Project Title:
Use of a gnotobiotic mouse community for gut microbiome studies

Principle Investigator:
Gregory Phillips, Ph.D. (VMPM)

Collaborating Investigator:
Michael J. Wannemuehler, Ph.D. (VMPM)

Abstract:
Recent experimental evidence reveals that the bacterial communities (microbiota) that comprise the mammalian gastrointestinal (GI) tract can have a profound influence on the health of the host. Diseases ranging from colorectal malignancies to inflammatory bowel diseases (IBD) have been linked to an abnormal microbiota (dysbiosis) in humans and animal models. Despite the importance of bacteria to the wellbeing of humans and animals alike, how the microbiota influences health and disease is still not well understood. To better understand how specific microorganisms interact with the host, we are using a unique gnotobiotic mouse community, the Altered Schaedler Flora (ASF), which is comprised of animals colonized with only 8 known bacterial species. Despite the low complexity of the microbiota, ASF mouse exhibit normal immune system development and growth. Use of this resource includes monitoring the changes in relative number, spatial distribution and gene expression in response to alterations in diet and following infection with bacterial pathogens. Independent student projects include, but are not limited to, using PCR to measure changes in the abundance of individual ASF community members in response to infection with Escherichia coli, as well as identifying genetic changes in the ASF that occur in response to changes to the gastrointestinal (GI) tract. The ASF model also offers the potential to study exciting new results that indicate that the composition of the GI microbiota may actually influence animal behavior. The overall impact of these studies will lead to a better understanding of how the GI microbiota influences human and animal health and disease.
Project Title:
Experimental strategies for brain rescue and repair

Principle Investigator:
Don Sakaguchi (GDCB)
(http://dssakagu.public.iastate.edu/Sakaguchi/)

Abstract:
This highly interdisciplinary project seeks to develop approaches to facilitate rescue and repair of the damaged nervous system. As a potential treatment strategy for neurodegenerative diseases and injury, stem cells and progenitor cells have been proposed as unique sources of transplantable cells for a therapeutic approach. A goal of this strategy is for the transplanted cells to provide neuroprotection and/or to replace degenerating cells in the diseased or damaged nervous system. We are implementing these procedures using rodent models of ocular diseases, traumatic brain injury and peripheral nerve damage. Our working hypothesis is that the transplanted cells can provide neuroprotection or replace lost cells and restore function in the diseased/injured nervous system. The intern will have the opportunity to be a part of an active research team. Intern will have the opportunity to observe and learn the following techniques: general laboratory procedures, data collection and analysis, mammalian cell culture, cellular reprogramming strategies (genetic and small-molecule approaches), immuno-cytochemical procedures, fluorescence microscopy, image analysis, and tissue engineering strategies.

Questions about this research opportunity may be directed to Don Sakaguchi (email: dssakagu@iastate.edu).
Project Title: Metagenomics of the equine uterine microbial environment

Principle Investigator: Dr. Swanand R. Sathe, Assistant Professor, Theriogenology (VCS)

Collaborating Investigator(s): Dr. Paul Plummer, Assistant Professor, Microbiology (VDPAM)
Dr. Eleas Wu, Intern, Theriogenology (VCS)

Abstract:

Bacterial endometritis is one of the leading causes of infertility in mares and ranks as the third most common medical condition of adult female horses. This is a major concern among breeders and veterinarians due to the increased costs, time spent in treating and increased incidence of embryonic loss associated with this condition. The current methods of diagnosing bacterial endometritis in mares include culture, cytology and uterine biopsy. The samples for bacterial culture may be obtained by a swab technique or by conducting a low volume lavage and then culturing the backflow recovered post-lavage. While routine culture techniques have been, and will continue to remain, an important strategy for the study of bacterial diseases, it is estimated that upwards of 99% of bacterial organisms are non-culturable using current methods. This fact is especially important as there are many infected mares that go undetected based on negative culture results and remain infertile or sub fertile. This significant limitation reveals a critical need for the application of new culture-independent methods that facilitate the characterization of the entire microbial communities in a specific environment (as the uterus) including monitoring it’s perturbations during disease states. This is the basis for metagenomics studies where new DNA sequencing technologies can be used for analysis of complex microbial communities with increased sensitivities, such as the mare’s uterus in a normal (pregnant and non-pregnant) and diseased state. This approach may have a significant impact on our understanding of the underlying mechanisms and the role of specific bacterial communities in development of bacterial endometritis in the mare and ultimately may help identify more effective treatment strategies.

Our research aims to study the normal and abnormal uterine microflora in mares during various stages of estrous cycle and early pregnancy (embryo flush mares and 35 day pregnancies). Uterine flushes from culture positive and culture negative mares will be analyzed using metagenomic DNA sequencing and efforts will be made to identify normal healthy microbial populations and their perturbations in face of ongoing infection. We expect to generate novel data that will help in our understanding of the role of these uncultivable microbes in healthy, infected and pregnant uteri of mares. With newer and faster sequencing methods now available, this technology has the potential of becoming the new gold standard in investigating uterine infections.
Project Title:
Assessment of Retention of Surgical Skills

Principle Investigator:
Jennifer Schleining, DVM, MS, DACVS-LA, Associate Professor (VDPAM)

Collaborating Investigator(s):
Stephanie Caston, DVM, DACVS-LA, Assistant Professor (VCS)
Jared Danielson, PhD, Associate Professor (VPTH)

Abstract:
Performing surgery, along with diagnosing and treating disease, is part of the legal definition of veterinary practice. As such, teaching surgical skills with the goal of producing practice ready, surgically competent new graduates is a core requirement of the veterinary curriculum. Furthermore, employers of ISUCVM graduates highly value surgical proficiency in new hires. In 2014, a prioritized list of important skills for new graduates — rated by employers of Iowa State University graduates — placed Surgical Skills second only behind Communication Skills. The increasing societal and financial challenges of providing live, terminal surgeries as part of the surgical curriculum are driving curricular change to refine surgical opportunities and animal use. While there is increasing scientific evidence supporting clinical skill development in veterinary medicine, there is a paucity of literature citing retention of skills learned in a veterinary surgical laboratory. Evidence that is available is largely in reference to human laparoscopic skill retention using trainers and human dystocia correction using simulation. This proposed study seeks to determine to what extent retention of surgical skills remains 24 months following completion of the junior surgery course. One specific area of interest is the retention of procedures students only perform once in live, terminal laboratories. Briefly, recent graduates will be invited to complete a short survey to determine how often they have performed specific procedures in the 6 months following graduation. Participants will then be assessed using a previously validated global rating scale performing a live surgery (cystotomy) utilizing pigs as a model of abdominal surgery of a monogastric species. Participants will be grouped according to their level of participation in the procedure during a terminal lab, and their skill at performing the procedure will be compared across groups. Results of this study would help inform decisions about veterinary surgical curricula.
Principle Investigator:
Ravindra Singh
SINGH LAB
Department of Biomedical Sciences
College of Veterinary Medicine, Iowa State University

Singh laboratory works on emerging new frontier of translational RNA biology and antisense technology. Particular focus of his lab is to find novel therapeutic targets to correct aberrant splicing, which is misregulated in several pathological conditions. His award winning invention has led the phase III clinical trial for the treatment of spinal muscular atrophy (SMA), the leading genetic disease if children and infants. Please contact him or refer to his website for more information: http://vetmed.iastate.edu/users/singhr

Singh lab has several projects to analyze molecular markers of genetic disease progression. Summer scholars (veterinary students) selected through CVM/NIH internship program would learn one or more of the following techniques:

1. Tissue culture experiments
2. Transgenic animal (mouse) breeding, genotyping and phenotyping
3. Isolation and processing of RNA from pathological samples (human and animal samples)
4. Design and perform PCR experiments to amplify alternatively spliced transcripts
5. Run agarose and polyacrylamide gel electrophoresis
6. Perform gene silencing experiments
7. Perform cloning and expression experiments
8. Perform protein isolation and purification
9. Perform immunological tests
10. Write and present scientific report

Note: Singh lab is particularly interested in those students, who wish to pursue research career after DVM. Opportunities for publication and travel to National or International Scientific Conference would be provided if candidate generates high quality original data during summer research.
Project Title:
Understanding the development of epilepsy from rodent models

Principle Investigator:
T. Thippswamy, Professor, (BMS)

Abstract:

The main goal of the projects in my lab is to test whether preclinical neuroprotectants, when given soon after the symptomatic drugs following an acute exposure to a neurotoxin, for example kainic acid or organophosphates prevent delayed neurotoxicity and reduce mortality and morbidity. These neurotoxins induce seizures. Although seizures can be controlled in some individuals by using antiseizure drug such as diazepam, it does not protect seizure consequences at a later stage. The process of development of epilepsy, i.e, spontaneous recurrent seizures is called epileptogenesis. In spite of advancement in science and technology it not yet clear why some individuals become epileptic after a single seizure or following exposure to neurotoxin or traumatic brain injury. Several changes occur after first seizure and there is a phase called “latent period” with no obvious clinical signs of seizures after first seizure. We are interested in investigating the electrographic activity, neurobiological changes that occur in the brain during this latent period, in a way, “period of epileptogenesis”. We use both rat and mouse models. The projects involve, radio transmitter implant in mouse and rat for continuous EEG recording to understand real time changes in the brain during epileptogenesis. Brain, serum and cerebrospinal fluid (CSF) will be collected for various analyses at different time points after first set of seizures. The common techniques used are, histology and immunofluorescence, Western blot, EEG data analysis and behavioral testing for cognitive learning and memory. The summer project student will get the opportunity to work with postdoc and a graduate students to investigate cellular and molecular mechanisms of epileptogenesis.
Project Title:
Further investigations into the phenotype of a T-B-NK+ SCID pig

Principal Investigator:
Christopher Tuggle (AnSci)

Collaborating Investigator(s):
Crystal Loving (NADC)
Joan Cunnick (NADC)

Abstract:

At Iowa State University, we have identified mutations in the Artemis gene that causes Severe Combined Immune Deficiency. We have published preliminary analyses of the immune cell deficits and the molecular defects (Ewen et al 2014 Vet Immunol. Immunopath.; Waide et al., 2015 J. Immunology). Major uses of the SCID pig are in testing efficacy of stem cell-derived therapies, as well as in humanization; the creation of a human immune system in the pig for testing vaccine efficacy. We are interested in determining the cell-cell interactions between human and pig. Specifically, we are testing the recognition of human CD47+ cells by SIRPA+ porcine cells, to evaluate the ability of human hematopoietic cells to survive in SCID pigs. We are also interested in the function of the NK cell in the absence of an adaptive immune system; specifically we will ask why human cancer can persist in a NK+ SCID pigs as has been shown (Basel et al., 2012). We will use molecular and flow cytometry approaches to investigate these questions in both normal and SCID-derived cells. A summer student will be able to participate in these experiments, as well as experience animal work within the SCID biocontainment facilities newly constructed at Vet Med.
2016 ISU CVM SSRP Mentor Abstract #26

Project Title:
Effect of waiting room experience on blood pressure measurement in the cat

Principle Investigator:
Dr. Laura Van Vertloo, VCS-Small Animal Internal Medicine

Collaborating Investigator(s):
Dr. Joyce Carnevale, VCS-Primary Care/Behavior
Dr. Suzanne Millman, VDPAM-Animal Welfare

Abstract:

Measurement of blood pressure in the feline patient is an important part of a complete medical evaluation. It becomes especially important with aging as secondary hypertension is seen in several common conditions of the elderly cat such as chronic kidney disease and hyperthyroidism. Unfortunately, obtaining clinically meaningful and reliable blood pressure measurements from cats is frequently made challenging by the effects of stress associated with the hospital visit.

This summer, we will be evaluating the effect of different waiting room experiences on blood pressure and stress responses. We hypothesize that cats will experience less stress when provided opportunity to wait in the examination room and when concealed in a carrier covered with a towel sprayed with Feliway. Our primary variable of measurement will be blood pressure readings, with secondary variables including time to obtain blood pressure readings, and physiologic and behavioral indicators of feline stress.

During this project, the student will learn about feline clinical practice, animal behavior and animal welfare, and will gain clinical skills including obtaining blood pressure measurements and low stress handling of cats. The student will learn about experimental methods pertaining to animal behavior and welfare, experimental design, literature reviews, statistical analysis and scientific writing. The student should be prepared for some evening and/or weekend work during the actual data-collection phase. There also will be opportunities to be involved in other projects in the animal welfare laboratory during the summer.

The ideal candidate has interest in feline medicine, shelter medicine or animal behavior and welfare, has good communication and organization skills for recruiting and coordinating study participants, and skills for working independently and in a team. Feline handling and clinical skills are an asset, but not a requirement. Students are encouraged to discuss their interest in this project with Drs. Van Vertloo, Carnevale or Millman.
Project Title:
The effects of anti-inflammatory and immunosuppressive doses of glucocorticoids on glucose homeostasis and fluid balance in healthy dogs and cats

Principle Investigator:
Jessica Ward, DVM, DACVIM (VCS, Cardiology)

Collaborating Investigator:
Johann “Hans” Coetzee, BVSc, PhD, DACVCP (VDPAM)

Abstract:

Glucocorticoids (GCs) have a wide variety of clinical applications in veterinary medicine, but their use in patients with severe heart disease is limited by concern for precipitating congestive heart failure (CHF). Steroid-associated CHF in cats has been reported after administration of long-acting depot GCs; the implicated mechanism is transient GC-induced hyperglycemia causing intravascular fluid shift. However, GCs may also have a therapeutic role in advanced decompensated CHF by increasing GFR and potentiating diuresis.

The objective of this study is to determine whether clinically relevant doses (anti-inflammatory or immunosuppressive) of commonly-used intermediate-acting GCs (prednisone/prednisolone or dexamethasone) cause hyperglycemia and concomitant hemodynamic changes in healthy dogs and cats.

This study will be designed as a prospective randomized crossover trial. Study subjects will be purpose-bred dogs and/or cats. In the first trial, dexamethasone will be administered intravenously at either an immunosuppressive (0.29mg/kg/day) or anti-inflammatory (0.14mg/kg/day) dose for 2 weeks. After a 2-week washout period, subjects will receive the alternate dose for 2 weeks. The second trial will follow an analogous design with administration of prednisone (dogs) or prednisolone (cats) orally at either an immunosuppressive (2mg/kg/day) or anti-inflammatory (0.5-1.0mg/kg/day) dose.

Testing performed at day 0 (baseline), 7, 14 and 21 (washout) will include a CBC, chemistry panel, urinalysis, serum insulin, fructosamine, serum ADH, blood pressure, thoracic radiographs, echocardiogram, total body water (via bioimpedance), plasma volume (calculated), and glomerular filtration rate (via iohexol clearance). Additionally, during drug administration, blood glucose and body weight monitoring will be performed every 12 hours. Data at each time point will be compared by 1-way repeated measures ANOVA.

We hypothesize that immunosuppressive doses of intermediate-acting GCs will cause hyperglycemia and intravascular fluid shift in cats but not dogs, and that anti-inflammatory doses will not cause significant changes in either species.
Project Title:
Serological surveillance for T’Ho virus (a recently discovered flavivirus) in vertebrate animals in the Yucatan Peninsula of Mexico

Principle Investigator:
Brad Blitvich (VMPM)

Abstract:
Recently, we discovered a novel virus in mosquitoes collected at the Merida zoo in the Yucatan Peninsula of Mexico. The virus has been named T’Ho virus is recognition of the location from which it was discovered (T’Ho is the Mayan word for Merida). T’Ho virus is a member of the genus Flavivirus which also includes West Nile virus, dengue virus and Zika virus. The overall goal of this summer project is to determine whether T’Ho virus commonly infects vertebrate animals in the Yucatan Peninsula of Mexico. We have obtained serum samples from a variety of mammalian, avian and reptilian species from the Merida zoo as well as livestock (horses and sheep) from surrounding areas. Serum samples will be tested for the presence of T’Ho virus-specific antibodies by a technique known as the plaque reduction neutralization test (PRNT). The purpose of this study is to identify vertebrate spp. susceptible to T’Ho virus infection.