence of D. immitis parasites at necropsy. In addition, lung tissue extract (LE) and thoracic fluid filter paper extract (TFE) were prepared from each carcass and tested via the SNAP® 4Dx® Plus test, which concurrently tests for the presence of D. immitis antigen and antibodies to Borrelia burgdorferi, Anaplasma spp. and Ehrlichia spp.. Compared to the necropsy results, the sensitivity and specificity of the SNAP® 4Dx® Plus test with LE was 80% (95% confidence interval (CI) 44.4-97.5%) and 98.9% (95% CI 96.2-99.9%), respectively. The sensitivity and specificity using TFE was 70% (95% CI 34.8-93.3%) and 97.9% (95% CI 94.7-99.4%), respectively. Regarding the tick-borne pathogen components, 1.0% (95% CI 0-3.8%) of LE samples and 0.5% (95% CI 0-3.1%) of TFE samples tested positive for B. burgdorferi antibody. No samples tested positive for Anaplasma spp. or Ehrlichia spp. antibodies. The collective results support the use of the SNAP® 4Dx® Plus test with LE and TFE samples for population-level surveys for D. immitis in wild canids in southern Ontario.
43. MiR-21, MiR-125b, MiR-146a and MiR-181c expression in exosomes from canine mesenchymal stem cells
Edouard Marchal1
Luis Gaitero2, Thomas Parmentier1, Fiona James2, Leanne Stalker1, Gabrielle Monteith2, Jonathan Lamarre1
1Department of Clinical Studies, University of Guelph
2Clinical Studies, Ontario Veterinary College
Mesenchymal Stem cell (MSC) therapy is an emerging treatment for neurological conditions and the exosomes they released are partially responsible for their effects. MicroRNAs miR-21, miR-125b, miR-146a and miR-181c are beneficial after spinal cord injury. It is unknown if canine MSCs exosomes carry these specific microRNAs and if their quantities vary between cell lines and time in culture. This study aimed to compare the expression of these microRNAs in canine MSCs exosomes between different cell lines and passages. Adipose MSCs were harvested from the falciform ligament of three dogs, and isolated, cultured, and passaged with standard adherent culture techniques. Cells were characterized by flow cytometry. Exosomes were isolated from their conditioned medium using a commercial kit. Relative expression of miR-21, miR-125b, miR-146a and miR-181c was determined by RT-qPCR using the ΔΔCq method, using both the spike-in cel-miR-39 and U6 as reference genes. Results were compared between cell lines and passages using one-way ANOVA. All microRNAs were detected in the three cell lines at every passage (two to five), except miR-146a that was not detected in two passages of one cell line. There was no significant difference in the mean relative quantity between different passages (p = 0.871), but there was significant difference between different cell lines for all four microRNAs (miR-21 p = 1.768E-3, miR-125b p = 1.768E-3, miR-146a p = 2.795E-3, miR-181c p = 1.327E-2). These results suggest that the quantity of these exosomal microRNAs is stable with increasing time in culture but should be evaluated for each cell line.

44. The efficacy of dry-off antibiotic treatment in dairy cattle to cure existing intra-mammary infections: A systematic review and network meta-analysis
Carrie McMullen1, Charlotte Winder1, David Kelton1, Annette O'Connor2, Jan Sargeant1
1Department of Population Medicine, University of Guelph
2Veterinary Diagnostic and Production Animal Medicine, Iowa State University
The prevalence of intra-mammary infections (IMI) at dry-off in dairy cows is approximately 13%, with an even greater number developing an IMI during the dry-period. Dry-off antibiotics are thus commonly used during this period to both cure and prevent IMI. The objective of this research is to determine the relative efficacy of currently labelled dry-off antibiotics in curing IMI over the dry period, using a systematic review and network meta-analysis approach. Five electronic databases (MEDLINE, CAB Abstracts, Science Citation Index, Conference Proceedings Citation Index â€“ Science, and AGRICOLA) and the table of contents of four conference proceedings will be searched for relevant literature. Data extraction will be performed for all controlled trials with natural disease exposure evaluating dry-off antibiotic therapy for the cure of IMI, provided an appropriate comparator group is described (i.e., different antibiotic treatment, placebo, non-antibiotic treatment, or no treatment). Results will be synthesized as a network meta-analysis, which allows the assessment of multiple antibiotic options through the use of both direct and indirect evidence. This research will aid veterinarians and dairy producers in making evidence-based decisions concerning antibiotic use, and will support the judicious use of antibiotics in dairy cattle. For example, if products are equivalent in efficacy, one with a lesser level of importance for human health can be chosen.
45. The functional utility of a unique subset of bone marrow-derived dendritic cells for cancer vaccines
Bob Mould
Department of Pathobiology, University of Guelph

The potency of dendritic cell (DC)-based vaccines as cancer biotherapies needs to be improved. DC culturing protocols expand heterogeneous populations of cells that include subsets of macrophages and DCs. When we compared the functionality of DCs differentiated from murine bone marrow in the presence of GM-CSF, we identified a subset of DCs that produce IL-12 but lack production of other inflammatory cytokines such as TNF-α. Interestingly, this population could be expanded when IL-4 was added during a particular window to the DC culture. Using flow cytometer cell sorting, we isolated subsets within the heterogeneous cultures and vaccinated mice with these cells after they were stimulated with lipopolysaccharide and pulsed with SIINFEKL (OVA257-264) peptide. The IL-12 single producing subset of DCs outperformed all other subsets by inducing the highest-magnitude SIINFEKL-specific CD8+ T cell responses. LPS-stimulated DCs were phenotypically characterized 12-hours post-stimulation using flow cytometry. We confirmed that not only the introduction, but also the timing of adding IL-4 into a DC culture was critical for the expansion of the unique DC population. Furthermore, we were able to demonstrate the existence of this subset in a very different culture protocol utilized by another lab, suggesting this uniquely potent subset likely exists within many commonly used culturing methods. Notably, isolation of our unique DC subset facilitated induction of high magnitude T cell responses at lower doses than conventional mixed cell vaccines, which may help alleviate manufacturing burdens. Future studies will determine why this unique subset is superior to other subsets.

46. Muscarinic receptor function is developmentally regulated in layer VI of the medial prefrontal cortex
Ashutosh Patel1, Myles St-Denis, Sierra Codeluppi, Craig Bailey
Department of Biomedical Sciences, University of Guelph

The neurotransmitter acetylcholine (ACh) activates its nicotinic and muscarinic classes of receptors, which are both located on pyramidal neurons within layer VI of the rodent medial prefrontal cortex (mPFC). The activation of these receptors by ACh plays an important modulatory role in prefrontal-dependent cognitive functions. The objective of this study was to determine the contribution of specific muscarinic receptor isoforms toward ACh's effects in this brain region. Whole-cell electrophysiological recordings were performed in mPFC layer VI neurons from young postnatal (postnatal day (P) 15-20) and adult (P60-100) mice of both sexes. Muscarinic responses to ACh application demonstrated transient inhibition in a subset of neurons and prolonged excitation in all neurons. The ratio of neurons exhibiting transient inhibition, and the duration of this response, were significantly greater in young mice than in adult mice. Pharmacological experiments using isoform-selective antagonists demonstrated that both the M1 and M3 isoforms are required for the inhibition response in all groups, whereas the M2 isoform contributes to the inhibition response in male mice only. The M1 isoform contributes to the excitatory response in all groups, whereas the M2 and M3 isoforms contribute to the excitatory response in adult mice only. Semi-quantitative RT-PCR performed in isolated mPFC tissue revealed that mRNA expression for mAChR isoforms was greater in adult mice than in young mice. Ongoing experiments aim to determine whether the function of these mAChR isoforms correlates with the morphology of recorded neurons.
47. Engaging medical, pharmacy, and veterinary students in antimicrobial resistance communication research
Courtney Primeau¹, Carolee Carson², Jennifer McWhirter¹, Scott McEwen¹, Jane Parmley¹
¹Department of Population Medicine, University of Guelph
²Public Health Agency of Canada
Introduction: A significant driver of antimicrobial resistance (AMR) is antimicrobial use (AMU) in human and veterinary medicine. Therefore, education and awareness among antimicrobial prescribers and dispensers is critical. Both human and veterinary health professionals have important roles to play and studies have shown that engaging stakeholders prior to developing communication materials can increase relevance, awareness, and dissemination of research findings. Objectives: To explore medical, pharmacy, and veterinary student perceptions and understanding of factors associated with emergence of AMR, and to identify key messages, knowledge translation and transfer (KTT) methods, and dissemination strategies for effective communication of AMR information to future antimicrobial prescribers. Methods: Beginning in November 2018, focus groups were conducted with medical, pharmacy, and veterinary students in Ontario, Canada. A semi-structured format using standardized open-ended questions and follow-up probes was followed. Thematic analysis was used to identify and analyze patterns within the data. Results: Preliminary analyses showed that students believe AMR to be an important global issue, and the main drivers include prophylactic AMU in animals and treating without confirmation of diagnoses. Students felt that although infographics provide easily digestible information, KTT materials such as fact sheets are more effective at providing sufficient information without overwhelming target audiences. Conclusions: This research may help inform future communication materials and develop tailored KTT tools for dissemination of important AMR information.

48. Program evaluation and community-level population health interventions: developing a comprehensive evaluation framework for the Nurturing Neighbourhoods Initiative of Guelph, Canada
Aarabhi Rajendiran
Department of Population Medicine, University of Guelph
Through comprehensive early childhood development programs, vulnerable children and families are provided the support needed to either prevent or minimize the burden of chronic disease through timely access to health and social services in their own communities. The Nurturing Neighbourhoods Initiative (NNI) is a multi-agency, cross-sectoral and neighbourhood-based early childhood development and prevention initiative. In order to critically examine the impact of the NNI, the need to develop an ongoing and sustainable program evaluation framework becomes apparent as mentioned in the first program evaluation conducted for the NNI by Case & Haanstra in 2014. Our hypothesis is that a developmental evaluation (DE) framework will support the process of implementing and evaluating NNI in local communities through the combined use of rigorous evaluation methodologies and innovative thinking - thus providing an accurate measure of the true impact of NNI in the local communities of Guelph. Methods used include: - Key informant interviews, community stakeholder focus group, observation, "check-in" study (mini interviews conducted to gather feedback as part of DE process). Methods have shown that there is a need to continually obtain feedback in order to build an evaluation framework that overcomes common barriers faced by community programs including communication across multiple agencies, funding, and capacity. Results can be used by community organizations who find traditional program evaluation are only meeting accountability purposes and want to learn more about how DE can be used to adapt programs to meet the needs of both stakeholders (i.e. staff, funders, policymakers)
49. Validating a semi-quantitative assessment method for degree of methylene blue staining in canine sentinel lymph nodes
Ann Ram, Michelle Oblak
Department of Clinical Studies, University of Guelph
Sentinel lymph node (SLN) mapping provides important prognostic information for metastasis. Methylene blue (MB) is the most common contrast agent used to identify SLNs, typically in combination with another agent. One of the challenges with the use of MB is that it can be difficult to discern whether a lymph node is stained blue, or if the discolouration is due to natural lymph node coloration, as brown can often appear blue. In addition, the literature does not report an objective means to score the degree of SLN staining, therefore making it very difficult to compare data between studies. While ideally, a digital algorithm would be used in every case, this is not practical in many situations. Therefore, a more objective, simple method for MB stain quantification is necessary to improve reporting. The purpose of this prospective pilot study was to develop a digital algorithm and validate a semi-quantitative scoring method for surface MB staining in whole lymph nodes. LN were assessed ex vivo, photographed and scored based on surface staining (0 - no blue stain, 1 - 1-50% stained, 2 - 51-100% stained). The lymph node images were analyzed for signal-to-background ratio in Image J (using a threshold of 0-125). Twelve lymph nodes were included. Scoring and analysis of lymph nodes depicted strong agreement between the semi-quantitative scoring and image analysis (K = 0.875). Further analysis will be performed to include interobserver variability and agreement between ex vivo and photographic scores. Based on this preliminary work, the use of a semi-quantitative scoring system shows promise for an objective assessment for MB staining in clinics and future research.

50. Circadian rhythm impact on cardiovascular disease in gender dependent manner
Mina Rasouli, Cristine Reitz, Tarak Khatua, Iman Aziz, Nina Harris, Faisal Alibhai, Tami Martino
Department of Biomedical Sciences, University of Guelph
Introduction: Cardiovascular diseases manifest differently in males and females. Circadian medicine is a promising new therapeutic approach for cardiovascular diseases; however, sex differences need to be considered. Hypothesis: The circadian mechanism underlies the pathophysiology of heart disease, and it differs in males versus females. Understanding these differences is fundamentally important for sex-specific chronotherapy. Methods and Results: First, to determine the resilience of males versus females to myocardial infarction (MI, heart attack), we used the murine MI model and found greater survivorship in females, and less time-of-day difference versus males. Next, to investigate the role of the circadian mechanism in the heart, we followed aging male ClockΔ19Δ19 mice by echocardiography for 2 years, and found that ClockΔ19Δ19 male mice developed profound age-dependent cardiomyopathy versus wildtypes littermates. In contrast, female mice were protected from heart disease even when CLOCK was disrupted. Next, we are investigating sex-differences in innate remodeling post-MI, and find that immunocyte recruitment to infarcted myocardium differs, including leukocytes (CD45+), neutrophils (CD45+CD11b+Ly6G+), macrophages (CD11b+F4/80+) and T-cells (CD45+CD3+CD4+). We will also investigate sex-specific chronotherapies involving diet or exercise. Conclusions: Understanding heart disease pathophysiology in both biological sexes is imperative to translate circadian biology to clinical cardiology, leading to longer, healthier lives.
51. **AAV-mediated expression of monoclonal antibodies for the prevention of filovirus virus infection**

Amira Rghei¹, Laura van Lieshout¹, Shihua He², Geoff Soule², Byram Bridle¹, Sarah Wootton¹

¹Department of Pathobiology, University of Guelph
²National Microbiology Laboratory, Public Health Agency of Canada

Vectored monoclonal antibody (mAb) expression mediated by adeno-associated virus (AAV) gene delivery is able to generate protective and sustained concentrations of therapeutic mAbs in animal models for a variety of infectious diseases, including Ebola virus and HIV. Our rationally engineered AAV6 triple-mutant capsid, AAV6.2FF, facilitates rapid and robust mAb expression following intramuscular administration. Previously, using AAV6.2FF-mediated expression of murine IgG2A mAbs 2G4 and 5D2 in mice, we demonstrated 100% protection against Ebola virus challenge. We have now re-engineered our expression platform to produce human IgG1 mAbs comprised of the heavy and light chain variable domains of MR191 and MR78, two potent antibodies against the Marburg virus glycoprotein. Intramuscular injection of mice with 6e10 vector genomes (vg) of AAV6.2FF-MR78 and AAV6.2FF-MR191 resulted in serum concentrations of 100µg/mL and 300µg/mL of human IgG, respectively, for sustained periods of time (>32 weeks). Mice receiving 1e11vg (high) and 1e10vg (low) doses of AAV6.2FF-MR191 were 100% protected against lethal Marburg virus challenge. Additionally, mice receiving AAV-mAb vectors mounted an equivalent humoral immune response against a non-lethal challenge of PR8 influenza A virus as their non-AAV treated counterparts, suggesting high concentrations of systemic mAbs do not interfere with the endogenous immune response. AAV-mediated antibody gene transfer is a viable method for prolonging the therapeutic effect of recombinant mAbs, representing a potential “vaccine” strategy for those with compromised immune systems or in possible outbreak response scenarios.

52. **Infection of stimulated leukocytes by oncolytic viruses: implications for single- versus multi-dosing protocols**

Ashley Ross, Amanda AuYeung, Robert Mould, Thomas McAusland, Jacob van Vloten, Sarah Wootton, Byram Bridle

¹Department of Pathobiology, University of Guelph

The field of oncolytic virotherapy was founded on the premise that the main mechanism of action was direct virus-mediated killing of cancer cells. This resulted in a paradigm of repeated delivery of oncolytic viruses (OVs) to maximize infection of tumors before the immune system cleared the virus. However, recent research argues that induction of tumour-specific immune responses is an equally important mechanism. If OVs are to be used as in situ or conventional transgene-encoding vaccines, the ideal dosing regimen may need to be reconsidered. From an immunological perspective, rapid, multi-dosing protocols for vaccines are usually avoided. Further, studies have shown that activation of leukocytes can promote their infection with viruses. Therefore, we hypothesized that activated leukocytes might become susceptible to killing by OVs, making single-dosing regimens superior in some contexts. Indeed, in vitro flow cytometry studies demonstrated that activated T cells were susceptible to infection with vesicular stomatitis virus (VSV), resulting in their death. I.V. administration of VSV to mice followed two days later by a second dose showed that multi-dosing potentiated infection of T cells in vivo. Moreover, multi-dosing with a VSV-vectored booster vaccine at a two-day interval abrogated survival of mice with intracranial melanomas, as compared to a single-dose protocol. Further, infection of activated human blood-derived T cells was pronounced, suggesting the findings have clinical relevance. This suggests that multi-dosing protocols might be contraindicated for some applications of OVs. Optimal dosing frequencies should be evaluated before OVs enter clinical trials.
53. Discriminatory effects of BPA and its analog, BPS, on AMH levels and sex ratio in bovine oocytes and in vitro produced blastocysts
Angela Saleh, Laura Favetta
1Department of Biomedical Sciences, University of Guelph

Endocrine-disrupting compounds, such as Bisphenol A (BPA) and Bisphenol S (BPS), affect embryonic development and fertility. BPA is a world-wide-used plasticizer, commonly replaced by its analog, BPS, because of its toxicity. Our laboratory previously found that in vitro exposure of bovine oocytes to BPA affects early development, however little is known about the effects of BPS. Anti-Müllerian Hormone (AMH) is a marker of oocyte developmental capability. Women undergoing IVF with higher BPA urinary levels, show lower AMH levels and pregnancy success. The aims of this study are to assess BPA and BPS effects on 1) AMH and its receptor (AMHR2), 2) embryonic development and 3) sex ratio. Bovine oocytes were matured in vitro in four groups: control, vehicle (0.1% ethanol), BPA (0.05mg/ml in 0.1% ethanol), and BPS (0.05mg/ml in 0.1% ethanol). AMH and AMHR2 protein levels were measured in cumulus-oocyte-complexes (COCs), denuded oocytes, and their corresponding cumulus cells by western blotting. Preliminary results show a statistically significant increase in AMHR2 protein in COCs (p<0.05) exposed to BPA, supporting our mRNA data. In vitro fertilization of the four treatment groups showed a significant decrease (p<0.05) in cleavage and blastocyst rates after BPA, but not BPS, exposure. Blastocyst sex ratio was assessed by detection of exclusively male genes DDX3Y and USP9Y, by qPCR. A significant decrease in male blastocysts (p<0.05) was detected following BPA exposure. These preliminary results suggest that BPS may be a valid alternative to BPA, as it does not emulate BPA’s detrimental effects.

54. Efficacy of a 4-week training program for reducing pre-existing veterinary fear in companion dogs
Anastasia Stellato1, Sarah Jajou1, Cate Dewey1, Tina Widowski2, Lee Niel1
1Department of Population Medicine, University of Guelph
2Department of Animal Biosciences, University of Guelph

Dogs often show fear during veterinary appointments and desensitization and counter-conditioning training is recommended to reduce this fear. We assessed the effect of a standardized 4-week training program involving desensitization and counter-conditioning to the clinic and a physical examination on behavioural and physiological signs of fear in dogs. Dogs with mild-moderate fear were recruited and randomly allocated to receive training (n=33) or no training (n=23; Control). For dogs in the training group, the owner performed gradual, exam-style handling on their dog and visited the veterinary clinic for a duration of 4-weeks. Dog behaviour was video recorded, and responses before and after training were assessed by a blinded observer for both clinic entrance, and examination. For behavioural measures, mixed poisson and logistic regression models assessed the effects of training, testing phase, sex, and age, with dog as a random effect. Physiological measures were analyzed with linear regression models. Corresponding baseline responses during the first visit were included as covariates. For both clinic entrance (F1,32=11.09, p=0.0022) and examination (F1,33=10.89, p=0.0023), the rate of lip licking was higher in trained dogs than controls, possibly due to use of food during training. During the examination, control dogs had higher odds of reduced posture compared to trained dogs (OR: 3.8, p=0.025). While we observed some positive effects, further research is necessary to explore alternative types of training programs (e.g., longer, more intensive and individualized), and to assess how individual dog characteristics and fear responses influence response to treatment.
55. Predictors of safe storage and temperature control practices among older adults
Abhinand Thaivalappil1, Ian Young2, Andrew Papadopoulos1
1Department of Population Medicine, University of Guelph
2School of Occupational and Public Health, Ryerson University

Introduction: Unsafe food containing pathogens and chemicals cause more than 200 diseases. One of the major groups at risk for foodborne illness are the elderly. Seniors account for 48 million in the United States and 6 million in Canada and these estimates continue to rise annually. In this study, we aimed to analyze a subset of a national survey conducted in 2014-2015 to identify potential determinants of outcomes related to safe storage and temperature control using multivariate methods. Methods: The Public Health Agency of Canada collected data from 1078 seniors (65+) using a structure telephone survey across all provinces and territories. The survey collected numerous demographic indicators and food safety practices. We selected three outcomes and nine determinants to examine using survey logistic regression models with stepwise hierarchical selection. Results: Most participants were women (66%), had education above the high school level (52%), and lived alone (49%). Seniors were aware that elderly are at greater risk of foodborne illness compared to the general population (78%), followed instructions on food labels (90%), and refrigerated leftovers within recommended guidelines (82%). However, only a small proportion of respondents put meats, poultry and seafood on the bottom shelf of the refrigerator (21%). Determinants of food storage practices and temperature control (e.g. education, income, number of individuals in household) were identified. Conclusions: Food safety practices are better among older women, worse among older seniors (75+), and those who read food labels. Some recommendations are suggested for messaging and future research in this area.

56. Optimizing pet rabbit care and welfare, and the owner-rabbit bond
Carol Tinga, Lee Niel

Rabbits are subject to high relinquishment and rehoming rates, suggesting that the human-animal bond may sometimes be lacking for this species. We hypothesize that the human-animal bond can be enhanced through environmental and social enrichments that make rabbits more engaging pets, and propose a series of epidemiology studies and animal welfare experiments to explore and test this hypothesis. Two cross-sectional, epidemiology surveys employing regression analysis will be used to (1) identify and describe risk factors for pet rabbit welfare and owner attachment, and (2) to assess associations between owner attachment and particular types of pet rabbit behaviours and owner interactions. This second study will more fully identify and then quantify factors that make rabbits satisfying and engaging pets versus unsatisfying and unengaging pets. Arising from the above research, controlled, pet rabbit experiments will be designed to assess the effect of key environmental and social interventions on rabbit behaviour and the human-animal bond. We predict that a large, enriched cage (an environmental intervention), and out-of-cage time combined with positive, rabbit-directed owner behaviours (an environmental and social intervention) will result in more highly motivated, natural rabbit behaviours and more owner interest, care and bond than a small, barren cage. This will be the first practical, science-based model of environmental and social interventions that could improve pet rabbit welfare and the welfare of people who choose to keep them as pets. These combined results may also provide a model for improving other small animal welfare and human-animal bonds.
Oral abstracts (Session I: 1:30-2:10)

Room: LLC 1713

57. Evidence for reactive neurogenesis in the leopard gecko, Eublepharis macularius
Laura Austin, Matt Vickaryous

Department of Biomedical Sciences, University of Guelph

Neurogenesis is the ability to generate new neurons from resident progenitor populations. Although best understood as a normal physiological process, in several species of teleost fish and salamanders, neurogenesis is also capable of replacing neurons lost or damaged due to injury - so called reactive neurogenesis. While reactive neurogenesis does not appear to resolve brain injuries in mammals, for most other species less is known. Here, we investigated reactive neurogenesis in the lizard Eublepharis macularius, the leopard gecko. To initiate reactive neurogenesis, we administered geckos with a single dose of the neurotoxin 3-acetylpyridine (3AP). Using the cell death markers Fluoro-Jade and TUNEL, we determined that neuronal loss occurs within 4 days following 3AP administration. Cell death is largely restricted to the medial and dorsomedial cortices, areas of the forebrain widely accepted to be the reptilian homologs of the mammalian hippocampus and neocortex, respectively. As evidenced by a decrease in expression of the neuronal marker NeuN, cell death within the regions appears to selectively target neurons. Remarkably, by 30 days following 3AP administration the medial and dorsomedial cortices appear to be structurally restored with a pattern of NeuN expression that closely resembles the uninjured brain. This preliminary data provides the first evidence that the leopard gecko is capable of reactive neurogenesis, a phenomenon otherwise rare among amniotes (reptiles + mammals).

58. Canine osteosarcoma plasma microRNA profile pre- and post-amputation
Michael Edson1, Geoffrey Wood1, Darren Wood1, Alicia Viloria-Petit2, Anthony Mutsaers2

Department of Pathobiology, University of Guelph
Biomedical Sciences, University of Guelph

Osteosarcoma is the most common primary bone tumor in both humans and dogs. The standard of care for canine appendicular osteosarcoma involves amputation of the limb and adjuvant chemotherapy. Although the median survival time is less than a year, patient's treatment outcome is hard to predict. There is currently no decisive method to determine which dogs will benefit the most from this aggressive treatment. Therefore, it is necessary to discover and validate biomarkers that can predict clinical outcome. MicroRNAs (miRNAs) are small non-coding RNAs that are involved in numerous cell processes and have potential as biomarkers. miRNAs are present in plasma, providing easy collection by blood sampling. This study aims to profile plasma miRNA expression in healthy dogs versus dogs with osteosarcoma, both before and after amputation. By examining matched pre- and post-amputation samples from the same individuals we hope to determine which circulating miRNAs are potentially associated with the primary tumor. Plasma samples of five dogs for each group were collected and pooled, miRNA was extracted, and reverse transcribed to cDNA. Quantitative real-time PCR was conducted to determine miRNA expression using a miRNA Array featuring 277 canine miRNAs. The miRNAs of interest from these findings were then selected for a custom miRNA array (47 miRNAs + controls) and are being used to examine correlations to clinical outcome in over 15 control and 40 osteosarcoma cases. Because miRNAs are highly conserved across species, we anticipate that miRNAs with clinical utility in our study may also benefit human osteosarcoma patients.
59. Remodeling of hippocampal dendritic morphology following surgical stress is modulated by testosterone
Lauren Isaacs, Eric Lawton, Ari Mendell, Neil MacLusky
1Department of Biomedical Sciences, University of Guelph
Gonadal and stress hormones have profound effects on hippocampal (HC) dendritic morphology. Our laboratory has shown that orchidectomy (ORCH) causes expansion of apical dendrites within the CA3 HC sub-region at 10-days and 2-months after surgery compared to sham-ORCH rats. At 10-days, sham-ORCH causes atrophy of CA3 apical dendrites while testosterone (T) replacement partially recovers CA3 apical dendrites. However, the time-course of surgical stress and glucocorticoids (GC) and the role of T in the recovery of HC dendritic morphology has yet to be fully elucidated. We hypothesize that even brief surgical stress results in the remodeling of HC apical dendrites while T promotes the recovery of dendritic morphology. We first determined the time-course of GC 1-, 3- and 10-days. Unstressed rats treated with dexamethasone had decreased dendritic branching at 3-days compared to untreated controls. To determine the role of T in the recovery of dendritic morphology following surgery, rats received either ORCH, ORCH+T replacement, sham-ORCH or left intact then sacrificed 1- or 2-months after surgery. At 1-month, ORCH rats a similar expansion of CA3 apical dendrites seen at 10-days. While ORCH+T rats had comparable CA3 apical branching to intact rats, sham-ORCH caused atrophy of CA3 apical branching. At 2-months, sham-ORCH rats appear to almost completely recovered. However, surgery dramatically reduced CA3 apical dendritic length at 1- and 2-months. No effects were observed in CA1 branching in any group. These results indicate that surgical stress rapidly alters CA3 dendritic structure that is persistent for up to 2-months and is at least in part mediated by GC action.

60. Technical consideration for immune profiling of cerebrospinal fluid from dogs with central nervous system diseases
Tamara Morrill1, Fiona James2, Janet Beeler-Marfisi1, Olaf Berke3, Stefan Keller1
1Department of Pathobiology, University of Guelph
2Clinical Studies, Ontario Veterinary college
3Population Medicine, Ontario Veterinary College
Diagnosing canine central nervous system (CNS) diseases can be challenging due to non-specific clinical signs. Immune profiling characterizes 'immune signatures' by next-generation sequencing (NGS) of lymphocyte antigen receptor (LAR) gene repertoires and may be helpful to diagnose CNS diseases. This study's objectives were to identify sample characteristics that can reliably predict whether immune repertoires can be sequenced from CSF and to optimize immune profiling of CSF samples from dogs with neurological disease. We assessed 1) the utility of whole genome amplification (WGA) to increase input DNA for target enrichment and 2) the suitability of cell-free (cf) and cell-associated (ca) DNA for immune profiling of CSF samples.
CSF was collected from 12 dogs with neurologic disease as a part of a neurological examination. DNA was extracted from the ca and cf fractions, a portion of each was treated with WGA prior to target enrichment by PCR and sequencing of LAR genes using the Illumina Miseq system. Samples that were subject to WGA had significantly more reads than samples that did not undergo WGA (P=0.04). However, non-WGA samples contained a higher proportion of LAR gene sequences and had higher values for clonotype and effective species count (p<0.05). The ca and cf fraction comparison showed no significant difference for these variables(p>0.05). Lymphocyte count had a positive correlation with raw reads (r2=0.59) and might be useful to predict whether a sample is suited for immune profiling. Future work will be directed at analysing the immune repertoires from a larger patient cohort to investigate if CSF immune profiling can be used to diagnose canine CNS diseases.
61. Sex fuels differential liver injuries during impaired type I IFN receptor signaling
Maedeh Darzianiazizi, Jacob Van Vloten, Kulkarni Ravi, wood Geoffry, Shayan Sharif, Byram Bridle, Khalil Karimi

Department of Pathobiology, University of Guelph
Excessive anti-viral responses to either hepatotropic or non-hepatotropic viruses can result in acute liver failure. Innate antiviral response is largely governed by type I interferon (IFN)-α/β receptor (IFNAR) signaling; and virus-induced aberrant type I IFN response is now well-established in development of immunopathologies and subsequent organ failure. The liver is a highly sex-dimorphic organ implicated in host antiviral immune response and sex-biased immunological response renders differential predisposition to pathogenesis of diseases including viral infections. Understanding sex factors underlying virus-induced liver injuries opens new avenues towards development of therapeutics narrowly tailored to sexes. We investigated sex disparity in IFNAR-mediated cytokine response and its implication in liver pathogenesis in the context of a non-hepatotropic virus infection. Recombinant strain of vesicular stomatitis virus-administered wild type mice showed hepatic viral load associated with local and systemic inflammatory cytokine responses. In contrast, IFNAR-/- mice mounted notably higher levels of both hepatic and systemic pro-inflammatory cytokines strongly biased towards females. Female IFNAR-knockout mice with exaggerated cytokine responses developed massive liver pathogenesis compared with their male counterparts and control groups. Consistent with critical role for early cellular type I IFN response in control of viral infection, IFNAR-/- mice, notably male mice, showed higher titers of the virus in liver than WT mice. Sex disparity, however, was not observed in liver viral titers of WT mice.

Conclusions: Our findings indicate that IFNAR-mediated antiviral cytok

62. Identifying genotypes and morphotypes of Eimeria species infecting Ontario domestic sheep and goats
Evelin Rejman, John Barta
Department of Pathobiology, University of Guelph
Coccidiosis, caused by the protozoan parasites in the genus Eimeria, is a costly disease impacting the Ontario small ruminant industry mainly through reduced animal performance and cost of treatment. Both clinical and subclinical disease cause a decrease in animal performance through reduced feed efficiency and weight loss from gut damage, loss of electrolyte and nutrients from diarrhea and, sometimes, death of youngstock. At least 12 Eimeria species infect domestic sheep and another 9 Eime ria species infect domestic goats but only a few are considered highly pathogenic. Disease severity is assessed typically using fecal oocyst counts (i.e. oocysts per gram, OPG) obtained using a modified McMaster method. Less pathogenic species can be excreted at high OPG but with minimal clinical impact whereas pathogenic species can cause damage with low OPG. Consequently, conventional enumeration methods may be unreliable for assessing the disease severity. Accurate identification of the causative Eimeria spp. is a critical step in disease management. Traditional identification of Eimeria species using oocyst morphometrics is unreliable due to overlapping measurements with few species-specific features but Eimeria species can be identified unequivocally using sequence based genotyping of mitochondrial CDS or nuclear 18S rDNA loci. In the present study, species morphotypes are being linked with corresponding genotypes; these well characterized Eimeria species can then be readily identified within fecal samples using PCR and quantified in NGS based assays. Both assays can be used to characterize the diversity of individual Eimeria species on individual farms across geographic regions.
63. Cracking down on coccidiosis: using novel molecular techniques to identify and quantify eimeria spp. infections in poultry
Ryan Snyder¹, Michele Guerin², Billy Hargis³, Greg Page⁴, John Barta¹
¹Department of Pathobiology, University of Guelph
²Population Medicine, University of Guelph
³Poultry Science, University of Arkansas
⁴Poultry, Trouw Nutrition Canada

Eimeria species infecting poultry are the cause of coccidiosis, a common and costly intestinal disease affecting the poultry industry. Identification of the several Eimeria species in mixed samples is required for understanding this disease complex. Molecular assays can provide the most reliable means of identifying these parasites based on DNA targets present in a sample. Conventional PCR, both direct and nested, has been used successfully for Eimeria species identification but standard PCR cannot provide quantification data. Newer technologies may be able to provide the necessary data for measuring the relative abundance of Eimeria species in a sample. Digital droplet PCR (ddPCR) is a sensitive quantitative method that could be applied to the identification and quantification of Eimeria species. A ddPCR-based method was developed that exploited mitochondrial genome targets that were genus-specific or species-specific. Primers and probes targeting the mitochondrial cytochrome oxidase c subunit 3 were designed and their reaction efficiencies optimized. DNA samples of known identities were tested to assess the feasibility of this experimental assay. The development of protocols for the optimization of running efficient reactions was completed. Obtaining relative species abundance and correlating it with oocyst per gram counts (OPG) will create data needed by veterinarians, researchers, technical representatives, nutritionists, and producers. These precise measures of parasite diversity and relative abundance are prerequisite for unraveling this disease complex and thereby improve control of coccidiosis and associated diseases in commercial poultry industries.

64. Effect of tracheal antimicrobial peptide on the development of mannheimia haemolytica pneumonia in cattle
Ksenia Vulikh¹, Laura Bassel¹, Lauren Sergejewich¹, Emily Kaufman¹, Shayan Sharif¹, Joann Hewson², Jeff Caswell¹
¹Department of Pathobiology, University of Guelph
²Clinical Studies, University of Guelph

Respiratory disease causes significant economic loss to the beef industry. Tracheal antimicrobial peptide (TAP) is naturally produced in bovine airways and has bactericidal activity against the pathogens that cause pneumonia in cattle, but its expression is suppressed by glucocorticoid (stress) and viral infection. We hypothesized that, in calves challenged with Mannheimia haemolytica, administering TAP to the respiratory tract would prevent pneumonia. In a novel Mannheimia challenge model using partially colostrum-deprived calves, treatment with non-oxidized TAP did not reduce bacterial loads in the respiratory tract or protect against disease. Sodium chloride and serum inhibited bactericidal activity of TAP. These findings suggest that TAP does not control bacterial infections in vivo because of interference by physiological salt levels and serum in inflamed tissues. Thus, stimulation of TAP expression in calves at risk of disease may not be effective for disease prevention in vivo.
65. Investigation into the serotypes of Streptococcus suis isolates in nursery pigs in Ontario, Canada
Leann Denich1, Zvonimir Poljak1, Vahab Farzan1, Robert Friendship1, Emily Arndt1, Marcelo Gottschalk2
1Department of Population Medicine, University of Guelph
2Infectious Diseases in Production Animals, University of Montreal

Streptococcus suis naturally inhabits the nasal cavities and tonsils of pigs. Some strains can cause systemic infection leading to a variety of diseases. This study describes S. suis serotypes isolated from sick pigs, compares serotypes found in systemic and upper respiratory sites of the same pigs, and compares serotypes in upper respiratory sites of sick and healthy pigs. A case control study involving 4-8-week-old nursery pigs from 12 Ontario farms was conducted. Cases with clinical signs of S. suis were selected and matched with equal numbers of healthy controls based on herd, visit time and pen. An array of samples was collected and tested for glutamate dehydrogenase and recombination protein N genes by PCR. If both were positive S. suis was deemed present. Isolates were then serotyped using a two step-multiplex PCR. In total, 698 samples were collected from 128 pigs (451 from 64 cases and 247 from 64 controls). Serotypes common in systemic sites were 29 (3 farms) and (2,1/2), 7 and 9 (2 farms each), as well as untypable (4 farms). In confirmed cases, serotypes 9, (2,1/2) and untypable were most common. Cluster analysis showed existence of four major groups of confirmed cases: i) serotype 9, ii) untypable, iii) mixed serotype and iv) serotype (2,1/2). Detection of serotype 9 (p=0.03) or (2,1/2) (p=0.08) in upper respiratory sites of cases was associated with detection of the same serotype in systemic sites however, isolation of these serotypes was very low. There was also no association of serotypes in upper respiratory sites amid cases and controls. This study provides a good understanding of which S. suis serotypes are most commonly found in clinical cases.

66. Short- and long-term behavioural effects of adolescent alcohol and cannabis co-use
Shahnaza Hamidullah1, Claudia Lutelmowski1, Samantha Creighton2, Karling Luciani1, Jude Frie1, Jibran Khokhar1
1Department of Biomedical Sciences, University of Guelph
2Department of Psychology, University of Guelph

Cannabis and alcohol co-use is prevalent in adolescence but its long-term effects on behavior remain largely unexplored. Therefore, the objective of this study is to investigate the long-term effects of adolescent alcohol and Î”9-tetrahydrocannabinol (THC) co-exposure on behavior. We hypothesize that co-exposure will produce more pronounced behavioral deficits in adulthood compared to either drug exposure alone. Male Sprague Dawley rats received vaporized THC (10 mg/pad) or vehicle every other day and had continuous access to 10% ethanol in a two-bottle choice design during adolescence (post-natal day 28-42). Alcohol intake was measured during the exposure period to assess the acute effects of THC on alcohol consumption. In adulthood, a battery of behavioral tests was performed. Adolescent rats appeared to show higher alcohol preference on days in which they were not exposed to THC vapor. In adulthood, co-exposed animals trended towards better short- and long-term memory retention on the novel object preference test compared to those that received either drug alone. Although no differences in acquisition were observed in the conditioned avoidance response, those exposed to THC alone exhibited higher resistance to extinction compared to co-exposed and alcohol-exposed animals. Exposure to THC vapor appears to increase alcohol drinking in adolescent rats. In addition, co-exposure to THC and alcohol during adolescence can produce long-lasting behavioral effects in a variety of learning paradigms. These studies contrast our previous findings with injected THC exposure, suggesting that different routes of THC administration can produce varying short- and long-term consequences.
67. Next-generation sequencing based minimal residual disease monitoring of canine multicentric B cell lymphoma
Akash Jairaj¹, Dorothee Bienzle¹, Nikos Darzentas², Anthony Mutsaers³, Ehab Misk¹, Victoria Sabine³, Karolina Skowronska³
¹Department of Pathobiology, University of Guelph
²Internal Medicine II, University Hospital Schleswig-Holstein, Central European Institute of Technology, Masaryk University
³Clinical Studies, University of Guelph

Multicentric B cell lymphoma (mBCL) is a common neoplasm in dogs with variable rates and duration of remission. Hyper variability of lymphocyte antigen receptor genes enables identification of tumor clones and minimal residual disease (MRD) monitoring. In human medicine, next-generation sequencing (NGS)-based MRD monitoring is used to assess treatment success and to detect early relapse. This study aims 1) to determine if NGS-MRD assessments of mBCL can predict time to relapse or overall survival, 2) to determine the best sampling time points during and after treatment, and 3) to assess if cell-free DNA (cfDNA) extracted from PBMCs or cell-associated DNA (caDNA) extracted from plasma is a more sensitive sample. Fifty-six patients met the inclusion criteria, of which, 42 patients had an immunophenotype consistent with mBCL. In 36 patients, the antigen receptor gene sequence of the neoplastic clone(s) could be sequenced from lymph node aspirates and the neoplastic clone composed at least 38% of all reads. Blood samples were collected at 2-4 week intervals over 26 weeks of treatment and 1-3 months thereafter. To date, MRD has been assessed from the blood of 10 patients, 8 of which reached complete remission during treatment. Presence of the neoplastic clone could be identified up to 9 weeks before clinical relapse. Out of 3 patients' sequencing runs analyzed thus far, 1/3 were first detected in both caDNA and cfDNA, and 2/3 were first detected in cfDNA. These data suggest that NGS-based MRD detection can identify relapse earlier than clinical assessment. However additional data from the remaining 26 patients are required to substantiate these results.

68. I know what you ate last summer - DNA metabarcoding for tick blood-meals
Genevieve Lumsden¹, Evgeny Zakharov², Scott Weese¹, Robbin Lindsay³, Claire Jardine¹
¹Department of Pathobiology, University of Guelph
²Canadian Centre for DNA Barcoding, University of Guelph
³National Microbiology Laboratory, Public Health Agency of Canada

In Eastern North America, the vector-host assemblages for Borrelia burgdorferi, the causative agent of Lyme disease, are likely changing due the northward range expansion of both the pathogen and its vector, Ixodes scapularis. Vector blood-meal analysis (BMA) can identify the origin of blood-meals consumed by ticks thus providing valuable insights into host-vector interactions. DNA metabarcoding may be an effective way to assess vector BMA; however, studies on questing, unengorged ticks are lacking. Here we aimed to: 1) assess the ability of DNA metabarcoding to identify blood-meals in engorged adult ticks fed on known hosts, and 2) test the technique on unengorged nymphs that fed on unknown hosts as larvae. To infer host species identification, vertebrate DNA was amplified and sequenced for comparison against known COI barcode references. Preliminary results yielded a putative species identification for 68.8% of engorged adults (n=16) and 18.2% of unengorged nymphs (n=55). Further optimization of the technique will be conducted to improve detection of remnant bloodmeals in unengorged nymphs. Validating this approach as a convenient tool for tick BMA will permit comprehensive investigations into the role of vertebrate hosts in the transmission of B. burgdorferi and other tick-borne pathogens.
69. Risk assessment for the incursion and establishment of orbiviruses in Ontario, Canada

Samantha Allen, Claire Jardine, Tara Furukawa-Stoffer, Aruna Ambagala, Kathleen Hooper-McGrevy, Mark Ruder, Nicole Nemeth

1Department of Pathobiology, University of Guelph
2National Centre for Animal Disease, CFIA
3National Centre for Foreign Animal Diseases, CFIA
4Southeastern Cooperative Wildlife Disease Study, University of Georgia

Epizootic hemorrhagic disease (EHD) and bluetongue (BT) viruses are midge-borne orbiviruses that present an imminent threat to Ontario's wildlife and livestock populations. Their northward spread in North America may be facilitated by changing climatic conditions. Recent detection of BT virus-seropositive cattle and documentation of Culicoides sonorensis midges in the province suggest that Ontario is at risk for the incursion and establishment of EHD and BT viruses. Ontario ruminants are immunologically naïve to these viruses; thus, their introduction may lead to negative impacts on livestock (farmed cattle, sheep and deer) through morbidity, mortality and production loss. We sought to characterize Culicoides vector biology and assess for recent and/or ongoing transmission of EHD and BT viruses in livestock in Ontario for two consecutive field seasons. From June-October of 2017-18, CDC-type LED light traps were placed on farms and in natural areas across southern Ontario, and all Culicoides vectors collected were taxonomically identified. Species identity was confirmed molecularly as needed. Sera from livestock were screened for antibodies to EHD and BT viruses by ELISA and virus serotype identity was confirmed by virus neutralization assay. In the 2017 field season, 19,126 Culicoides spp. were caught, Avaritia being the most commonly identified subgenus. A small portion of C. sonorensis, a known vector of EHD and BT viruses, were also collected in the 2017 field season. In the 2018 field season, 7,604 Culicoides spp. were collected, C. biguttatus being the most common.

70. Chromosome rearrangement breakpoints in the pig genome are distributed non-randomly

Brendan Donaldson, Samira Rezaei, Daniel Villagomez, Tamas Revay, William Allan King

1Department of Biomedical Sciences, University of Guelph
2Produccion Animal, Universidad de Guadalajara

Chromosome rearrangements are one of the main etiological factors contributing to hypoprolificacy in mammals. The domestic pig is considered to have the highest prevalence of chromosome rearrangements amongst domestic species. To date over 200 unique chromosome rearrangements have been identified in the pig genome, however the factors influencing the formation of these chromosome rearrangements remain poorly understood. Observation of porcine chromosome rearrangements suggests that rearrangement breakpoints are non-randomly distributed in the pig genome. Thus, we sought to establish if observable structural chromosome factors are associated with the presence of rearrangement breakpoints. In total 196 unique chromosome rearrangements, and 354 cytogenetic breakpoints were analysed across three levels, the chromosomes, chromosome arms, and cytogenetic bands. At the chromosome and chromosome arm levels, breakpoints were found to be unevenly distributed, with several chromosomes and chromosome arms being shown to rearrange more frequently than expected, relative to their length, and their opposing chromosome arms. At the cytogenetic band level, the length of bands, chromatin density, and presence of fragile sites were associated with having a higher number of breakpoints, and higher translocation frequencies. Using the number of breakpoints and translocation frequency of bands, hotspots for rearrangement in the pig genome were proposed. The characteristics of these bands were largely similar to that of hotspots in the human genome. These hotspots are proposed to be a starting point for future molecular analyses into the genomic landscape of porcine chromosome rearrangements.
71. Pet owner perspectives on current practices surrounding the communication of laboratory test results
Natasha Janke¹, Jason Coe¹, Elizabeth Stone², Theresa Bernardo³, Cate Dewey³
¹Department of Population Medicine, University of Guelph
²Clinical Studies, University of Guelph
³Population Medicine, University of Guelph
Communication practices vary widely among primary care practitioners in the field of veterinary medicine. Communication strategies that build the veterinarian-client relationship have been shown to enhance both veterinarian and client satisfaction. With the recent movement towards preventive medicine and interest in empowering clients to actively participate in the care of their pets, there remains a lack of data available on current communication practices of laboratory results and client preferences for receiving this information. The objective of this novel study is to explore the perspectives of pet owners on current practices for reporting laboratory test results. Participants were recruited using snowball sampling through social media platforms including, Facebook and Twitter. This online survey was conducted with companion animal owners and sought their experiences having their pet's bloodwork done, receiving the results, and preferences for receiving information. To date, over 800 surveys have been collected from pet owners throughout Canada, the United States and other countries. Results are currently being analyzed and will be presented.

72. Effect of flavophospholipol on the fecal microbiota of weaned pigs challenged with Salmonella
Saranya Nair¹, Vahab Farzan¹, Scott Weese², Zvonimir Poljak⁴, Robert Friendship⁵
¹Department of Population Medicine, University of Guelph
²Department of Pathobiology, University of Guelph
Research suggests flavophospholipol, an antibiotic, may have the ability to alter the gut microbiota equilibrium in favour of beneficial bacteria while inhibiting the colonization of pathogenic bacteria (e.g. Salmonella). Thus, the objective of this study was to evaluate the changes in the fecal microbiota of weaned pigs treated with flavophospholipol and challenged with S. Typhimurium. Twenty-one weaned pigs were fed either a diet containing 4 ppm of flavophospholipol (Flavomycin®, Huvepharma) or a non-medicated feed (control group) for 36 days post-weaning (Day 1 to Day 36). On Day 7 and 8, pigs were orally challenged with a 2 mL dose of 10^8 CFU/mL of S. Typhimurium DT 104. Community bacterial DNA was extracted from fecal samples collected at Day 6 and Day 36 were used to assess the fecal microbiota using 16S rRNA gene sequencing. Sequencing data were visualized using mothur, and analyzed in StataSE, JMP and R. Specifically, results demonstrated a significant increase in phylum Proteobacteria (P=0.001) and decrease in Firmicutes (P=0.012) and genus Roseburia (P=0.003) in the flavophospholipol treated pigs suggestive of possible microbial dysbiosis. Based on these findings, it is difficult to conclude whether treatment with 4 ppm of in-feed flavophospholipol is aiding in reducing Salmonella and promoting favorable indigenous bacteria in the pig microbiota. Further research using a larger sample size will help to draw conclusions on the impact of flavophospholipol on the porcine fecal microbiota.
Oral Abstracts (Session II 2:20-3:00)

Room: LLC 1713

73. Electrode scalp impedance differences between wired and wireless electroencephalography machines in healthy dogs
Julia Luca, Luis Gaitero, Andrea Sanchez, Gabrielle Monteith, Michal Hazenfratz, Fiona James
Department of Clinical Studies, University of Guelph

The objective of the study was to compare electrode scalp impedance measurements in dogs recorded by wired and wireless EEG machines. Seven, spayed or neutered adult beagles, weighing between 6-10 kg, with normal physical and neurological examinations were used for EEG impedance measurements. One beagle was recorded twice resulting in 8 recordings. For each recording, impedance was measured using 10 SWEs, resulting in 80 impedance readings. Electrodes were placed on specific locations F7/F8, F3/F4, T3/T4, C3/C4, Fz, and Cz on the canine skull. First the wired EEG machine was connected to the SWEs to measure impedance values. Secondly, after the wireless EEG device was disconnected from the SWEs, the wireless EEG machine was immediately connected to the SWEs to measure impedance values. The wireless EEG machine recorded higher impedance measurements in comparison to the wired EEG machine in 79/80 locations (P < 0.05). The wireless EEG machine's impedance readings were on average 2.83 kΩ (CI = 95%, SD = 1.42, ltl = 6.07, utl = 0.40) higher than the wired EEG impedance readings. Impedances from the wired machine ranged between <0.5 kΩ and 9 kΩ (mean = 3.09, median = 2.00, SD = 2.15), whereas impedances from the wireless machine ranged between 2.688 kΩ and 16.065 kΩ (mean = 5.92, median = 5.05, SD = 2.59). Despite these differences in impedance measurements between the wired and wireless EEG machine, both machines appear to measure the same impedance patterns. Therefore, wireless EEG machines should be considered equally acceptable for use in veterinary clinical settings.

74. Extended-spectrum cephalosporin resistance in Enterobacteriales from Canadian turkeys
Jonathan Moffat¹, Julie Calvert¹, Gabhan Chalmers¹, Michael Mulvey², Agnes Agunos³, Richard Reid-Smith³, Patrick Boerlin¹
¹Department of Pathobiology, University of Guelph
²National Microbiology Laboratory - Winnipeg, Public Health Agency of Canada
³National Microbiology Laboratory - Guelph, Public Health Agency of Canada

The goal of this study was to assess how frequently extended-spectrum cephalosporin-resistant (ESC-R) Enterobacteriales can be found in turkey feces using enrichment cultures. The associated resistance determinants were further characterized by PCR and genome sequencing. Three hundred and eight fecal samples were collected from 77 farms in British Columbia, Québec, and Ontario between May 2016 and June 2017. Isolate identification was done using MALDI-TOF and susceptibility to ESCs was assessed by disk diffusion following CLSI guidelines. The presence of blaCTX-M, blaSHV, and blaCMY for ESC resistance was tested by PCR. Most resistant isolates were Escherichia coli (n=704) with few other Enterobacteriales identified. Resistant Klebsiella pneumoniae, Proteus mirabilis, and Enterobacter cloacae were also identified in a small portion of samples. ESC-R Enterobacteriales were recovered in 67% of fecal samples. blaCMY was found in 75% of ESC-R E. coli with blaCTX-M (emerging in Canadian food animals) also providing resistance in 14% of isolates. These data show that Enterobacteriales that are resistant to ESCs can be found in the majority of turkey feces. The distribution of ESC resistance genes in Enterobacteriales from turkeys mirrors similar findings in clinical isolates from broiler chickens in Québec that found blaCMY as the predominant resistance determinant. The high frequency of samples containing Enterobacteriales resistant to critically important antibiotics detected with enrichment cultures urges caution in the selection of antibiotics used in turkeys and is in line with recent legislative changes to prohibit the use of these antibiotics in Canadian turkeys.
75. Glucocorticoids regulate G-protein coupled estrogen receptor (GPER) protein levels and functional activation in immortalized hippocampal neurons

Kate Nicholson, Ari Mendell, Carolyn Creighton, Neil MacLusky

Department of Biomedical Sciences, University of Guelph

Within the hippocampus, estrogens exert neuroprotective and neurotrophic effects that modulate learning, memory, and cognition. The rapid non-classical effects of estradiol are partially mediated by activation of the membrane-bound G-protein coupled estrogen receptor (GPER). In response to acute behavioural stressors, females exhibit significantly more cognitive impairments in hippocampus-dependent associative learning when compared to their male counterparts. Earlier studies have shown that acute behavioural stressors are sufficient to impair the neurotrophic and memory enhancing effects of estradiol within the female hippocampus. However, the effects of stress-induced regulation of GPER expression and signalling still remain poorly understood. To determine the effects of stress hormone exposure on GPER protein levels and functional signalling, two novel lines of immortalized murine hippocampal neurons were used. The mHippoE-14s and mHippoE-18s have been characterized for expression of important neurotransmitter and neurosteroid receptor mRNAs. As both cell lines exhibit glucocorticoid receptor (GR) and GPER expression, cells were treated with 10 nM of the synthetic GR agonist, dexamethasone, to assess for changes in GPER protein expression and functional signalling at multiple time points. The female derived mHippoE-14s exhibit reduced GPER protein and functional activation 24 hours following treatment with dexamethasone. This downregulation of GPER expression and functional signalling may contribute to the stress-induced loss of estradiol's neurotrophic and memory enhancing effects, making the female particularly vulnerable to the detrimental effects of stress.

76. Reporting characteristics of disease maps: evaluating zoonotic infectious diseases

Inthuja Selvaratnam, Olaf Berke, Jan Sargeant, Abhinand Thaivalappil, Jamie Imada, Andrew Beardsall, Monica Vythilingam

Department of Population Medicine, University of Guelph

Objectives: The increasing availability of spatial data and mapping software makes disease mapping widely practiced and accessible. Although disease maps are ubiquitous and regarded as informative communication tools in public health, there are no widely agreed upon and established guidelines for their proper reporting. With a growing number of disease maps published daily, this study examined a cross-sectional sample of research articles presenting disease maps of zoonotic infectious diseases. Study objectives were to a) identify basic map characteristics reported with disease maps, b) assess disease map purposes and applications, and c) identify whether limitations and biases in geospatial analyses were reported. Methods: Two reviewers conducted duplicate screening of research articles identified from a search in Medline and other databases in the last 2 years. To apply integrated knowledge translation, experts in the field (e.g., spatial epidemiologists, health geographers) were consulted to inform data charting. Study map characteristics were extracted and quantitatively summarized. Preliminary Results: A sample of 100 articles meeting eligibility criteria suggest a majority of published disease maps do not report characteristics such as projection parameters - relevant for reproducibility, and interpretations of geospatial analyses. For example, “distances” can vary based on projection parameters that are used, and thus the statistics that are based on such distance measures. The findings from this investigation suggest there are gaps and inconsistencies in the reporting of basic map information in the literature, and an evidence-based reporting guideline is needed.
77. Micronas as prognostic markers for chondrogenic potency of mesenchymal stromal cells derived from equine cord blood
Hamed Alizadeh, Thomas G. Koch
Department of Biomedical Sciences, University of Guelph

Multipotent Mesenchymal Stromal Cells (MSCs) are a heterogeneous population of cells with varying chondrogenic potency. Biomarkers predicting the chondrogenic potential of MSCs would allow for more time- and cost-effective identification of MSC cultures suitable for cartilage repair strategies compared to current post-chondrogenic induction determination of potency. MicroRNAs (miRNAs) are involved in the regulation of many cell functions and are often secreted by the cells. The miRNAs may be useful as biomarker to determine the chondrogenic potential of undifferentiated MSCs. We hypothesized that equine Cord Blood derived MSC (eCB-MSC) cultures exhibiting variable chondrogenic potency are associated with differential expression of miRNAs. The objective of this study is to assess the prediction value of miRNAs for chondrogenic potential of eCB-MSC cultures. In this study, ten eCB-MSC donors were initially evaluated for their ability to produce neocartilage using standard chondrogenic differentiation assay consisting of 3D pellet cultures in the presence of TGF-beta-3. The chondrogenic differentiation potential was scored based on histological matrix formation, quantitative glycosaminoglycan deposition and mRNA expression levels of chondrogenic marker genes. Subsequently, total RNAs were isolated for determination and differential expression of a panel of microRNAs (miR-34a, miR-140, miR-148a, miR-199a, miR-410) and their target genes between eCB-MSC cultures with high and low chondrogenic potential. Three eCB-MSC cultures out of 10 exhibited low chondrogenic potential, whereas 3 showed high and 4 moderate chondrogenic potential. Expression analysis of candidate microRNAs

78. Correlation of salivary antibody to carbohydrate larval antigen with gastrointestinal nematode parasitism in sheep under Ontario grazing conditions
Emma Borkowski1, Niel Karrow2, Paula Menzies3, Jacob Avula1, Brandon Lillie1, Andrew Peregrine1
1Department of Pathobiology, University of Guelph
2Animal Biosciences, University of Guelph
3Population Medicine, Ontario Veterinary College

Gastrointestinal nematodes (GINs) are an important cause of financial loss on Ontario sheep farms. With the rising prevalence of anthelmintic resistance, breeding sheep with a superior immune response to GINs is an attractive control strategy. In New Zealand, such sheep are identified by measuring salivary antibody to a carbohydrate larval antigen (CarLA). However, GIN epidemiology in cold continental climates, such as in Ontario, is different from New Zealand. The purpose of this study was to determine whether salivary CarLA antibody correlates with GIN burden under Ontario grazing conditions. Replacement ewe lambs (n=107) on an Ontario sheep farm were followed from 2016-2017, including their first lambing and lactation. GIN fecal egg counts (FECs) were monitored every 6-8 weeks from May-November. Salivary CarLA antibody was measured at the beginning, middle and end of each grazing season, and at midgestation in late winter. Mean CarLA levels increased in 2016, declined over winter, and rapidly increased during the 2017 grazing season. Spearman correlation coefficients between CarLA levels were consistently positive, of weak to moderate strength, and generally significant. Increased salivary CarLA was significantly associated with decreased GIN FEC throughout both grazing seasons, independent of anthelmintic treatment. These results indicate that CarLA is unaffected by anthelmintic treatment, and that levels measured during a lamb's first grazing season are predictive of subsequent levels. Therefore, under Ontario grazing conditions, selection of replacement ewes with high CarLA may reduce pasture contamination following lambing and during their second grazing season.
79. Cardiac regeneration following a direct puncture wound to the leopard gecko (Eublepharis macularius) heart
Kathy Jacyniak, Matthew Kenneth Vickaryous

1Department of Biomedical Sciences, University of Guelph

Among vertebrates, injuries to the heart are resolved via one of two different mechanisms: scar formation or tissue regeneration. In adult mammals, the primary mode of cardiac wound healing is scar formation, leading to the permanent replacement of contractile muscle cells (cardiomyocytes) with non-contractile fibrous tissue. In contrast, some teleost fish and salamanders can regenerate lost or damaged heart muscle, thus restoring function. For reptiles less is known. Here, we investigated wound healing following a cardiac puncture in the leopard gecko (Eublepharis macularius). As for other squamates, the gecko heart has two atria and a single ventricle. The ventricular myocardium is trabeculated (spongy) and, under normal homeostatic conditions, cardiomyocytes proliferate. Cardiac punctures to the ventricle are readily tolerated by geckos. To characterize the reparative events post-puncture, we used serial histology and immunostaining for markers of cell proliferation (proliferating cell nuclear antigen), cardiomyocytes (myosin heavy chain), and fibroblasts and endocardial cells (Vimentin). One day post-cardiac puncture (dpc), the wound site is characterized by the formation of a blood clot capping the puncture, and the localized loss of cardiomyocytes. Between 5 and 10 dpc, there is a surge in proliferating cardiomyocytes at the border of the lesion, and an increase in proliferating Vimentin+ cells within the wound itself. By 14 dpc, cardiomyocytes have repopulated the wound site, restoring the original trabeculated architecture of the myocardium. Taken together, these data demonstrate that the gecko heart is capable of cardiac regeneration following a puncture wound.

80. Assessing the analgesic efficacy of non-steroidal anti-inflammatory drugs compounded with iron dextran for use at the time of castration in piglets
Kristen Reynolds¹, Terri O'Sullivan¹, Ron Johnson², Robert Friendship¹, Jennifer Brown³

¹Department of Population Medicine, University of Guelph
²Biomedical Sciences, Ontario Veterinary College, University of Guelph
³Prairie Swine Center, University of Saskatchewan

Piglet castration is a painful procedure, creating both acute and ongoing pain. The current Canadian Code of Practice for Care and Handling of Piglets states that control of post-procedural pain is required. The combination of iron dextran (ID) already given to piglets with non-steroidal anti-inflammatory drugs (NSAIDs) at the time of processing has potential benefits including; a decrease piglet handling, a reduction of injections that piglets receive, and reduction of labour and costs of associated with piglet castration overall. The objectives of this study are to determine if the analgesic efficacies of the NSAIDs meloxicam (M) and ketoprofen (K) are altered after mixing with ID and administered to piglets at castration. Piglets (n=175) from 25 litters were assigned to 1 of 7 treatment groups: M or K alone, compounded M+ID, compounded K+ID, or 1 of 3 control groups; sham handled (SH), ID+castration (ID+C), ID and no castration (ID-C). Piglets navigated a chute at 6 time-points after castration. Times to navigate through the chute (CNT) were recorded and compared. After controlling for chute timepoint, all treatments group had faster CNT versus the ID+C group (P < 0.001). There was no decrease in CNT for NSAIDs mixed with ID, as compared to NSAIDs administered alone (P > 0.05). Piglets treated with NSAIDs (given alone or mixed with ID), had shorter CNTs supporting decreased pain following castration than piglets castrated without NSAID administration. The practice of compounding M and K with ID does not appear to reduce drug efficacy for the control of for the control of post-procedural pain. Future research to examine tissue drug depletion is required for food safety.
81. Investigating the salivary scavenger and agglutinin protein in equine asthma
Gary Lee1, Laurence Tessier2, Dorothee Bienzle1
1Department of Pathobiology, University of Guelph
2BenchSci
Purpose: Salivary Scavenger and Agglutinin (SALSA, also known as Deleted in Malignant Brain Tumors 1; DMBT1) is a protein with putative functions in innate immunity and tissue repair. In humans, the protein has been localized mainly to mucosal epithelia and secretions, including those of the airways. Knowledge regarding SALSA in horses is limited, but transcriptomic analysis of bronchial biopsies indicated low expression during remission and exacerbation in asthmatic relative to non-asthmatic horses. This study aims to analyze the structure and function of SALSA in horses. Objectives: Our objectives were to determine the sequence of the SALSA gene and to characterize tissue expression in horses. Methods: The SALSA gene from bronchial cDNA samples of multiple horses was amplified and sequenced. Tissue microarrays from 4 horses containing 21 tissues each were constructed. Immunohistochemical assays for SALSA were validated and applied to equine tissue microarrays. Results: The gene in horses includes five scavenger receptor cysteine-rich (SRCR) domains, two CUB (C1r/C1s, uegf, bmp-1) domains and one zona pellucida domain. These domains mediate microbial agglutination and the binding of ligands such as those involved in innate immunity. The nucleotide and amino acid sequences varied between horses (95-99% identity), suggesting the presence of isoforms. SALSA was highly expressed at mucosal sites, including tracheal, bronchial and bronchiolar epithelium. Conclusions: SALSA is a multifunctional protein with multiple isoforms in different individuals and a predilection for mucosal cells.

82. Risk factors for aggression in adult cats that were fostered through a shelter program as kittens
Kristina O’Hanley, Lee Niel, David L. Pearl
1Department of Population Medicine, University of Guelph
Aggressive behaviour in cats is a threat to human and animal safety and can also impact cat welfare if breakdown of the human-animal bond leads to neglect, relinquishment or euthanasia. The influence of early and ongoing management factors on cat aggression was examined for cats aged 1 to 6 years that were adopted following shelter fostering as kittens (N=262). Early management details were extracted from shelter records, and adoptive owners completed an online survey concerning the frequency and severity of aggression, owner demographics, home environment, and training/correction methods. Factor analysis on aggression questions identified four outcome variables for further analysis using logistic regression; frequency of aggressive behaviours towards the owner, severity towards people, frequency towards cats and severity towards other animals. Surprisingly, we did not find any associations between aggression and management factors related to early social exposure that have been anecdotally suggested to influence aggression. Most factors found to be associated with adult aggressive behaviours in cats were related to the cat’s characteristics, the adoptive home environment, and owner training methods. These results highlight several potential areas for future research, and for owner education to reduce cat aggression, particularly for kittens acquired through shelter-run fostering programs.
83. Mental health outcomes in veterinarians in Canada
Jennifer Perret, Colleen Best, Jason Coe, Deep Khosa, Amy Greer, Andria Jones-Bitton
Department of Population Medicine, University of Guelph
Studies in several countries including the United Kingdom and the United States have reported a higher rate of poor mental health outcomes among veterinarians relative to the general population, and these outcomes are implicated in the high rate of death by suicide in the profession. The objective of this study was to estimate the prevalence of anxiety, depression, secondary traumatic stress, compassion satisfaction, burnout, perceived stress, resilience, and suicidal ideation among veterinarians in Canada, and compare the results with data from the general population when possible. An online questionnaire was disseminated in French and English to veterinarians in Canada from February through July, 2017. The survey contained validated psychometric instruments to measure the mental health outcomes of interest, as well as questions regarding suicidal ideation, career, and demographics. Approximately 10% of all licensed veterinarians in Canada completed the survey. Participants had significantly higher levels of anxiety, depression, secondary traumatic stress, burnout, perceived stress, and suicidal ideation, as well as low resilience, relative to the general population. Female participants had significantly higher levels of perceived stress, anxiety, depression, secondary traumatic stress, and burnout, as well as low resilience, relative to male participants. Overall, these results serve as a call to action for supports and educational programs directed at veterinarian mental health, with specific attention paid to the differing needs of the genders.

84. Hippo signaling pathway disruption during Bovine preimplantation embryo development
Jyoti Sharma, Pavneesh Madan
Department of Biomedical Sciences, University of Guelph
Blastocyst formation is an important milestone during preimplantation embryo development. Two distinct cell lineages namely trophectoderm and inner cell mass develop during blastocyst formation. The Hippo signaling pathway is known to be responsible for lineage segregation during murine blastocyst formation. Recently our lab has demonstrated the presence of core several cascade components of the Hippo signaling pathway namely, MST1, MST2, YAP1, and TAZ, during bovine preimplantation embryogenesis. However, the role of these cell signaling components during early bovine embryogenesis requires further investigation. Therefore, we hypothesize that inhibition of Hippo signaling pathway components disrupts lineage segregation and the formation of bovine blastocyst. To elucidate the role of YAP1/TAZ in bovine embryogenesis, presumptive bovine zygotes were treated with different concentrations (0.5, 1 and 5 µM) of Atorvastatin or Cerivastatin, the known chemical inhibitors of the Hippo signaling pathway. After treatment, laser confocal microscopy and qRT-PCR methods were used to quantify the differences in protein localization and gene expression of the downstream components of the Hippo signaling pathway. After statin treatments, a significant decrease was observed in cleavage and blastocyst rates of bovine embryos. In addition, following treatment with Atorvastatin (5 µM) or Cerivastatin (0.5 µM) a decrease was observed in the nuclear localization of YAP1/TAZ, thereby inactivating the Hippo signaling pathway. Overall, these findings affirm a significant role of Hippo signaling components during bovine blastocyst formation thereby developing interventions for healthier embryos.
85. Factors associated with self-reported anxiety impacting academic performance among post-secondary students
Konrad Lisnyj, Regan Russell, Andrew Papadopoulos
Department of Population Medicine, University of Guelph

Anxiety rates have increased substantially among post-secondary students in recent years. Extensive research has identified risk and protective factors of anxiety in this population, as well as the factors impacting academic performance individually. Comparatively, fewer studies have examined the interrelationship of the risk and protective factors of academic anxiety, to which this study addresses this gap. The American College Health Association collects information on post-secondary students’ habits, behaviours, and perceptions of various health topics, including anxiety, through the National College Health Assessment (NCHA) survey. This cross-sectional observational study utilized the 2016 NCHA survey data from 1,864 respondents at a post-secondary institution in southwestern Ontario. Univariable and multiple logistic regression analyses were performed to measure the association between various risk and protective factors of anxiety and its implications on the academic performance of students at the 5% significance level. The multivariable model yielded nine significant factors: being diagnosed with/treated for anxiety and being interested in receiving information on depression/anxiety were the two greatest risk factors, while managing daily responsibilities and belonging to a community were the two greatest protective factors. This study identified several factors affecting anxiety that impacts academic performance. Wellness interventions should integrate a proactive approach that diminish risk factors and promote protective factors to alleviate the burden of academic anxiety in post-secondary students.

86. Social inclusion in disability group homes: facilitators and barriers to success
Erin Rodenburg, Erin Papadopoulos, Jennifer McWhirter, Andrew Taylor
Department of Population Medicine, University of Guelph

Despite social inclusion being a key component of quality of life, people with intellectual disabilities (ID) are continuing to experience high levels of social isolation. Group homes are the most common form of community living for this population and social inclusion must be promoted within them. The present review outlines the factors affecting social inclusion for adults living with ID in group homes. Five databases (ProQuest, PubMed, PsychNET, PAIS and CINAHL) were searched and inclusion/exclusion criteria were used to narrow the results to 22 articles. The articles included are international and published after 2006. Three main themes became apparent in the literature: (1) The built environment/community and social inclusion, (2) the role of group home staff and social inclusion, and (3) personal promotion of social inclusion. While the findings from these articles congregate into three themes, the identified barriers/facilitators are varying and highlight the scope of responsibility held by these group homes and surrounding communities in promoting social inclusion of their residents. The findings presented in this review provide information for group homes to provide an environment where facilitators such as well-developed internal planning, and staff prioritization of social inclusion can be enhanced and barriers such as lack of funding and coordination can be mitigated to fulfill policy obligations and address the neglect of the critical policy of life domain.
87. **Quantifying T cell and antibody responses induced by antigen-agnostic immunotherapies**
Jacob van Vloten, Lisa Santry, Elaine Klafuric, Thomas McAusland, Sarah Wootton, Byram Bridle
*Department of Pathobiology, University of Guelph*

Immunotherapies for cancers encompass any treatment that re-targets a patient's own immune system against their malignancy. Recent years has seen successful translation of immunotherapies to the clinic, which is highlighted by immune checkpoint blockade and oncolytic virotherapy. Research into the development and optimization of new immunotherapeutic strategies is gaining momentum. To support evaluating these strategies, researchers require methods to detect and quantify induced immune responses, specifically those governed by adaptive cytotoxic T cells and antibody-producing B cells. Until recently, most methods to evaluate these immune responses relied on prior knowledge of target antigens. However, genetic studies have shown that tumors can harbor many antigens capable of eliciting immune responses, and these can differ substantially across tumor types, between patients and even within the same tumour. This realization has led to the testing of "antigen-agnostic" immunotherapies that allow tumor-derived cells to drive the immune responses instead of pre-selecting target antigens. We have developed two independent methods without the prerequisite of defining target antigens; one to quantify tumor-specific cytotoxic and helper T cells, and one to quantify tumor-directed antibody responses. These methods allow researchers to expand their preclinical research models to those that do not have defined tumour antigens, and can be modified to monitor immune responses in veterinary and human patients receiving immunotherapies.

88. **A within-host mathematical model of influenza A (H9N2) virus infection dynamics and type-I interferon response in chickens**
Wendy Xie¹, Amy Greer¹, Sharif Shayan², Salah Uddin¹, Zvonimir Poljak¹, Alexander Yitbarek²
¹Department of Population Medicine, University of Guelph
²Department of Pathobiology, University of Guelph

Within-host mathematical modeling can improve our understanding of disease dynamics and help to inform intervention strategies. Low pathogenic H9N2 avian influenza (AI) is a zoonotic pathogen which has significant economic and agricultural impact, but research on H9N2 AI virus kinetics in chickens is limited. A better understanding of the host innate immune response may contribute to the development of improved vaccination protocols. The study objectives were to use a within-host model to determine the impact of three type-I interferon (IFN) antiviral response pathways and a cellular latent period on cloacal and respiratory virus shedding in chickens. A compartmental model of host cells, type-I IFN response, and virus particles was parameterized using least squares fitting to H9N2 virus titres from experimentally infected chickens. An eclipse phase compartment was used to represent latently infected cells. Best model fit was determined using the Akaike Information Criterion. The model demonstrated that an eclipse phase with type-I IFN mediated suppression of viral replication and CD8+ T-cell destruction of infected cells was most consistent cloacal virus shedding, while an eclipse with only type-I IFN mediated suppression of viral replication in infected cells was most consistent with oropharyngeal virus shedding. Viral infection of gastrointestinal cells showed increased virus production rate and sensitivity to type-I IFN, and shorter eclipse phase compared to infection in respiratory cells. These results provide a potential explanation for the delay to peak cloacal virus shedding and demonstrate differences between H9N2 respiratory and gastrointestinal infections.
89. Combining decitabine with oncolytic virotherapy preferentially kills acute myeloid leukemia cells via lethal oxidative stress

Elaine Klafuric, Megan Strachan-Whaley, Lisa Santry, Amanda AuYeung, Jacob van Vloten, Byram Bridle
Department of Pathobiology, University of Guelph

Acute myeloid leukemias (AML) are aggressive hematological cancers for which the standard of care has limited efficacy, with high rates of relapse. The DNA methyltransferase inhibitor decitabine (DCB) is an epigenetic modifier in clinical trials to treat leukemias, albeit with limited efficacy. Oncolytic viruses (OVs) preferentially replicate in and kill cancer cells but perform poorly against leukemias that are spread throughout normal tissues. We discovered that combining DCB with OVs induced durable remissions and resistance to relapse in mouse models of acute T- and B-lymphocytic leukemias. Therefore, we hypothesized that treatment with DCB would sensitize AML cells to killing by oncolytic Newcastle disease virus (NDV). In vitro resazurin dye-based assays supported the hypothesis. Further, most mice challenged with C1498 AML cells and treated with DCB seven and eight days later, followed by NDV eleven days post-challenge, achieved durable remissions and resisted a homologous re-challenge. Co-administration of the pan-reactive oxygen species (ROS) scavenger N-acetyl-L-cysteine abrogated efficacy. This implicated induction of lethal oxidative stress as a mechanism of action. Flow cytometric detection of ROS suggested that DCB and NDV caused oxidative stress in leukemia cells, with the combination therapy having an additive effect. More specific reagents, such as dihydroethidium and mitoSOX, will be used to quantify cytoplasmic vs. mitochondrial ROS, like superoxide. Targeted ROS inhibitors will be employed to confirm which subtypes of ROS are involved. In conclusion, this treatment appears to be effective at preferentially killing AML cells via lethal oxidative stress.

90. Treatment of hypertension by cannabinoid chronotherapy

Aidan Murray¹, Cristine Reitz¹, Mina Rasouli¹, Tarak Khatua¹, Jibran Khokhar¹, Linda Parker², Tami Martino¹
¹Department of Biomedical Sciences, University of Guelph
²Department of Psychology, University of Guelph

Introduction: With Canada's legalization of marijuana in 2018, one of the biggest new user groups is anticipated to be individuals aged 50+. These individuals are also at increased risk for hypertension (high blood pressure). Hypothesis: The circadian mechanism regulates time-of-day cardiovascular responses to cannabinoids; this has the potential to open new avenues for treating heart disease. Methods and Results: First, to determine the dose-response to tetrahydrocannabinol (THC), cannabidiol (CBD), and a THC 50:50 CBD mix, we used running-wheel actigraphy and found THC and 50:50 given at 3mg/kg reduced waketime locomotor activity (5849±1802 (THC), 2489±947 (50:50) vs. 11,314±2111 (baseline); counts). Second, to determine the effects of cannabinoids on blood pressure, we used the murine transverse aortic constriction model, and found CBD given at sleeptime reduces nocturnal blood pressure vs. baseline (Δchange -11.04±1.09 mmHg). Third, to demonstrate the role of the circadian mechanism, we will determine blood pressure responses to CBD using CLOCKΔ19/Δ19 mice. Fourth, to determine how CBD may interact with existing anti-hypertension medications, we will determine blood pressure responses to CBD plus the angiotensin-converting enzyme inhibitor, enalapril. Conclusion: Nocturnal hypertension is associated with cardiac hypertrophy, leading to heart failure. This study suggests that CBD can lower elevated nocturnal blood pressure, opening potential new avenues for treatment of hypertension.
91. Drosha expression and microRNA profiles during bovine oocyte maturation in vitro following meiotic arrest
Deirdre Stuart¹, Allison Tscherner², Meritxell Vendrell-Flotats³, Leanne Stalker¹, Lamarre Jonathan¹
¹Department of Biomedical Sciences, University of Guelph
²Developmental Biology, Ottawa Hospital Research Institute
³Universitat Autònoma de Barcelona

MicroRNAs regulate gene expression post-transcriptionally by binding to messenger RNAs and causing degradation or suppressing translation. One critical step in miRNA synthesis is mediated by a multiprotein complex called the Microprocessor. This complex consists of type III RNase Drosha, DGCR8 and RNA helicases, which collectively cleave precursor primary transcripts to pre-miRNAs. The role of Drosha in embryogenesis has been shown to be nonessential in mice, due to the utilization of an endo-siRNA pathway involving Dicer for mRNA silencing. However, more recent work in bovine and humans indicate that this may be a species-specific phenomenon and that Drosha may be important for normal early embryo development in those species.

Earlier results in our laboratory demonstrated a marked increase in mRNA and protein levels of Drosha within the bovine oocyte over maturation, continuing after fertilization until the 2-4 cell stage. To further characterize the role of Drosha in this context, we examined the expression and localization of Drosha within germinal vesicle (GV) and mature (MII) oocytes using immunofluorescence and confocal microscopy. Results indicated a marked increase in Drosha expression, in MII oocytes relative to GV oocytes. A comparable increase in expression was observed after 24 h inhibition of maturation with 100µM butyrolactone-I. Following inhibition, maturation and fertilization, pri-miRNA and miRNA expression was evaluated and compared by qRT-PCR between GV and MII oocytes and presumptive zygotes. Collectively these studies support potentially important roles for Drosha and the effect of meiotic arrest in the maturing oocyte and early embryo.

92. Klossiella equi, a coccidian parasite in the kidneys of horses: Is this 'rare' parasite more common than we assumed?
Elizabeth Zeldenrust¹, Alexandre Leveille¹, Karen Carlton¹, Daniel Kenney², John R Barta¹
¹Department of Pathobiology, University of Guelph
²Clinical Studies, University of Guelph

Klossiella equi is a monoxenous coccidian parasite (Apicomplexa: Eucoccidiorida: Adeleorina) that infects the kidneys of equids globally. Immediately infective sporocysts are shed in urine; prepatent and patent periods are unknown. Infections with K. equi usually show no clinical signs and, consequently, are diagnosed as incidental findings during necropsy. However, these intracellular parasites cause histopathological lesions and gross lesions have been reported in heavy infections. Prevalence of K. equi in Ontario horses is unknown but assumed to be low because infections are detected rarely during routine necropsies at OVC. However, histopathological screening by microscopy is likely an insensitive diagnostic method. The recently completed mitochondrial genome of K. equi provided potential molecular targets for diagnostic use that could be more sensitive than microscopy. PCR primers were designed to detect K. equi in equine samples. For this study, kidney, blood and urine samples were collected opportunistically from equine necropsy cases. To date, thirteen kidney samples have been PCR tested for the presence of K. equi. No parasites were noted during routine histopathological screening of these cases; surprisingly, PCR detected an active infection with K. equi in almost half (6/13) of the tested kidney samples. Careful re-examination of kidney sections from these PCR positive horses demonstrated early parasite stages at low numbers. Klossiella equi is clearly more common in Ontario horses than previously assumed. In future, PCR testing of blood and urine samples from PCR-positive horses will be used to test this PCR assay as an antemortem diagnostic tool.
**93. Navigating health informatics for new veterinarians: a competency-based framework**

Zenhwa Ouyang\(^1\)

Elliot Robson\(^2\), Kevin Havas\(^2\), Elizabeth Stone\(^3\), Zvonimir Poljak\(^1\), Theresa Bernardo\(^1\)

\(^1\)Department of Population Medicine, University of Guelph

\(^2\)Eduworks

\(^3\)Clinical Studies, University of Guelph

**Background:** New veterinarians will encounter new technologies and data sources in practice, many of which may be in the hands of pet owners. Successful veterinarians will learn to leverage these technologies and data sources to improve healthcare delivery, client satisfaction and the human-animal bond. **Objectives:** The purpose of this project was to create a competency framework for newly graduating veterinarians in health informatics. **Materials and Methods:** The competency framework development (CFD) process, based on Developing-A-Curriculum, is an occupational analysis method that uses the consensus of an expert panel to build a skills map for future practitioners. Five veterinarians participated in the final CFD process. Meetings were conducted online. The CFD was led by Eduworks, a company that specializes in developing competency frameworks. **Results:** Eight competencies were created addressing: involvement in emerging technologies; ethical use of technologies; optimization of healthcare delivery; mental health in veterinarians; managing online presence; client education; public health; and data management and analysis skills. The majority of statements focused on critically assessing, staying up-to-date with, facilitating the introduction of, leveraging and educating clients about technologies. **Conclusion:** The practicing veterinarian has many responsibilities in her or his professional career. The practicing veterinarian’s role regarding technology and data is not limited to analyzing data; it is more aptly described as a facilitator. They need to be aware of new technologies for both animals and humans and to critically evaluate their contributions to the

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**94. Characterization and control by vaccination of an unnamed Eimeria species causing clinical coccidiosis in commercial Chukar partridge (Alectoris chukar) flocks**

Jessica Rotolo, Ryan Snyder, John Barta

\(^1\)Department of Pathobiology, University of Guelph

An Ontario commercial chukar partridge flock experienced high morbidity and mortality due to coccidiosis caused by an Eimeria species. Biological characterization of the life cycle and sequence-based genotyping methods were employed to identify the pathogenic agent. The morphology of oocysts and sporocysts were characterized using light microscopy with computerized image analysis software. Chukar partridges were experimentally infected, and daily fecal collection post-inoculation was used to determine the prepatent period and duration of shedding. Histological analysis of tissue collected at 8 locations along the intestinal tract every 8 hours throughout prepatency was performed for the characterization of endogenous stages. Five asexual generations were observed prior to oocyst formation over its 120 hour prepatent period; oocyst shedding persisted until 10 days post-inoculation. To complement the biological characterization, the complete mitochondrial genome and partial nuclear 18S rDNA were sequenced. Comparisons with described Eimeria sp. infecting partridges and other galliforms suggest that the biological and molecular features of the pathogenic species are unique and warrants description as a new species. Following characterization of this new parasite, two vaccination methodologies will be explored to elicit protective immunity: 1) a live oocyst vaccination followed by monitored 2-step partial house brooding; and 2) the use of a 'bioshuttle' program (vaccination/anticoccidial combination). Exploring methods to control this pathogenic Eimeria sp. is essential to maximize the health of commercial chukar partridges and ensure the commercial success of this operation.
95. Effects of dexamethasone on FKBP5, FKBP4, and DUSP6 gene expression in the mHippoE-14 and mHippoE-18 cell lines
Emily Craig, Neil MacLusky
Department of Biomedical Sciences, University of Guelph
Evidence for involvement of alterations in gene expression in neurological disease has mounted in recent years, with the expression of many genes of interest being directly or indirectly affected by stress. In this study, we sought to determine the effects of the synthetic glucocorticoid dexamethasone (DEX) on expression of genes associated with neurological disease, including FK506 binding protein 51 (FKBP5), FK506 binding protein 52 (FKBP4), and Dual Specificity Phosphatase 6 (DUSP6), and the proteins which regulate their action, in a cell culture model. Two T-antigen immortalized mouse embryonic hippocampal cell lines (mHippoE14, female-derived; and mHippoE18, male-derived) were utilized. Cells were treated with 10 nM DEX, and RNA was collected 1, 3, 6, 12, and 24 h post-treatment to assess the effects. DEX increased expression of FKBP5 in both cell lines at 6 hours, with increasing expression sustained at 24 hours in the mHippoE18 cell line only. Similarly, DEX induced downregulation of DUSP6 trends towards resolution in the mHippoE14 cells, possibly reflecting the previously-reported sex difference in stress regulation of this gene (Labonte et al Nat Med, 23 (2017) 1102-1111). Expression of FKBP5 and MKP3 have been associated with multiple neurological disorders, including major depressive disorder, bipolar disorder, and schizophrenia. Sex differences in neurological disorders may this, in part, be attributable to sex differences in the stress responsiveness of genes that contribute to disease susceptibility.

96. Lymphoid neoplasia in psittacine birds: Disease presentation corresponding to immunophenotype
Daniel Gibson1, Nicole Nemeth2, Hugues Beaufré3, Csaba Varga4, Michael Garner5, Leonardo Susta1
1Department of Pathobiology, University of Guelph
2Southeastern Cooperative Wildlife Disease Study, University of Georgia
3Clinical Studies, University of Guelph
4Ontario Ministry of Agriculture, Food and Rural Affairs, University of Guelph
5Northwest Zoopath
Lymphoid neoplasia is the most common type of round cell neoplasia in psittacine birds and is most commonly lymphoma of B- or T-cell origin. In psittacine birds, these diseases are sporadic and there are limited data describing prevalence or diagnostic features, making specific diagnoses challenging, and inhibiting the development of reliable grading schemes to be used in prognostic studies. The purpose of this study was to describe the demographic, anatomic, and histological, features of lymphoid neoplasia relating to the immunohistochemical (IHC) reactivity of three commonly used lymphoid markers (CD3, Pax5, and MUM-1). Cases of lymphoid neoplasia (n = 38) in psittacine birds from the last 20 years were retrieved from the Ontario Veterinary College and other North American institutions and were assessed for growth patterns, organ distribution, and cellular morphology. Tissue microarrays were constructed from tumour tissue to assess IHC reactivity. The most common immunophenotype was consistent with B-cell lymphoma (n = 19) according to the relative proportions of immunoreactive cells. Other cases were consistent with T-cell lymphoma (n = 6), plasmacytoma (n = 3), non-B non-T lymphoid neoplasia, as well as four cases with both a B and T-cell immunophenotype, based on neoplastic cells with reactivity for both Pax5 and CD3, respectively. This is the first study describing a large cohort of psittacine lymphoid neoplasia, describing previously reported and novel immunophenotypes. These data provide baseline information which can be used to improve diagnostic accuracy, as well as to contribute to prognostic estimates to better manage these diseases in psittacine birds.
97. Efficacy of pain control for caustic paste disbudding in very young calves
Cassandra Reedman1, Charlotte Winder1, Todd Duffield1, Kerry Lissimore1, Trevor DeVries2, Niel Karrow2, Ziwei Li2
1Department of Population Medicine, University of Guelph
2Animal Biosciences, University of Guelph

Dairy producers disbudding calves with caustic paste are less likely to provide pain control than those using cautery. Little research has been conducted on pain control for this method and no studies have examined calves under a week of age. The objective of this study was to evaluate the efficacy of local anesthesia and NSAID analgesia in very young calves. 140 heifer calves aged 1-9 d were enrolled into 28 blocks and randomly allocated to 1 of 5 interventions: sham control; no pain control; lidocaine; meloxicam; and lidocaine and meloxicam. Data were analyzed using mixed models with a fixed effect for baseline values and a random effect for trial block. Compared to no local anesthetic, lidocaine reduced serum cortisol at 15, 30, 45, and 60 min post-disbudding (60 min; ‐138 pg/ml, 95% CI ‐200 to ‐76 pg/mL), values were not different between lidocaine treated calves and sham controls at these time points. At 60, 90, 120, and 180 min, calves treated with lidocaine/meloxicam had reduced cortisol compared to lidocaine alone (180 min, -61 pg/mL, 95% CI -112 to -10 pg/mL), values did not differ between lidocaine/meloxicam calves and sham controls at these time points. At 3-4 d, treatment with lidocaine/meloxicam tended to reduce haptoglobin (-0.16 mg/mL, 95% CI 0.00 to 0.32). At 60, 90, and 120 min, lidocaine treated calves had decreased pressure sensitivity (90 min, -2.26 kgf, 95% CI -3.15 to -1.37). No differences were seen in pressure sensitivity between groups at 180 min, 3-4- or 6-7-d. These findings suggest that the combination of local anesthesia with NSAID analgesia are beneficial at reducing pain indicators in very young calves disbudded with caustic paste.

98. Cryptosporidium 18S Reader: a new bioinformatics tool to enhance species identification
Christine Yanta1, Guy Robinson2, Rebecca Guy3
1Department of Pathobiology, University of Guelph
2Cryptosporidium Reference Unit, Singleton Hospital, Public Health Wales Microbiology
3Division of Enteric Diseases, National Microbiology Laboratory at Guelph, Public Health Agency of Canada

Cryptosporidium spp. are coccidian parasites that cause gastrointestinal disease in domestic animals and humans. This zoonotic pathogen is a major veterinary and public health concern due to high instances of infection in young children and immunocompromised patients, as well as young animals. To identify sources of contamination and transmission routes, species identification is commonly performed by traditional Sanger sequencing techniques on the 18S gene target. However, uninterpretable chromatograms are encountered during this molecular analysis due to overlapping peaks arising from two factors: co-infections and polymerase slippages during PCR amplification. As a result, we have developed a tool that can read a Sanger sequence chromatogram directly for the 18S gene target and correctly identify all species within the sample. This SSU reader can separate overlapping peaks by calculating log intensity ratios to remove polymerase slippages or perform a homology search against a custom, reputable database to identify all species present in a co-infection. This tool played an important role in both the Phase 2 National Dairy Study and an Environmental Water Study in Quebec. From the National Dairy Study, the most prevalent of the four Cryptosporidium species found amongst cows and newly weaned calves across Canada was C. andersoni along with one co-infection. In Quebec's water samples, the most prevalent species was C. parvum, followed by C. andersoni and other various mixed species. Overall, this program permits fast and reproducible sequence analysis of all nuclear 18S rDNA chromatograms, enhancing species identification for this parasite and to aid surveillance.
99. The effects of midazolam and nitrous oxide on the minimum anaesthetic concentration of isoflurane in the ball python (Python regius)
Cedric B. Larouche¹, Craig Mosley², Hugues Beauroër³, Christopher Dutton⁴, Dorothee Bienzle⁵
¹Department of Pathobiology, University of Guelph
²VCA Canada
³Clinical Studies, Ontario Veterinary College, University of Guelph
⁴Toronto Zoo
⁵Pathobiology, Ontario Veterinary College, University of Guelph
Nine healthy adult female ball pythons (Python regius) were used in a semi-blinded, randomized, crossover study evaluating the effects of midazolam and nitrous oxide (N₂O) on the minimum anesthetic concentration of isoflurane (MACiso). Three protocols were performed on each snake with two-week washout periods. Premedication with 1 mg/kg intramuscular (IM) midazolam or 0.2 mL/kg IM saline was followed by induction with facemask. Isoflurane was delivered in 100% oxygen in the midazolam and the saline trials, and in 50% N₂O and 50% oxygen in the N₂O trial. Snakes were endotracheally intubated and inspired and end-tidal gas concentrations were monitored throughout the experiment. The study was designed following a standard bracketing technique and the MACiso was determined by logistic regression. Electrical stimulation delivered at the base of the tail was used as the supramaximal stimulus. Cardiac blood gas analyses were performed immediately following intubation and after the last stimulation. The MACiso at 30.1 ± 0.4°C was 1.11% (95% confidence interval [CI], 0.94 - 1.28%) in 100% oxygen and significantly decreased to 0.48% (95% CI, 0.29-0.67%; p < 0.001) with midazolam, and 0.92% (95% CI, 0.74 - 1.09%; p = 0.016) with N₂O. No clinically relevant differences between treatments were noted with blood gases except for a lower partial pressure of oxygen with midazolam and N₂O treated groups. Heart rate was significantly lower by 2 beats minute⁻¹ with midazolam and N₂O compared to isoflurane alone. The MACiso in ball pythons was lower than that of previously reported reptilian species.

100. Understanding antimicrobial resistance along the farm-to-fork continuum using integrated assessment modelling: methods for the IAM.AMR project
Brennan Chapman¹
¹Department of Population Medicine, University of Guelph
Antimicrobial resistance (AMR) is one of the most significant global public health threats of the 21st century in terms of its scope, complexity, and its potential to disrupt human and animal health. An integrated assessment model framework was developed to describe the risk to consumers from AMR arising - or being disseminated through - the agri-food production system for select food-animal commodities. This framework, Integrated Assessment Modelling for Antimicrobial Resistance (IAM.AMR), was designed to integrate measures of association (MoAs) derived from disparate epidemiological studies and national surveillance systems to capture and explore the impact of factors influencing AMR along the farm-to-fork continuum. MoAs were integrated into the model as odds ratios using a branching probability tree approach. A comparison of model results indicates that certain bug-drug-commodity combinations result in greater exposure to antimicrobial resistant bacteria for consumers in Canada. Additionally, we demonstrate through sensitivity analysis that the probability of resistance at the earliest stage in the production chain can influence model outcomes to a greater extent than individual factors, reaffirming the need for accurate measures of resistance at placement - the start of the production chain. These findings have significant implications for future applications of integrated assessment modelling, and the expansion of the existing framework to incorporate additional food-animal commodities, exposure routes, and data inputs derived from whole genome sequencing.
101. Characterizing blaCTX-M-1 plasmids from Escherichia coli isolated from dogs, poultry, swine, horses, and cattle in Canada
Ashley Cormier¹, Gabhan Chalmers¹, Pauline Zhang¹, Tim McAllister², J. Scott Weese¹, Michael Mulvey³, Patrick Boerlin¹
¹Department of Pathobiology, University of Guelph
²Agriculture and Agri-Food Canada
³National Microbiology Lab of Canada

In Canada, blaCTX-M-1 is overwhelmingly the most common blaCTX-M variant found in Escherichia coli from chicken and horses and can be recovered at lower frequencies in pigs, cattle, and dogs. Whole genome sequencing has identified a large genetic diversity of isolates carrying this variant, warranting further investigation into the plasmids carrying this gene. The objective of this study was to characterize blaCTX-M-1 plasmids circulating in E. coli isolates from Canadian animals. Forty-nine blaCTX-M-1 positive E. coli isolates from chicken, horses, swine, turkey, dogs, and cattle were selected for plasmid characterization. Short-read sequences were obtained for a subset of isolates using Illumina technology and long-read sequences were obtained using the Oxford Nanopore MinION. Genomes were assembled using Unicycler Hybrid assembly and the resulting blaCTX-M-1 plasmids were analysed and compared using the Mauve Alignment plugin in Geneious. Plasmids from the same incompatibility group with similar susceptibility profiles were found across multiple animal species. Sequence alignments showed groups of conserved plasmids unique to each species in both chicken and horses. These results are similar to what has been reported in Europe where related blaCTX-M-1 plasmids circulate in bacteria from horses. Further investigation will be necessary to determine if the blaCTX-M-1 plasmids circulating in E. coli from Canadian horses and chickens relate to those found in animals and humans in Europe, and if they carry determinants that provide a selective advantage to their bacterial host in these animal species.

102. Circadian rhythms and sleep benefit heart health and healing from cardiovascular disease
Cristine Reitz, Faisal Alibhai, Tami Martino
Department of Biomedical Sciences, University of Guelph

Introduction: Circadian rhythms and sleep are critical to heart health. However, it's not fully understood how these benefits accrue, as current research seldom interrogates healthy paradigms, but instead focuses on the adverse effects of rhythm disruption or impaired sleep. Hypothesis: Manipulating the circadian system to increase sleep in mice leads to entirely novel insights into how to benefit heart health and treatment of heart disease. Methods and Results: To study the benefits of circadian rhythms and sleep, we housed nocturnal C57Bl/6 mice in an extended protocol of 12h light: 4h blue: 8h dark, which effectively increased their sleep period by 4 hours. We then assessed the benefits on heart disease, in mice subjected to transverse aortic constriction (TAC). In comparison to controls, TAC mice under the extended protocol had significantly better heart function (% ejection fraction; 50.29±±2.41% vs. 62.61±±4.50%). To elucidate the molecular mechanisms, we used an unbiased microarray and bioinformatics approach, and discovered significantly less activation of adverse cardiac remodeling pathways (e.g. natriuretic peptide B, Nppb, -2.07-fold; regulator of calcineurin 1, Rcan1, -3.39-fold), consistent with the improved outcomes. Conclusions: Using a remarkably simple strategy, we engineered an evidence-based murine model to determine how circadian rhythms and sleep benefit heart health and healing from cardiovascular disease.
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