Project Title: Evaluation of Acclimation and Low Stress Cattle Handling on Health and Performance of Feedlot Cattle

Principle Investigator(s): Grant Dewell

Collaborating Investigator(s): Renee Dewell

Abstract: (300 words or less):

Bovine respiratory disease continues to be the major cause of morbidity and mortality in feedlot operations despite the advancement in vaccines and antibiotics. Feedlot calves undergo tremendous stress prior to arrival at the feedlot (weaning, comingling, auction market and transportation) and after arrival (comingling, handling and processing, and diet change). The combination of several of these stressors can impair immunity and lead to increased morbidity and decreased performance. This project will enhance the comprehensive animal welfare research program initiated by our research team. The specific objectives of this project are to: 1) Determine the impact that acclimation and low stress cattle handling have on respiratory morbidity and mortality in feedlot cattle. 2) Measure physiological differences (cortisol, haptaglobbin, MMP9 and Creatine phosphokinase) between acclimated and low stressed handled calves compared to traditionally handled calves. 3) Determine the impact that acclimation and low stress cattle handling have on performance of feedlot cattle. Specifically, 80 pens of cattle (40 freshly weaned bawling calves and 40 comingled auction market calves) will be enrolled in the study. Half of the pens will be acclimated and handled with low stress practices and half of the pens will be traditionally handled. Serum samples will be collected from a random subset of calves at initial processing and at re-implant processing. Respiratory morbidity and mortality will be recorded and performance measures will be recorded at the end of the feeding period.
Project Title: Mitigation of fluoroquinolone-resistant *Campylobacter* in cattle

Principle Investigator(s): Grant Dewell

Collaborating Investigator(s): Qijing Zhang, Orhan Sahin, Paul Plummer

Abstract: (300 words or less):

Thermophilic *Campylobacter* are major foodborne pathogens and leading bacterial causes of gastroenteritis in the United States and other countries. Clinical treatment of campylobacteriosis requires the use of fluoroquinolone (FQ) or macrolide antibiotics, but antibiotic-resistant *Campylobacter* is becoming increasingly more prevalent. *Campylobacter* is highly prevalent in food producing animals. Our long-term goal is to control antibiotic resistance by reducing the development and transmission of antibiotic-resistant foodborne bacterial pathogens on farms. The main goal of this project is to identify critical control points and mitigation strategies for FQ-resistant *Campylobacter* in ruminants by using an integrated approach. Specifically objective three is to develop outreach and training programs to reduce FQ-resistant *Campylobacter*. For measuring the success and impact of our extension/outreach component, we will utilize pre- and post-extension surveys. We expect that our extension efforts will result in changes in the antibiotic use practices that lead to a better control of antimicrobial resistance on farms. The pre-extension survey will be conducted as a baseline during year one of the project prior to any information dissemination. An identical post-extension survey will be repeated at the end of the third year and the results will be compared to the first survey. The surveys will be conducted by mail and by interview of producers and veterinarians.

The primary objective of the 2017 summer scholar project will be to initiate production of the first survey of feedlot producers and veterinarians to determine current use practices of antibiotics that may lead to antimicrobial resistance. Additionally, the summer scholar will be able to participate in other portions of the larger project which may include the microbiology laboratory and/or animal model research.
Project Title: ARSENIC POISONING AND NEURONAL HEALTH

Principal Investigator:

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Summary:

Water contamination is a major public health concern in different communities in the US. The presence of contaminants in water can lead to adverse health effects, including neurological disorders. Arsenic is a naturally occurring element found in groundwater as a byproduct of soil and rock erosion. Agricultural irrigation spreads fertilizers and pesticides that can contain arsenic. The U.S. has a serious arsenic contamination problem in the Midwest. High levels of arsenic in groundwater are prevalent in western Nebraska. Arsenic is also detected in Lincoln city’s drinking water (6.9 - 9.8 parts per billion or ppb) but while its levels remain below the EPA (Environmental Protection Agency) limits (10 ppb), they have increased from previous years. The National Academy of Science has reported that even at 3 ppb arsenic might represent a health concern and a recent report shows that child IQ is negatively affected by exposure to arsenic in drinking water at 5 ppb. Until recently, arsenic containing food additives were fed to pigs, chickens and turkeys to promote growth, increase feed efficiency, and prevent diseases. Animal poisoning is also a concern. For example, in parasitic treatment drugs, the level of arsenic is in sub-lethal ranges and will not harm a dog, but over-dosage can lead to toxicity. However, dogs often accidentally ingest products containing arsenic (chemical compounds for consumer products, such as herbicides, insecticides, wood preservatives, and in some drug formulas) when they gain access to such compounds. Thus, research towards understanding the subtle negative effects of low/subtoxic arsenic exposure in animal and human health is necessary. This research project aims to identify the brain-associated dysfunction induced by subtoxic arsenic exposure. To achieve this, we will use molecular/cell biology techniques to determine the role of mitochondrial dysfunction and cellular metabolism in neuronal/glial dysfunction using animal models and in vitro cell lines. This experience will provide veterinary students with a clear insight into the mechanisms associated with the neurotoxicity of environmental exposures and with knowledge regarding the use and availability of research tools to characterize better these diseases at the molecular level as future veterinary scientists. More information about Dr. Franco’s research can be found at: http://francolab.unl.edu/
Comparative pharmacokinetics of meloxicam between healthy post-partum versus mid-lactation dairy cows

Principle Investigator: Patrick Gorden, DVM

Collaborating Investigator(s): Johann Coetzee, Michael Kleinhenz, and Joshua Ydstie

Abstract:

Pain is a physiological response that cattle often experience as a result of pathological conditions or through implementation of common management procedures. Meloxicam is a non-steroidal anti-inflammatory drug that is often utilized by bovine veterinarians to control pain in their patients. Pain control measures in bovines involves extra label therapies, as there are no labeled products for pain. In a recent project (Summer Scholar 2016), our research team discovered significant differences between plasma and milk drug concentrations between post-partum and mid-lactation cows following oral meloxicam therapy. This would necessitate longer withdrawal periods for meat and milk in the post-partum cow following meloxicam therapy as compared our normal recommendations. In this project, we propose a trial to investigate the reasons for this difference. A parallel design trial with two groups of post-partum cows and two groups of mid-lactation cows is proposed. One group of post-partum cows will receive oral therapy while the other will receive IV therapy. The mid-lactation cows will be treated in a similar manner as the post-partum cows. Blood samples will be collected and analyzed using liquid chromatography-mass spectrometry (LC-MS) to determine plasma meloxicam concentrations. The data will then undergo pharmacokinetic modeling to determine important pharmacokinetic parameters. As a result of this approach, we hope to better explain the bioavailability of oral meloxicam in both stages of lactation. We then propose to utilize that data to design a project to look at establishment of withdrawal periods in the post-partum cow and also determine how long into lactation veterinarians would need to prescribe longer withdrawal periods.
Project Title: Validation of PCRs for Porcine Teschovirus and Porcine Sapelovirus

Principle Investigator(s): Karen Harmon, Phillip Gauger, Jianqiang Zhang, Jeff Zimmerman, Paulo Arruda, Franco Matias Ferreyra

Collaborating Investigator(s):

Abstract: (300 words or less):
Numerous pathogens are associated with neurological disease in swine. These include, but are not limited to, viruses in the family Picornaviridae [Porcine Teschovirus (PTV), Porcine Sapelovirus (PSV) and Porcine Enterovirus (PEV)], pseudorabies, some strains of PRRSV, pestiviruses, including the recently identified Congenital Tremor Pestivirus, as well as a number of bacterial pathogens. Real time PCR is the most common assay utilized to identify these pathogens within diagnostic samples. Mere detection of these pathogens by PCR is often not enough to diagnose clinical disease and results should be interpreted in context of clinical presentation. However, accurate detection is essential to identify the agent as well as to advance our knowledge regarding the physiopathology of these pathogens in swine. The discovery of novel pathogens or genetically divergent strains of known pathogens adds another level of complexity and highlights the need to have highly sensitive and specific PCRs. Histologic lesions are often non-pathognomonic and should not solely be used to determine causation. Some of these agents are not currently present in the U.S., which makes accurate identification even more important when ruling out new/emerging viruses versus those currently within the US.

This study specifically addresses validation of real-time reverse-transcription PCR (RT-rPCR) assays for detection of PSV and PTV. Published assays and newly developed assays, designed using updated sequence information, will be compared. Samples submitted to the ISU Veterinary Diagnostic Laboratory will be used in the assay validation.
These could include, but are not limited to brain, spinal cord, blood, serum, heart, lung, lymph nodes, and feces. In addition, sequencing will be performed to further verify the identity of the viruses from positive samples. In summary, successful validation of these assays will provide important tools for better determining the presence of these agents in swine and studying their role and significance in swine disease.
Project Title: Identification of prognostication markers for canine mast cell tumors

Principle Investigator(s): J. M. Hostetter

Collaborating Investigator(s): A. F. Fales-Williams, A. Viall

Abstract: (300 words or less):

We are looking for a motivated and self-starting individual to work on developing a new assay for detection of markers expressed on mast cell tumors that will aid in establishing the prognosis for canine patients with this diagnosis. This project will use a new technology called RNAscope. This is a highly sensitive and specific technique that detects messenger RNA that has been expressed for the marker of interest. The student on this project will 1) initially work with the pathologists to identify a suitable marker to explore, 2) test a set of mast cell tumors that have come through the Veterinary Pathology Surgical Pathology Service for the marker using RNAscope technology, and 3) using a computer image analysis system to quantify the signal from the assay. Once the assay is optimized the student will compare the expression of the marker is biopsies that have been previously diagnosed as low and high grade mast cell tumor. This project will have the following components: histopathology, molecular biology, computer assisted morphometry, and statistical analysis.

The individual best suited for this position can work independently and ideally has an interest in pursuing pathology. The student will join residents for boards training seminars that meet twice per week. Experience with trouble-shooting a problem will be a handy tool for this project.

Canine mast cell tumors have been classified by a variety of schemes over the last few decades. Most recently, they have been divided into high grade and low grade mast cell tumors, with prognostic information dictated by the grade status. While this newest system is fairly predictive, there are a subset of tumors that defy the expected behavior. This project is attempting to classify the tumors beyond morphologic features, using the presence of a specific mRNA to specify tumor grade.
Project Title: Mechanisms of Protein Misfolding in Animal and Human Neurodegenerative Diseases

Principle Investigator(s): Dr. Anumantha Kanthasamy

Abstract: (300 words or less):

Protein misfolding and aggregation are key pathophysiological processes of many neurodegenerative diseases, including prion disease, Alzheimer’s disease, and Parkinson’s disease, but the mechanisms underlying protein aggregation processes have yet to be uncovered. The proteins associated with these neurological diseases, such as prions, alpha-synuclein and Amyloid β, contain metal-binding sites, and thus, we intend to characterize the role of metals in the protein-misfolding process using neuronal cell models. The specific objective of this project is to determine the role of divalent metal ions, such as iron, copper, manganese and zinc, in accelerating protein aggregation and stress granule formation. The functional relationship between metal-induced protein aggregation and cell death will be determined. Some of the skills a student will learn while conducting this project include cell culture, immunocytochemistry, confocal microscopy, fluorescence in situ hybridization (FISH), flow cytometry, protein analysis, advanced plate reader assays, qRT-PCR and Western blot. The students will also be trained in data analysis and manuscript preparation.
Objective

To determine if ventral dynamic compression plate (DCP) construct is superior to a lateral construct.

Hypothesis

It will require a greater vertical load force using a ventrally placed dynamic compression plate as compared to lateral.

Methods

Twelve equine cadaveric heads will be collected and stored at -27° C until dissection, implantation and mechanical testing. The heads will be allowed to thaw for 24 hours and dissection of the soft tissue will be performed down to bone. Radiographs will be taken to ensure bone quality and radiographic evidence of previous mandibular disease. A bilateral osteotomy will be performed using an oscillometric saw from dorsal to ventral along the most rostral aspect of the second premolar in a linear fashion with 1.5 mm gap. Six mandibles will be randomly assigned to the lateral construct and six mandibles to the ventral construct. A six hole, 4.5 mm DCP plate will be applied bilaterally based on standard Arbeitsgemeinschaft fuer Osteosynthesefragen/Association for the Study of Internal Fixation (AO/ASIF) recommendations to reduce the fracture. Dorsal to ventral perpendicular load force will be applied along the rostral aspect of the mandible. All constructs will be tested to failure, defined as failure of bone, failure of the bone- screw interface, and failure of the plates themselves. A paired T- Test will be used to determine if one construct requires a greater perpendicular force than the other.

Expected Outcomes

We expect to see a greater perpendicular force needed to result in failure of the construct using the ventral plate as compared to lateral.

Impact

Determining which plate construct requires the greatest force to failure will aid in mandibular surgical management in the equine rostral mandible.
Project Title: Exploring chemosensation in parasitic filarial nematodes.

Principal Investigator(s): Michael Kimber

Collaborating Investigator(s): None

Abstract: (300 words or less): Filarial nematode infections (*Dirofilaria* in canines, *Wuchereria/Brugia* in humans) are challenging to control because although we have effective drugs against larval parasite stages, chemotherapy options for adult parasites are limited. Targeting infectious stages before they establish as adults is therefore a logical approach to filarial disease prevention. Chemosensory pathways are integral to host-seeking and host-invasion behaviors and are essential to the establishment of infection but are poorly understood in parasites. In this project we propose to explore the chemosensory mechanisms and behaviors of infectious stage filarial nematodes. We will use a simple agar plate assay to profile parasite responses to specific compounds present in human and canine hosts. In this way we can better understand the tactic behaviors to stimuli that facilitate infection – which stimuli attract the parasites, and which are repellant. We will also use basic molecular approaches (PCR/qPCR) to explore the expression of proteins that may be involved in parasite chemosensation, such as chemoreceptors and channels. In this way we will be able to generate a mechanistic understanding of these attractive or repellant behaviors. A better understanding of chemosensation in filarial worms will not only provide insight into mechanisms of transmission and establishment of infection but may also lead to the development of novel strategies for disruption of parasite transmission.
Project Title: **Johne’s disease in beef cattle**

Principle Investigator(s): Amanda Kreuder, DVM, PhD, DACVIM (LAIM)

Collaborating Investigator(s): Adam Krull, DVM, PhD

Abstract: (300 words or less):

Johne’s disease, a chronic diarrheal disease of ruminants, has historically been considered an economically important disease of dairy cattle with little impact on U.S beef herds. Evaluation of Iowa State Veterinary Diagnostic Laboratory submissions shows a substantial increase in Johne’s positive animals from Iowa cow-calf operations over the past several years. Johne’s is a devastating disease that has no treatment or cure, is difficult to diagnose, and once present on a farm may be challenging to eradicate. A previous survey of cow-calf producers in the U.S. indicated that only 31% of producers were able to even recognize the name of the disease or had any knowledge about it. There is a critical need to assess the current knowledge of Johne’s disease in Iowa’s cow-calf producers and veterinarians. Therefore, we plan to conduct surveys of these groups to identify knowledge gaps so appropriate interventions can be developed to decrease the spread of this disease throughout Iowa’s cow-calf industry. The summer scholar student would be involved in survey development, implementation, and data analysis. In addition, current herd testing strategies were designed specifically for the dairy industry and may not fit the very different management system of Iowa cow-calf producers. Therefore, we plan to perform environmental and along with various herd testing strategies to compare the effectiveness of these herd testing strategies on mitigating the risk of Johne’s transmission. The summer scholar student would be involved in data collection and analysis of this portion of the project. Our overall goal is to provide producers and veterinarians with concrete information to increase producer awareness and improve herd management decisions regarding Johne’s disease in Iowa’s cow-calf herds.