

2017 SUMMER RESEARCH STUDENTSHIPS (IN ADDITION TO URA AND USRA)

Students interested in working on a particular summer research studentship project should contact the faculty member directly in advance of the competition closing date of February 10, 2017 to discuss possible involvement with the project.

Faculty will select the student based on the following criteria:

- Academic record (i.e., transcripts provided by the student)
- General interest in research and the summer research project
- Willingness to adhere to the terms and conditions of the Studentships particularly the commitment to be present for a maximum of 35 hours per week during the entire 16-week period of the research project. As students will receive 4% vacation pay on their hourly rate, it is expected that they will work full-time (35hrs/week) for the entire 16 weeks.
- Restrictions as stated in the studentship.

Faculty will inform the Associate Dean Research and Innovation at ovcsumre@uoguelph.ca of the name of the student chosen for the summer research student assistantship by February 13, 2017.

Please note that the competition closing date has been extended owing to the delay in posting the positions.

Below is a list of the 2017 summer research studentship project titles. It is followed by a list of project descriptions that include names and departments of faculty contacts.

James and Marjorie Pinkney Summer Research Studentship – Animal Welfare (Restricted to DVM students)	
1	Euthanasia of poultry by physical and gas methods: use of telemetry for welfare evaluation - Patricia Turner (Pathobiology) pvtturner@uoguelph.ca
Dr. Robert Ward Woolner Summer Student Research Funding – Small Animal Veterinary Medicine (Restricted to DVM students)	
2	Evaluating cross-matching techniques to increase blood transfusion safety in cats and dogs - Shauna Blois (Clinical Studies) sblois@uoguelph.ca
Merial Veterinary Scholars Program Scholarships (Restricted to DVM students)	
3	Safety evaluation of a novel nanoparticle imaging agent in dogs - Michelle Oblak (Clinical Studies) moblak@uoguelph.ca

4	Identification and quantification of circulating osteosarcoma tumour cells in the blood of dogs with osteosarcoma and correlation with the development of clinical metastasis - Brigitte Brisson (Clinical Studies) bbrisson@ovc.uoguelph.ca
Andrea Leger Dunbar Summer Research Studentships (No Restrictions)	
5	Production of an avian bornavirus reverse genetics platform - Leonardo Susta (Pathobiology) lsusta@uoguelph.ca
6	Differential gene expression during the mare-embryo dialogues associated with normal and failing pregnancies - Keith Betteridge (Biomedical Science) kbetter@uoguelph.ca
7	Assessing the distribution and abundance of Ixodes scapularis in Ontario - Claire Jardine (Pathobiology) cjardi01@uoguelph.ca
8	Development of a vaccine to protect against Toxoplasma gondii infection in sheep - Sarah Wootton (Pathobiology) kwootton@uoguelph.ca
9	Cytologic profile of bronchoalveolar lavage fluid in Ontario horses diagnosed with inflammatory airway disease in association with air pollution: a retrospective study - Janet Beeler-Marfisi (Pathobiology) jbeelerm@uoguelph.ca
10	Creation and validation of companion animal cancer cell lines for translational research - Brenda Coomber (Biomedical Science) bcoomber@uoguelph.ca
11	The impact of nidogen-1 on mammary tumor development and progression - Roger Moorehead (Biomedical Science) rmoorehe@ovc.uoguelph.ca
12	An investigation into the epidemiology of babesiosis in Ontario ticks and cervids - Nicole Nemeth (Pathobiology) nnemeth@uoguelph.ca
13	Determination of important causes of morbidity and mortality in captive psittacine birds submitted to the Ontario Veterinary College Teaching Hospital: management and treatment implications - Leonardo Susta (Pathobiology) lsusta@uoguelph.ca and Nicole Nemeth (Pathobiology) nnemeth@uoguelph.ca
14	Antibody specificity in canine cancers - Geoffrey Wood (Pathobiology) gewood@uoguelph.ca
Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Summer Research Studentships (No Restrictions)	
15	Comparison of surgical site infection rates following open or minimally invasive surgery in dogs - Ameet Singh (Clinical Studies) amsingh@uoguelph.ca
16	Effect of different carbohydrate sources on glycemic index, starch fractions and appetite-related gut hormones in dogs - Adronie Verbrugghe (Clinical Studies) averbrug@uoguelph.ca

17	Investigating the occurrence of Echinococcus multicularis in wild small mammals - Claire Jardine (Pathobiology) cjardi01@uoguelph.ca and Andrew Peregrine (Pathobiology) aperegri@ovc.uoguelph.ca
18	Mental health support for agricultural producers: A scoping review of Ontario, Canadian, and international support programs - Andria Jones-Bitton (Population Medicine) ajjones@uoguelph.ca
19	In vivo tracking of equine stem cells following intravenous injection - Thomas Koch (Biomedical Science) tkoch@uoguelph.ca
20	MicroRNAs as markers and mediators of embryo development - Jonathan LaMarre (Biomedical Science) jlamarre@ovc.uoguelph.ca
21	Assessment of prevalence of Equine Herpesvirus-1, and relative risk of abortion in Ontario breeding farms - Brandon Lillie (Pathobiology) blillie@uoguelph.ca
22	Genetic selection for disease resistance: adapting High Immune Response Technology for application in the beef industry - Bonnie Mallard (Pathobiology) bmallard@ovc.uoguelph.ca
23	Efficacy of NSAIDs when compounded (mixed) with iron dextran on pain relief following castration in piglets - Terri O'Sullivan (Population Medicine) tosulliv@uoguelph.ca
24	Peripheral blood mononuclear cell activation dynamics during bovine intestinal Mycobacterium avium subspecies paratuberculosis infection - Brandon Plattner (Pathobiology) bplattne@uoguelph.ca
Ministry of Advanced Education and Skills Development (MAESD) Summer Research Studentships (Restricted to DVM Students)	
25	Exploring the use of emerging technology in veterinary medicine and its impact on the bonds among veterinarians, clients and their animals - Theresa Bernardo (Population Medicine) tbernardo@uoguelph.ca
26	Changes in nasal populations of bovine respiratory pathogens: effect of aerosol immunostimulation and relationship to development of pneumonia - Jeff Caswell (Pathobiology) jcaswell@uoguelph.ca
27	Profiling adaptive immunity in canine autoimmune thyroiditis - Stefan Keller (Pathobiology) smkeller@uoguelph.ca
28	Attitudes towards lifetime use and cumulative endpoints for research and teaching animals - Patricia Turner (Pathobiology) pvtturner@uoguelph.ca
29	Elucidation of the oncogenic mechanism of the envelope (Env) protein of Jaagsiekte Sheep Retrovirus (JSRV) - Sarah Wootton (Pathobiology) kwootton@uoguelph.ca

James and Marjorie Pinkney Summer Research Studentship – Animal Welfare (DVM students) (1 project)

1. Project Title: Euthanasia of poultry by physical and gas methods: use of telemetry for welfare evaluation

Faculty Contact: Patricia Turner (Pathobiology) pvtturner@uoguelph.ca

Project Description: On-farm euthanasia has become a priority issue for all livestock and poultry sectors in Canada and elsewhere. Recent undercover investigations of Canadian poultry producers, including egg and turkey farmers, have brought on-farm euthanasia to the forefront of public concern. It also highlighted the significant need for science-based recommendations for appropriate euthanasia techniques concerning poultry of all ages, types and sizes, including day old layer chicks, mis-sexed roosters on pullet farms and adult hens and toms. The scientists working on this project (Turner, Widowski, Torrey, etc) have received requests from individual egg, broiler, and turkey farmers, staff at EFC and veterinarians in the layer and turkey industries for information concerning euthanasia. The results of this project will provide much needed data to back up decisions about humane techniques to use on poultry farms and will provide direct benefits to poultry farmers making those decisions. The results can be used to directly inform recommendations in the Animal Care Programs for each of the industries. The specific research for this summer will involve instrumenting cull chickens and turkeys with telemetry devices to record EEG and ECG activity during euthanasia using either physical methods or CO₂ gas inhalation. This information is needed to determine what birds experience before and after loss of consciousness (sensitivity). The summer student will assist with poultry anesthesia, surgical prepping and monitoring, telemetry analyses, and behavioural scoring to assess bird welfare.

Dr. Robert Ward Woolner Summer Student Research Funding – Small Animal Veterinary Medicine (Restricted to DVM students) (1 project)

2. Project Title: Evaluating cross-matching techniques to increase blood transfusion safety in cats and dogs

Faculty Contact: Shauna Blois (Clinical Studies) sblois@uoguelph.ca

Project Description: Blood transfusion is an essential part of therapy for critical small animal patients. Crossmatching (CM) is a method used to test blood compatibility between a blood donor and an intended recipient, prior to blood transfusion, to decrease risk of transfusion reactions. CM is performed by sending a sample away to a reference laboratory, or less often in a clinic using very laborious techniques. As a result, CM is often not performed because results will not be immediately available for patients needing emergency transfusion, or because the test is too time-consuming to perform in the clinic. New in-clinic CM kits provide

rapid CM results for cats and dogs, but the accuracy of such kits is unknown and therefore needs to be explored.

This study aims to compare the accuracy of in-clinic CM kits in cats and dogs to standardized laboratory methods (the gold standard). CM will be performed on blood samples collected from patients that are in need of transfusion, and 2 different in-clinic CM techniques will be compared to the gold standard technique. In addition to testing accuracy of point-of-care CM kits, rates of incompatible CM among clinical populations will also be tracked in this clinical project. This project is funded by PVC Pet Trust.

Student responsibilities include: 1) assisting in recruitment of patients in need of transfusion at the OVC-HSC; 2) organizing sample collection; 3) performing in-clinic CM; 4) assisting with data collection for a retrospective study in support of this project (data analysis of medical records from the OVC-HSC of patients that have previously undergone transfusion); 5) participating in other clinical trials and research projects with the small animal internal medicine service as time allows.

By the end of the 16-week work placement, the student will become familiar with many aspects of clinical research, and will have the opportunity to be an author on manuscripts related to this research project.

Merial Veterinary Scholars Program Scholarships (Restricted to DVM students) (2 projects)

3. Project Title: Safety evaluation of a novel nanoparticle imaging agent in dogs

Faculty Contact: Michelle Oblak (Clinical Studies) moblak@uoguelph.ca

Project Description: This research project involves the evaluation of the safety of a novel imaging agent for both preoperative and intraoperative imaging in dogs. This project is AUP approved and funded in collaboration with a researcher at the University Health Network. In patients with cancer, evaluation for metastasis often occurs both prior to surgery and at the time of the procedure. Frequently, preoperative imaging and surgery occur days to weeks apart. This time difference results in multiple injections required for evaluation and can also cause inconsistent results. The agent we are evaluating would allow for a single injection at the time of imaging. As a result of the nanoparticles, the agent becomes trapped in the area of interest, prolonging its effectiveness and allowing for visualization for days-weeks after injection. There are 2 phases to this study. The first phase involves intravenous (IV) injection of the agent for evaluation in 6 purpose bred dogs. This phase of the research will involve safety evaluation as well as imaging at the time of injection and 24, 48, 72h, 7 & 14 days post injection to see how long the agent remains visible. As part of this research project, you will have the opportunity to practice patient handling, injection techniques, monitoring and IV catheterization (depending on training levels). You will also be assisting with post-procedure

monitoring, medication administration, venipuncture and care for the dogs. After a period of washout, the second phase of the study will occur. Phase 2 involves local injection of the imaging agent for evaluation of sentinel lymph nodes (SLN). In this phase, the agent will be administered locally and the dogs monitored for safety, drainage to the SLN as well as imaging similar to the previous study. The student selected for this research project will play a very important role in data collection and have the opportunity to present the research at the OVC CORE program and is required to attend the Meriel-NIH Veterinary Scholars Program Symposium to be held this year at the National Institutes of Health in Bethesda Maryland, USA from August 3-6 (all expenses paid). Depending on the interests and aptitude of the individual they will also participate in manuscript preparation and presentation of this research at future conferences.

- 4. Project Title:** Identification and quantification of circulating osteosarcoma tumour cells in the blood of dogs with osteosarcoma and correlation with the development of clinical metastasis

Faculty Contact: Brigitte Brisson (Clinical Studies) bbrisson@ovc.uoguelph.ca

Project Description: Osteosarcoma (OSA) is a common, aggressive and highly metastatic primary malignant bone cancer of dogs. Current standard of care consists of limb amputation to control local disease + chemotherapy to control metastatic progression. Despite this, many patients treated by amputation + chemotherapy will develop radiographic evidence of metastasis early in the course of disease. In veterinary medicine, metastasis is typically screened by thoracic radiographs with lung metastasis being visible only once they are 0.5-1cm in size making it a poor early indicator of metastasis. There is no current means to predict metastasis in dogs at this time.

Circulating tumour cells (CTC's) are being studied and are used clinically as an indicator of prognosis in human patients with certain cancers and have not yet been assessed in dogs, but could be beneficial to clients and clinicians making decisions about cancer treatment for their pets. In particular, it may allow identification of patients that do not respond to certain chemotherapy protocols allowing for a change in treatment prior to the development of gross / clinical evidence of metastasis and to predict prognosis for individual patients which may guide owner decision-making.

The objectives of this study are to: 1) establish and validate a protocol for detecting and quantifying CTCs in veterinary OSA patients (completed summer 2016); 2) quantify OSA CTCs in dogs treated with amputation + chemo and correlate CTCs with clinical development of metastasis; and 3) assess the utility of a commercial cell enrichment tube (Oncoquick™) for identification and quantification of CTCs. This project represents a unique, novel and exciting opportunity to develop an accurate, minimally-invasive and applicable method for identification of metastatic disease prior to clinical detection that will allow tracking of disease

progression and monitoring response to chemotherapy, and help to predict prognosis. This study has an approved AUP and is funded by the Ontario Veterinary Pet Trust.

The student will participate in case recruitment, will be exposed to the clinical treatment of dogs with OSA within the OVCHSC, will help with sample collection (blood and bone) and will learn laboratory methods of flow cytometry as they perform the analysis of blood samples for this study. Knowledge of flow cytometry techniques is considered an asset but is not a requirement as it can be learned. The student will be given the opportunity to co-author a publication that stems from the research and to attend rounds / clinics when possible. The student will participate in the CORE program and is required to attend the Merial-NIH Veterinary Scholars Program Symposium to be held this year at the National Institutes of Health in Bethesda Maryland, USA from August 3-6 (all expenses paid).

Andrea Leger Dunbar Summer Research Studentships (No Restrictions) (10 projects)

5. Project Title: Production of an avian bornavirus reverse genetics platform

Faculty Contact: Leonardo Susta (Pathobiology) lsusta@uoguelph.ca

Project Description: Avian bornavirus (ABV) is an emerging virus that has been recently detected in an increasing number of avian species, including psittacine birds, waterfowl and finches. Aquatic bird bornavirus (ABBV, a type of ABV) is highly prevalent in wild waterfowl in Canada, in which it infects the nervous system. Given the broad host range of ABVs, transmission and establishment of ABBV in poultry species is a possible threat, and warrants further studies on ABBV virulence and disease inducing ability. A reverse genetic platform for production of recombinant ABBV strains could immensely enable future studies on the biology of this virus. For instance, recombinant ABBV strains expressing the green fluorescent protein could allow better tracking of the virus in experimentally infected birds; modification of single genes could assess their contribution to virulence; rational attenuation of recombinant viruses could lead to vaccine production.

The goal of this project is to create the full-length DNA clone of a recombinant ABBV strain expressing the green fluorescent protein, enabling a platform for future experiments.

The summer student will closely work with a post-doctoral research fellow in the laboratory, as outlined by the following objectives: 1) PCR-clone different segments of ABBV genome and expression vector, based on specific unique restriction sites; 2) PCR-clone the coding sequence of N (nucleocapsid), P (phosphoprotein) and L (polymerase) genes of ABBV into expression plasmids to produce helper plasmids; 3) through multiple steps, ligate the multiple segments from objective 1 using the In-Fusion PCR system in order to produce a full length clone (FLC) of ABBV; and 4) confirm FLC correct sequence by sequencing. Depending on the progress throughout the summer, rescue of the FLC using the helper plasmids could be attempted.

At the completion of this assistantship, the student will have become familiar with ABV basic virology, molecular cloning, and reverse genetics of negative sense single stranded RNA viruses. These skills will be very valuable for coursework and training in microbiology, virology, molecular biology, and for future career in research.

6. Project Title: Differential gene expression during the mare-embryo dialogues associated with normal and failing pregnancies

Faculty Contact: Keith Betteridge (Biomedical Science) kbetter@uoguelph.ca

Project Description: This project is part of a broader study of the biology of normal and failing early pregnancy in horses. It will focus on the real-time qPCR quantification of genes that we have identified (by RNA sequencing) as being significantly up- or down-regulated in tissues in failing pregnancies compared with normal pregnancies, and which we believe to be important to the maternal-embryonic signalling (especially steroidal) that is essential to the establishment and maintenance of pregnancy. 'Next generation' sequencing data have already been generated (Drs Hayes and Lillie, Pathobiology) from endometrial biopsies collected from mares (n=5 per group) at 3 stages of pregnancy (Days 14-15, 20-23, 28-30), non-pregnant mares, and mares undergoing spontaneous or induced embryonic loss. On-going analysis of differential gene expression across these groups has so far yielded several genes (e.g. LCN1, GRIK1, GABRP, HDC, SLC39A2, OR51L1, ILRA31) of particular physiological interest. We will now use real time qPCR to verify gene expression in this subset. In addition, we will be looking at genes that are identified as being up- or down-regulated in the conceptus based on concurrent gene expression studies. The student will perform their benchwork in Dr. Lillie's multi-PI lab and be involved in all aspects of the project. Primarily involved in cDNA synthesis and RT-qPCR, he/she will also be exposed to molecular techniques including next-generation sequencing, RT-PCR, gel electrophoresis, DNA/RNA isolation, and how these techniques are applicable to disease diagnosis. He/she will also explore how the RNAseq data complement our previous microarray and proteomic data as potential indicators of pregnancy success or failure. Findings will be interpreted comparatively (across species) and in relation to published literature in the field.

7. Project Title: Assessing the distribution and abundance of *Ixodes scapularis* in Ontario

Faculty Contact: Claire Jardine (Pathobiology) cjardi01@uoguelph.ca

Project Description: Lyme disease is the most important vector borne disease affecting humans in North America. The distribution and abundance of the tick vector in Ontario, *Ixodes scapularis*, is changing rapidly. It is expected that this vector will continue to spread northward, and ongoing surveillance is needed to understand the changing risk of disease. The objective of this project is to monitor the distribution of *I. scapularis* and *B. burgdorferi* in Ontario. We will use tick dragging to assess the presence and abundance of ticks at our established field sites throughout Ontario. Ecological site data (e.g., vegetation type and % cover) will also be collected and used to identify site specific risk factors for tick invasion.

Results from the 2017 field season will be compared with data from previous years to assess the degree of spread of vector and pathogen. Up-to-date information about the current distribution of the tick and pathogen in Ontario is essential for informing public health messaging and will allow managers to target preventative measures to appropriate areas. The student selected for this project will be working throughout southern Ontario and will be part of a team led by a graduate student working on a related project. The student will be involved in field data collection, data analysis and will present their research findings as part of the OVC CORE program. The majority of the summer will be spent working in the field.

8. Project Title: Development of a vaccine to protect against *Toxoplasma gondii* infection in sheep

Faculty Contact: Sarah Wootton (Pathobiology) kwootton@uoguelph.ca

Project Description: *Toxoplasma gondii* is one of the most common causes of abortion in sheep and goats in Ontario and economic losses are tremendous. A modified-live vaccine (Toxovax) has been shown to be protective, but logistical barriers preclude its use in Canada. Parapoxvirus ovis (Orf virus; ORFV) recombinants are novel and have been reported to mediate protective cell-mediated immunity against a number of important veterinary pathogens, including but not limited to classical swine fever and pseudorabies virus. Attributes which favour the use of ORFV as a viral vaccine vector include a large genome allowing for multiple insertions, limited host range (sheep and goats), epitheliotropism, and cytoplasmic replication in host cells. Adenoviruses are popular viral vaccine vectors with a broad tropism in mammalian hosts, a high safety profile, easy manipulation due to a well-characterized genome, and have the ability to induce both innate and adaptive immune responses. We hypothesize that ORFV and Human Adenovirus serotype 48 (AdV48) expressing antigens from *T. gondii* will induce a protective immune response in sheep resulting in decreased tissue-cyst burden and/or incidence of abortion.

The objectives of this OMAFRA/OSMA funded project are: 1) to engineer recombinant ORFV and AdV48 expressing three antigens from *T. gondii*; 2) to evaluate the immune response in mice following immunization with recombinant ORFV/AdV48; and 3) to determine clinical efficacy of vaccination with recombinant ORFV/AdV48.

To date, we have engineered recombinant ORFV and AdV48 expressing three antigens from *T. gondii* (SAG1, GRA2, ROP2) known to stimulate potent T-cell responses. The summer research assistant would be responsible for assisting the PhD graduate student in the preliminary phases of objectives 2 and 3. The student will receive training in the areas of molecular biology, immunology, and mouse-handling, and no previous experience is necessary. Dependent on the progress of the project, the student may obtain hands-on experience with sheep. Students will be required to participate in weekly lab meetings and the Summer CORE Program.

9. Project Title: Cytologic profile of bronchoalveolar lavage fluid in Ontario horses diagnosed with inflammatory airway disease in association with air pollution: a retrospective study

Faculty Contact: Janet Beeler-Marfisi (Pathobiology) jbeelerm@uoguelph.ca

Project Description: The student will access the Pathobiology database ("Labvantage") to identify horses that had a diagnosis of Inflammatory Airway Disease (IAD, or mild-to-moderate persistent asthma) between the years of 2007 and 2017. The student will subcategorize the type of IAD based on the predominant cell type noted in the differential cell count (e.g., neutrophils, eosinophils, mast cells, etc.). These findings will be compared to historical records of air quality pollutant data available from the Ontario government (http://www.airqualityontario.com/science/data_sets.php) to determine if any associations between predominant cell type and degree of pollution exist. The student will also participate in the Career Opportunities and Research Experience program, undertake scientific presentations to peers at the OVC, and will participate in the writing of a scientific journal article based on the research findings. Through this project the student will learn about lung disease in horses, as well as how to analyze equine bronchoalveolar lavage fluid, manage data, perform statistical analyses, and how to approach scientific writing.

Background: Inflammatory Airway Disease is similar to mild-to-moderate forms of persistent human asthma. Typically noted in young performance horses, IAD is characterised by coughing in association with exercise and decreased athletic performance. Because of this, it is a disease of economic importance to both the racing and the sport horse industries in Ontario. Finally, increased air pollution is associated with increased numbers of asthma attacks in children and adults, but whether air pollution is also associated with IAD in Ontario horses has not been investigated.

10. Project Title: Creation and validation of companion animal cancer cell lines for translational research

Faculty Contact: Brenda Coomber (Biomedical Science) bcoomber@uoguelph.ca

Project Description: The Companion Animal Tumour Sample Bank, part of the U of G Institute for Comparative Cancer Investigation (ICCI), collects and stores samples of cancers from pets undergoing treatment for their disease at OVC. Whenever possible, additional tumour tissue is used to generate cancer cell lines for future research. We currently have over 25 ICCI cell lines in various stages of characterization, and are continuing to generate more at every opportunity. Cell lines are characterized by their morphology, growth habits, and expression of key markers related to cell identity and malignancy. A recent development in cancer pathobiology is the use of tissue microarrays (TMAs), which are microscope slides containing dozens of cores of tissue from cancer specimens, allowing high throughput screening of multiple cases for expression patterns. A modified approach to this creates TMAs with cores

from pellets of cultured cells. For this student project, we plan to generate an ICCI cell line bank TMA containing cores from pellets from our cell lines, matched tissue of origin, and pellets of human cancer cell lines with known expression patterns as positive controls. The student will therefore perform tissue culture protocols including isolation of cancer cells from excised tumour tissue for primary culture, subculture and growth assessment approaches, and maintenance and cryopreservation of cell lines. The student will also be trained in histological techniques including generation of agarose cell pellets, fixation and paraffin embedding, sectioning and immunohistochemistry. In addition, the student will participate in ICCI tumour banking and in the OVC summer CORE program.

11. Project Title: The impact of nidogen-1 on mammary tumor development and progression

Faculty Contact: Roger Moorehead (Biomedical Science) rmoorehe@ovc.uoguelph.ca

Project Description: Mycobacterium avium subspecies paratuberculosis (Map) is the etiologic agent of bovine paratuberculosis also known as Johne's disease, an economically significant production-limiting disease in the dairy industry. After initial infection, the disease is characterized by a long subclinical phase (two or more years) followed by progressive granulomatous enteritis, failure of adequate nutrient absorption, diarrhea, weight loss and eventually death. The pathogenesis and Map-specific immune responses of early infection remain poorly understood and in particular it is not understood why some calves are apparently able to clear the pathogen while others become persistently infected. Our hypothesis is that during early stages of intestinal Map infection, expression of activation markers on peripheral blood lymphocyte subsets is altered compared with uninfected calves. The student will develop multicolor flow cytometry and fluorescence microscopy assays to assess lymphocyte phenotype and activation status, and then study how this correlates with Map infection, early clearance and persistent infection. The hypothesis will be tested using a bank of PBMCs obtained from experimentally Map-infected calves.

12. Project Title: An investigation into the epidemiology of babesiosis in Ontario ticks and cervids

Faculty Contact: Nicole Nemeth (Pathobiology) nnemeth@uoguelph.ca

Project Description: Babesia odocoilei is an emerging tick-borne protozoan parasite of veterinary importance. It is the causative agent of cervid babesiosis, a fatal hemolytic disease of deer, elk and reindeer. B. odocoilei is transmitted by the black-legged tick, whose range is expanding in North America in association with climate change. Cervid babesiosis was first identified in Ontario at the Toronto Zoo in 2012; the impact of this disease on wild and farmed cervids in Ontario is unknown. The objective of this research is to describe the eco-epidemiology of cervid babesiosis in Ontario, by using molecular methods to test for B. odocoilei DNA in samples collected from wild, farmed and zoo cervids, and in the tick vector.

We hypothesise that *B. odocoilei*-infected ticks are transported into Ontario from babesiosis-endemic areas of the southern US by migratory birds; we will thus conduct fieldwork to collect and test ticks from northward-migrating birds. Our research has been endorsed by the Toronto Zoo, and coordinates well with ongoing research activities of Department of Pathobiology faculty members and the Canadian Wildlife Health Cooperative. This project is a core component of the graduate (DVSc) research of Dr. Ellie Milnes, currently in semester 5 of the OVC/Toronto Zoo zoological medicine residency. A pilot study in summer 2016 established tick collection and testing methods, the work plan for summer 2017 provides an exciting opportunity for a student to gain exposure to collaborative research on wildlife and vector-borne disease ecology, epidemiology, and entomology in both field and lab environments. The role of the summer student assistant in this project will be to assist with:

1. Tick dragging and collection at field sites in southern Ontario (including the Toronto Zoo).
2. Field work at Long Point Bird Observatory in conjunction with Bird Studies Canada and the Canadian Migration Monitoring Network. There will be early mornings and long hours in the field removing wild birds from mist nets and systematically examining them for and collecting ectoparasites. The student will gain an intensive introduction to ornithological field work, including training on bird handling and identification.
3. Laboratory speciation of avian ectoparasites using light microscopy and taxonomic keys.
4. Tick and tissue sample processing (DNA extraction and PCR).
5. Data organization, analyses, and summary, with the option for a student to collaborate on posters and papers for publication.

13. Project Title: Determination of important causes of morbidity and mortality in captive psittacine birds submitted to the Ontario Veterinary College Teaching Hospital: management and treatment implications

Faculty Contact: Leonardo Susta (Pathobiology) lsusta@uoguelph.ca and Nicole Nemeth (Pathobiology) nnemeth@uoguelph.ca

Project Description: The specific aim of this study is to perform an exhaustive review of pathological diagnoses (postmortem and biopsy) of psittacine birds submitted to the Ontario Veterinary College (OVC) and Animal Health Laboratory (AHL), with the overarching goal to formulate practical recommendations for diagnosticians and clinicians engaged in psittacine medicine, such as production of accurate lists of differential diagnoses, implementation of diagnostic algorithms, and identification of risk factors (e.g., age, sex, taxonomy, history) associated with disease prevalence.

This application builds on the initial groundwork laid over the past year within the frame of a recently funded OVC Pet Trust project, which resulted in organization and formatting of a large database (approximately 1300 cases) containing the pathological diagnoses of psittacine birds submitted to the OVC and AHL from 1995 to 2015. This database is fully searchable by key-

word and pivot table, with specific coding for signalment, etiological categories, affected organ systems, and diagnostic tests.

The work of the summer student will stem directly from this database, as outlined in the following objectives: 1) consolidate the existing database, through harmonization of the coding systems; 2) hierarchically identify, within each genus, the frequency of affected organ systems, and for each system the frequency of etiological categories; 3) identify and retrieve cases that necessitate review (i.e., final diagnosis was not reached) or additional testing (e.g., PCR for suspected infectious diseases); 4) modify the current database into a binary format, to be inputted into statistical software for regression analysis. Proposed timeline: Objective #1, week 1-3; Objective #2, week 4-6; Objective #3, week 7-11; Objective #4, week 4-16 (this objective can overlap with others).

At the completion of this assistantship, the student will have become familiar with most common psittacine/avian diseases, and different aspects of veterinary diagnostics and epidemiology. These skills will be very valuable for coursework and training within the DVM curriculum, as well as his or her future career. The operational cost of this research was provided by the OVC Pet Trust, and by mentoring a second student working on this project, we hope to show continuity and progress, as well as help an interested student develop their skills and interests in avian medicine / pathology.

14. Project Title: Antibody specificity in canine cancers

Faculty Contact: Geoffrey Wood (Pathobiology) gewood@uoguelph.ca

Project Description: Antibodies are used for both diagnosis and prognosis of cancer by immunohistochemistry (IHC). This allows detection of specific proteins that are targets for modern molecular therapies, and also helps predict how aggressive a cancer will behave. Antibodies raised against human proteins/peptides are often used for IHC in canine cancer biopsies, but whether these antibodies are actually binding to the correct canine proteins is often assumed, but not known. In particular, a recent study showed that an antibody to the common breast cancer prognosticating protein HER2 does not bind canine HER2 in dog mammary cancers. This project will use canine and human cancer cell lines already in the lab as well as samples collected from post-mortem examinations. The human cell lines have known levels of protein expression for specific markers including hormone receptors and tyrosine kinase receptors, all of which are targets of molecular therapies. Cell lines will be concentrated by centrifugation and fixed for IHC, and parallel experiments will isolate protein from these cells for western blotting. Comparisons of band molecular weight and density on westerns and IHC labelling intensity on slides will be made across species. Western blot bands will be cut out and sent to the University of Guelph mass spectroscopy centre for analysis of which proteins correspond to bands of interest. Finally, the effect of targeted molecular drugs will be tested on canine cell lines with varying target expression to validate the findings.

A substantial component of this position involves experiential learning and assisting in post-mortem examinations of domestic animal species in the post-mortem suite of Pathobiology. Therefore, proof of immunity to rabies (a protective titre) is required.

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Summer Research Studentships (No restrictions) (10 Projects: projects are related to OMAFRA research priorities)

15. Project Title: Comparison of surgical site infection rates following open or minimally invasive surgery in dogs

Faculty Contact: Ameet Singh (Clinical Studies) amsingh@uoguelph.ca

Project Description: Minimally invasive surgery (MIS) is gaining tremendous popularity in veterinary medicine. In people, MIS is associated with a reduced surgical site infection (SSI) rate compared to traditional surgery performed by open approaches. Although stated as a proposed benefit of MIS in veterinary patients, this association has not yet been explored. Surgical site infections are increasing in veterinary surgery and are associated with increased patient morbidity and treatment costs, prolonged hospitalization and client and medical caregiver grief and frustration. Additionally, the emergence of multi-drug resistant bacteria have complicated the treatment of SSI. Determining methods to reduce the incidence of SSI, including the use of MIS, is of paramount importance in veterinary surgery.

The student will join an active research team in the area of MIS and SSI and be involved in study design and data collection. The student will gain exposure to a variety of investigational activities and develop a broad understanding in performing basic and clinical research. The main study is prospective in nature with all cases undergoing MIS or open laparotomy or thoracotomy and classified as a “clean” or “clean-contaminated” eligible for enrolment. Active surveillance will be performed at 30 days post-operatively as stated by the Centers for Disease Control and Prevention guidelines for SSI. In addition, the student will have an opportunity to join other related projects ongoing by other members of the research group.

16. Project Title: Effect of different carbohydrate sources on glycemic index, starch fractions and appetite-related gut hormones in dogs

Faculty Contact: Adronie Verbrugge (Clinical Studies) averbrug@uoguelph.ca

Project Description: Obesity and diabetes are leading nutrition-related disorders among pets in North America and have significant impacts on animal morbidity and mortality. However, the effect of diet on these diseases is poorly studied in dogs. The type and amount of carbohydrates may play a key role in health and disease modulation. The glycemic index, a measure of post-prandial blood glucose response, which in humans significantly impacts glucose control, insulin sensitivity, weight management, and chronic disease risk. In pets, the

effects of carbohydrates on health are an area of debate and a lack of data to back up claims currently exists. The goal of this research is to examine the effect of different carbohydrate sources in pet food on glucose and insulin metabolism and relate this to the starch types present in the diet.

This research will determine the glycemic index and insulinemic response of four commercially available extruded dog foods containing different carbohydrate sources in a 6-week feeding trial in a healthy sled dog population. The types of starch fractions in the foods (rapidly digestible starch, slowly digestible starch, resistant starch) will be measured to determine if a relationship exists between the content of these starch fractions and glycemic and insulinemic response. This study will also look at canine gut hormones related to satiety, in order to determine a possible relationship with these different starch fractions and the feeling of fullness in dogs. Prior to this feeding trial, a 2-week pilot study will be performed to assess the potential of using white bread as a control in glycemic index testing for dogs (as done in humans), as opposed to a glucose solution.

This research will allow for the formulation of healthier foods for dogs since the majority of pet owners feed kibble due to its convenience, safety and appeal to pets.

The summer student will review the literature related to the research topic and will be involved in animal work and laboratory work. The animal work for the pilot study is planned for May 2017. Subsequently the laboratory work will be performed. The main study will occur June-July 2017 followed by bench top laboratory work. The summer student will have the opportunity to present the research at the OVC CORE program. And depending on the student's interests, the student will also participate in manuscript preparation and presentation of this research at future conferences.

17. Project Title: Investigating the occurrence of *Echinococcus multilocularis* in wild small mammals

Faculty Contact: Claire Jardine (Pathobiology) cjardi01@uoguelph.ca and Andrew Peregrine (Pathobiology) aperegri@ovc.uoguelph.ca

Project Description: *Echinococcus multilocularis* is a zoonotic parasite that has the potential to cause significant morbidity and mortality in people when untreated. In North America, adult *E. multilocularis* occurs in the small intestine of wild canids such as coyotes and foxes. If infective eggs are ingested by the typical intermediate host (wild small mammals) an alveolar hydatid cyst develops in the liver. The life cycle is completed when the intermediate host is ingested by wild canids. Historically, there have been two recognized endemic areas in North America for this parasite; the Northern Tundra Zone, and the North Central Region. Prior to 2012, *E. multilocularis* had never been diagnosed in Ontario. Since then, alveolar echinococcosis (AE) has been reported in 5 dogs, 2 non-human primates, and one free-living chipmunk in southern

Ontario. Currently, we rely on post mortem examination for diagnosing *E. multilocularis* in small mammal carcasses. Our specific objectives for this pilot project are to determine: 1) which small mammal species are acting as intermediate hosts of *E. multilocularis*; 2) the prevalence of *E. multilocularis* in different small mammal hosts; and 3) if abdominal ultrasound can be used as a screening tool to identify suspect cases of *E. multilocularis* in small mammals. For this pilot study we are focusing our investigations on the area where the infected chipmunk was identified as this is considered to be a high risk area. This study will allow us to identify intermediate hosts of *E. multilocularis* and determine their relative role in the transmission of this parasite in a high risk area. In addition, if abdominal ultrasound proves to be a useful diagnostic tool, we will have an alternative antemortem test for this parasite in small mammals. The student selected for this project will be involved in small mammal trapping and handling, necropsy, and data analysis and will present their research findings as part of the OVC CORE program.

18. Project Title: Mental health support for agricultural producers: A scoping review of Ontario, Canadian, and international support programs

Faculty Contact: Andria Jones-Bitton (Population Medicine) ajjones@uoguelph.ca

Project Description: This project will work towards filling an important knowledge gap facing the Ontario and Canadian agricultural industries. Recent work at the OVC supports international findings that agricultural producers experience higher levels of stress, psychological distress, and suicide than other occupations. Unfortunately, there is a serious gap in knowledge regarding the mental health supports available to producers in Ontario, and Canada at large. Collaborating agricultural organization partners have confirmed this being a serious barrier to provision of support for producers and have stressed the need to know what support systems are in place, where, what they offer, and how they are evaluated.

The student in this position will work on the difficult task of scoping the existing peer-reviewed, grey, and online literature, as well as communicate with mental health and agricultural organizations, to identify and describe the support programs currently in place in Ontario, other Canadian provinces, and in some instances, internationally (e.g., UK and Australia have large programs). This will help fill an important knowledge gap and is crucial to inform a larger project on mental health literacy and support for Canadian agriculture that the research team is currently working on.

The student may also assist with conducting key informant interviews for two larger projects related to mental health and wellbeing of agricultural producers and veterinarians, and assist with research involving the development of a mental health literacy training program for agriculture. Previous experience with website and app design an asset.

19. Project Title: In vivo tracking of equine stem cells following intravenous injection

Faculty Contact: Thomas Koch (Biomedical Science) tkoch@uoguelph.ca

Project Description: Exercise induced pulmonary hemorrhage (EIPH) is a common condition in racehorses and a significant equine welfare issue (OMAFRA priority). The etiology of EIPH is poorly understood but pulmonary inflammation is a downstream consequence of frequent bleeding. Attenuation of pulmonary inflammation from bleeding following intravenous MSC injection has been shown in vivo in humans and non-equine species. Work in the Koch lab has demonstrated that equine umbilical cord blood-derived (CB) MSC are more immunomodulatory than the more commonly used MSCs derived in vitro from adipose tissue or bone marrow aspirates. The hypothesis of this Equine Quelpf-funded project is that allogeneic equine CB-MSC will attenuate eiph-associated pulmonary inflammation in standardbred racehorses with active eiph.

The main experiment of the project is to evaluate the effect on lung bleeding within Standardbred horses suffering from EIPH following injection of allogeneic CB-MSC intravenously. However, insights into the functional mechanism of such stem cell therapy are sought in a separate study conducted on research horses. It is this second study we are seeking summer student support for.

In this summer project the successful student will work alongside DVSc student Dr. Dustin Dennis (large animal medicine) to determine the distribution of Molday-ion labelled CB-MSCs following intravenous injection in 3 research horses. Dr. Dennis is co-supervised by Dr. Joanne Hewson, Clinical Studies. Nuclear scintigraphy studies have documented that MSCs largely locate to the lungs following IV injection. However, this technology does not allow the assessment of the specific cell location within the lungs, interaction with resident cells or distribution to the systemic circulation beyond 24-hours. We have published the utility of using Molday-ION labelling for cell tracking studies in horse (Bourzac et al., AJVR, 2014). CB-MSCs are readily labelled with this iron particle that has a fluorescent protein attached to it. We will utilize the fluorescent nature of the labelled cells to identify them in fluid and tissue samples. We will determine the distribution of the injected MSCs over a 7-day period through a combination of bronchoalveolar lavage, lung biopsy and blood analysis studies.

The successful student will work in the clinic as well as the lab. In the lab, the student will learn aseptic tissue culture technique, histological tissue evaluation, and flow cytometry cell evaluation techniques. In the clinic, the student will assist with all aspects of the project from daily monitoring of the horses to diagnostic sampling. Dr. Koch has a thriving research environment consisting of 8-12 people. He has advised 2-3 summer students every summer for the past 4 years and the student will attend lab meetings, departmental seminars and interact with other undergraduate students, graduate students and the principle investigator on a daily basis. The student will participate in the Summer CORE Program at OVC.

20. Project Title: MicroRNAs as markers and mediators of embryo development

Faculty Contact: Jonathan LaMarre (Biomedical Science) jlamarre@ovc.uoguelph.ca

Project Description: Normal reproduction in veterinary species and humans depends on the stringent regulation of gene expression in developing embryos. Several published studies with significant impact from my laboratory have implicated small RNAs (miRNAs, piRNAs: Russell et al, BOR, 2016, Reproduction, 2017, Gilchrist et al, IJMS, 2016) as key mediators of preimplantation embryo development. Furthermore, preliminary studies suggest that miRNAs are actually released into the culture medium during in vitro embryo development, where they may act as biomarkers of embryo health. Current research suggests that the expression of specific miRNAs in embryo culture media may be indicative of blastocyst quality and probability of implantation. One major issue with this research is that a single embryo secretes a relatively small amount of miRNA into its culture media, making reproducible miRNA detection and quantification difficult. To address this issue, my lab has partnered with an IVF clinic that uses a routine laser-collapse technique to expel the fluid from an embryo before freezing. The aim of this 8-week project is to investigate whether this laser-collapse creates a culture media sample that has been enriched with miRNA. Specifically, the undergraduate research student associated with this project will perform single embryo RNA isolation and qRT-PCR analysis for specific miRNAs (miR-21, miR-10b, let-7i) from paired murine embryos/culture media samples.

Congruency between embryo/culture media miRNA expression profiles will be evaluated, and reproducibility of miRNA detection will be assessed. This project will serve as an essential proof-of-concept and will establish important baseline detection parameters for our forthcoming human-based trials. These techniques and the underlying concepts are indispensable for the effective detection of miRNA biomarkers in single-embryo culture media and should provide a strong base upon which the successful student could potentially build a research career in the area if desired. The operating costs associated with this project will be supported by NSERC and OCE grants to the supervising investigator as part of his ongoing research program. The student will work closely with both a senior Ph.D. student and a post-doctoral fellow to rapidly hone their technical and conceptual skills. Overall, these studies should help elucidate key miRNA molecules that are secreted into embryo culture media during early embryonic development and may reveal important biomarkers that can be non-invasively employed to predict successful embryo development.

21. Project Title: Assessment of prevalence of Equine Herpesvirus-1, and relative risk of abortion in Ontario breeding farms

Faculty Contact: Brandon Lillie (Pathobiology) blillie@uoguelph.ca

Project Description: The proposed research project is a joint project between the Department of Pathobiology (Dr. Lillie) and the Department of Clinical Studies (Dr. Arroyo), and will provide

an excellent opportunity for a veterinary student to get exposed to both field based research activities as well as molecular based laboratory work. The project involves surveying Ontario horse farms/breeding operations for the presence of Equine Herpesvirus (EHV) as well as immune responses to EHV. Farms will be visited every 2 months for 1 year and mares will have nasal and vaginal swabs and blood samples taken - 2 visits will occur during the summer semester. Samples collected will then be processed and analyzed in the lab for PCR and ELISA based analysis. The selected student will be involved in preparing mail-out sampling kits (for farms doing their own sampling) as well as farm visits, and sample processing.

The student involved in this project will work in a multi-PI lab as part of a large research team and be involved in all aspects of the project. They will be heavily involved in DNA isolation and processing of blood samples. They will also be involved in analyzing data from droplet digital PCR analysis and serology testing. In addition they will gain exposure to a variety of molecular techniques including, but not limited to, next-generation sequencing, RT-PCR, and gel electrophoresis that are also utilized in the Lillie lab. There will also be an opportunity to learn how these techniques are applicable to disease diagnosis. Students will be encouraged to participate in the Summer CORE Program as well as other activities in the Department of Pathobiology, such as research seminars and Gross Pathology and Histopathology Rounds when not on farm visits.

NB - Proof of a protective rabies titre is required.

22. Project Title: Genetic selection for disease resistance: adapting High Immune Response Technology for application in the beef industry

Faculty Contact: Bonnie Mallard (Pathobiology) bmallard@ovc.uoguelph.ca

Project Description: Respiratory disease (bovine respiratory disease [BRD]) in recently weaned beef calves is the leading cause of morbidity and mortality in feedlot cattle. Multiple viral and bacterial pathogens may initiate or complicate the disease process. Antibiotics are commonly used prophylactically, metaphylactically or therapeutically to minimize the incidence of BRD and minimize mortality rates. The development of antibiotic resistance by bacterial pathogens in feedlot cattle is a major concern, affecting the efficacy of available antibiotics for use in livestock and also for human medicine.

Although there has been research into BRD for decades, selective breeding of beef cattle for enhanced immune responses and increased resistance to BRD has received little attention. A testing method for evaluating the genetic potential of cattle to mount antibody-mediated (AMIR) and cell-mediated (CMIR) immune responses has been developed at the University of Guelph and patented. This High Immune Response (HIR) technology has been licensed to the Semex Alliance and is currently in use to genetically improve the health and welfare of dairy cattle, and reduce the need for antibiotics.

Research is in progress to apply this technology to the beef industry. With funding from the government of Ontario (OMAFRA) calves born at the Elora Beef Research Station are being tested for AMIR and CMIR immune responses, with monitoring of their health following feedlot entry. Summer student(s) would be active in restraint of young calves, in sample collection, in laboratory testing procedures (enzyme linked immunoassays and radial immunodiffusion assay), and data analysis. Sample collection and laboratory assays should be complete by early August.

23. Project Title: Efficacy of NSAIDs when compounded (mixed) with iron dextran on pain relief following castration in piglets

Faculty Contact: Terri O’Sullivan (Population Medicine) tosulliv@uoguelph.ca

Project Description: This project will provide a student (undergraduate or DVM) with research training in conducting on-farm clinical trials using behavior scoring in piglets and has a principle focus on pain control and piglet welfare. The current Canadian Code of Practice for the Care and Handling of Pigs states that all pigs require analgesia at the time of castration. Producers are currently compounding non-steroidal anti-inflammatory drugs (NSAIDs) and iron dextran (ID), in same bottle/syringe, to administer to piglets in one single injection at the time of processing/castration. We have recently completed a bioequivalence study that examined systemic meloxicam, flunixin meglumine, or ketoprofen levels when administered alone to piglets compared to when compounded with ID. The results of the study demonstrated that the amount of drug absorbed systemically is reduced when compounded compared to NSAID administered alone. However, there remains no information available to know, if or how much, the reduced bioavailability of the NSAIDs influences analgesia levels. The research project this student will be assisting with will evaluate analgesic efficacy of meloxicam or ketoprofen when compounded with ID in piglets at the time of castration. The project involves extensive on farm behavior observations and directly assisting with project management. Specifically, the student will be responsible for the collection, analysis, and interpretation of the behavior observation validation data (live scoring and video analysis, inter and intra-observer validation) and will work closely with the graduate (DVSc) student on this project. Ultimately, this research will inform practicing veterinarians and swine producers on best on-farm practices as it relates to piglet analgesia at the time of processing and castration. If efficacious, this method of compounding will enable producers to meet the requirements of the Code of Practice as well as maintain efficiency in on-farm labor associated with the increased requirements. Additionally, the information gained from this work has the potential to promote animal welfare by documenting appropriate ways to administer analgesia to piglets at castration/processing.

24. Project Title: Peripheral blood mononuclear cell activation dynamics during bovine intestinal *Mycobacterium avium* subspecies *paratuberculosis* infection

Faculty Contact: Brandon Plattner (Pathobiology) bplattne@uoguelph.ca

Project Description: *Mycobacterium avium* subspecies *paratuberculosis* (Map) is the etiologic agent of bovine paratuberculosis also known as Johne's disease, an economically significant production-limiting disease in the dairy industry. After initial infection, the disease is characterized by a long subclinical phase (two or more years) followed by progressive granulomatous enteritis, failure of adequate nutrient absorption, diarrhea, weight loss and eventually death. The pathogenesis and Map-specific immune responses of early infection remain poorly understood and in particular it is not understood why some calves are apparently able to clear the pathogen while others become persistently infected. Our hypothesis is that during early stages of intestinal Map infection, expression of activation markers on peripheral blood lymphocyte subsets is altered compared with uninfected calves. The student will develop multicolor flow cytometry and fluorescence microscopy assays to assess lymphocyte phenotype and activation status, and then study how this correlates with Map infection, early clearance and persistent infection. The hypothesis will be tested using a bank of PBMCs obtained from experimentally Map-infected calves.

A substantial component of this position involves experiential learning and assisting in post-mortem examinations of domestic animal species in the post-mortem suite of Pathobiology. Therefore, completion of phase II of the DVM program is preferred, and proof of immunity to rabies (a protective titre) is required. The student will also be encouraged to participate in the Career Opportunities and Research Experience (CORE) program at the OVC.

Ministry of Advanced Education and Skills Development (MAESD) Summer Research Studentships (Restricted to Veterinary Students) (5 projects)

25. Project Title: Exploring the use of emerging technology in veterinary medicine and its impact on the bonds among veterinarians, clients and their animals

Faculty Contact: Theresa Bernardo (Population Medicine) tbernardo@uoguelph.ca

Project Description: There is a great opportunity to improve animal healthcare and the relationships among veterinarians, clients and their animals through the use of emerging technologies (ranging from websites and apps, to social media and sensors). The internet is an important source of health information, and digital technologies have the potential to disrupt and/or improve the practice of veterinary medicine and the health and wellbeing of animals. The objective of this research is to better understand the role of technology in strengthening the human-animal bond and improving animal healthcare. The student will be involved in developing and implementing a wide variety of health informatics initiatives and will gain an appreciation of the range of emerging technologies currently available and criteria for their

adoption or success. The student will gain experience in methods such as searching the literature (scoping study), surveys and focus groups, as well as data management and analysis. Facility with, and enthusiasm for, the use of information technology (web searches, website development, social media, apps, videos) for veterinary medicine and animal health is desired and familiarity with reference management software, conducting online surveys and epidemiology would be considered an asset.

26. Project Title: Changes in nasal populations of bovine respiratory pathogens: effect of aerosol immunostimulation and relationship to development of pneumonia

Faculty Contact: Jeff Caswell (Pathobiology) jcaswell@uoguelph.ca

Project Description: Bovine respiratory disease is the most common disease of beef cattle, costs the North American beef industry in excess of \$1 billion annually, is a welfare issue from animal suffering, and is a main reason for preventive use of antibiotics in beef production. The disease most commonly occurs when calves are weaned, transported long distances, and mingled with calves from other sources. Thus, stress and viral infection suppress immune responses and are risk factors for bacterial pneumonia in cattle. The objective of this research is to develop an intervention to prevent this suppression of the respiratory immune system. Such an intervention would be of value in preventing respiratory disease in beef cattle in feedlots, and may reduce the need for preventative use of antibiotics in beef production. The main focus of the project is to determine the effects of an aerosol immunostimulant on populations of bacterial pathogens in the nasal cavity of cattle. Specifically, in recently weaned calves at high risk of respiratory disease, we will determine the effect of the immunostimulant on nasal populations of *Mannheimia haemolytica* and *Mycoplasma bovis* using real-time quantitative PCR, and how these changes relate to disease outcome. A second focus is to determine the effects of the same immunostimulant on development of bacterial pneumonia in 6-week-old dairy calves based on clinical findings, thoracic ultrasound, measurement of acute phase proteins in blood, and postmortem examination.

27. Project Title: Profiling adaptive immunity in canine autoimmune thyroiditis

Faculty Contact: Stefan Keller (Pathobiology) smkeller@uoguelph.ca

Project Description: Canine hypothyroidism is an endocrine disease that affects medium to large breed dogs and that is characterized by skin abnormalities, reduced activity, weight gain and reduced ability to tolerate cold. Most commonly the disease is caused by immune-mediated destruction of the thyroid gland, a condition that closely resembles Hashimoto's disease in humans. A central step in the pathogenesis of the disease is the recognition of autoantigens by antibodies, i.e. highly variable lymphocyte antigen receptors (LARs). Currently, no data exists on the composition and diversity of LAR gene sequences, i.e. LAR repertoires, in canine autoimmune thyroiditis. The objective of the project is to profile LAR gene repertoires in canine lymphoplasmacytic thyroiditis in tissue samples from hypothyroid and euthyroid patients by next generation sequencing. It is expected that the project will identify LAR gene

sequences that are shared between individuals (public sequences) and that are specific for autoimmune thyroiditis. If true, subsequent studies could prospectively assess the value of thyroiditis-specific 'signature sequences' as novel biomarkers for canine autoimmune thyroiditis.

The student will extract DNA from archived tissue samples of patients with canine lymphoplasmacytic thyroiditis, amplify LAR genes by conventional PCR using existing primer sets, prepare a library for next generation sequencing, sequence the library on an in-house Illumina sequencing platform and participate in data analysis using an existing bioinformatics pipeline. In addition, the candidate is expected to participate in the Summer CORE program.

28. Project Title: Attitudes towards lifetime use and cumulative endpoints for research and teaching animals

Faculty Contact: Patricia Turner (Pathobiology) pvtturner@uoguelph.ca

Project Description: Ethical justification for carrying out scientific and educational procedures using animals is based on a balance between the harm to the animals and the benefit to society or students from the knowledge gained. The level of harm will be affected by the degree of implementation of the 3Rs (replacement, reduction and refinement). Thus, the overall level of invasiveness of a procedure is directly affected by how the work is conducted and includes the impact on the animal caused by procedures such as sampling, administration of substances, surgery and the induction of disease. The use of this system allows Animal Care Committees and veterinarians to critically evaluate the animals' quality of life and to recognize signs of poor welfare, such that improvement strategies or endpoints may be selected. While all of these requirements can be met for a particular moment in time, there is the need to assess the animal's whole quality of life over the duration of a study or period of use in teaching to truly reflect its welfare. The Canadian Association for Laboratory Animal Medicine (CALAM/ACMAL) and the Canadian Council on Animal Care (CCAC) have discussed the concept of evaluating cumulative endpoints for animal use; however, to date, there is no formalized method or guideline for doing so. This project will involve conducting interviews with a range of Canadian stakeholders (researchers, educators, veterinarians, animal caregivers, etc) and one focus group session to address attitudes and practices at Canadian research institutions for assessing frequency of use and lifetime use of animals in research and teaching. The results of this work will be used to inform policy development that is aimed to guide Canadian Animal Care Committees, researchers, and educators in making decisions about quality of life and disposition of animals used in research and education.

29. Project Title: Elucidation of the Oncogenic Mechanism of the Envelope (Env) protein of Jaagsiekte Sheep Retrovirus (JSRV)

Faculty Contact: Sarah Wootton (Pathobiology) kwootton@uoguelph.ca

Project Description: JSRV is a replication competent oncogenic retrovirus that infects the distal respiratory tract of sheep and goats and causes Ovine Pulmonary Adenocarcinoma (OPA). JSRV is unique in that the viral envelope glycoprotein, Env, is a potent oncogene and is capable of inducing tumors in both small and large animals. The oncogenic pathways activated by JSRV's Env (Jenv) mirror that of many types of lung cancer, including a rare form of human lung cancer called Bronchioloalveolar adenocarcinoma, that disproportionately affects women with no previous smoking history. Using a membrane yeast two-hybrid assay, our lab has identified a series of potential Jenv binding partners that could elucidate its mechanism of oncogenesis. The student involved in this project would be expected to subclone genes and perform co-immunoprecipitation assays in order to confirm and characterize the positive protein-protein interactions. Establishing a connection between these binding partners and Jenv can help us understand the pathogenesis of JSRV and may identify novel therapeutic targets for the treatment of human lung cancer.