**Dr. Reid Hanson:** *A Study of the Visco-elastic and Friction Profiles of Equine Cartilage Surfaces.* Our lab seeks to characterize and compare the material properties of cartilage located within various joints of the equine limb. Specifically, we will investigate the visco-elastic stiffness and friction coefficient of the biphasic cartilage structure. These biphasic properties affect the performance of the joint as it carries different loads and motions. This study is to determine if different types of joints with different ranges of motion possess different material properties best suited for the joint’s individual conditions. Analyzing the various cartilage surfaces within each joint and between joints will lead to a better understanding of the mechanisms controlling the performance of healthy joints in horses and humans. This data will be used to translate into the design of better artificial joints. Articular cartilage samples will be extracted from recently deceased horses and analyzed in the Multiscale Tribology Laboratory in a multidiscipline lab between Engineering and Veterinary Medicine. Cartilage surface geometries will be characterized using nano-scale surface profilometry, scanning and transmission electron microscopy and mathematical/numerical modeling techniques to analyze the structure of the surfaces over many scales. The key is to mesh the geometries at multiple different scales into one complete model.

**Dr. Michael H. Irwin:** *Rodent models of mitochondrial disease.* We work with animal models of severely debilitating (and often lethal) human disorders caused by genetic mutations that affect mitochondrial function. These animal models are used to gain a better understanding of mitochondrial dynamics and pave the way for basic and translational technologies including targeted gene therapies. Ongoing studies revolve around innovative approaches toward manipulation of mitochondrial genetics, modeling of mitochondrial complex I dysfunction, and testing of potential therapies in rat and mouse models and in cultured cells.

**Dr. Jey Koehler:** Although cancer is a genetic disease in the sense that mutations allow cancer cells to grow independent of the inhibitory mechanisms, another important factor in how cancer behaves is the effect on the tumor cells of various internal “microenvironments”. This includes areas of low or ineffective blood flow, necrosis, acidic pH, scar tissue formation, and cross-talk between tumor cells and stromal cells. Our lab is focused on the role of low oxygen in the biology of cancer, including the formation and survival of a subset of cancer cells that behave like stem cells. This subpopulation often has increased resistance to chemotherapy and radiation therapy, and new therapies designed to kill this specific population may improve outcomes in cancer patients. Opportunities exist for the student to participate in developing and interpreting cell viability assays in response to drug treatment of cultured cells, RNA extraction for RNA and microRNA analysis via q-PCR and deep sequencing, immunocytochemistry, immunohistochemistry, and Western Blot assays, digital image analysis, and projects involving retrospective histopathology studies of tumors.

**Dr. Douglas Martin:** *Molecular Therapy of Neurodegenerative Disease.* The laboratory’s model of neurodegenerative disease is feline gangliosidosis, similar to human Tay-Sachs disease, a disorder in which abnormal function of lysosomes causes progressive nervous system dysfunction and death. Though first reported in 1881, Tay-Sachs disease remains virtually untreatable, and affected children die by 5 years of age after spending several years in a semi-vegetative state. However, new gene therapy strategies have been tested in mouse models of
gangliosidosis with excellent results. Before inclusion in human clinical trials, new therapies are tested in the feline model for safety and therapeutic benefit. The laboratory employs a variety of experimental techniques including intracranial injection of therapeutic agents, MRI-based analyses of disease progression, and biochemical and molecular biological evaluation of therapeutic benefit. Students may participate in both experimental procedures and laboratory research. This work is part of an international effort of collaborative scientists and physicians, the Tay-Sachs Gene Therapy Consortium, whose goal is to begin gene therapy clinical trials in humans.

**Dr. Bruce F. Smith:** *Molecular Genetics Of Inherited Disease And Cancer.* Several projects are available in the area of gene therapy for a variety of diseases including cancer. Cancer projects include laboratory studies and pre-clinical and clinical trials for dogs with osteosarcoma, lymphoma, melanoma, mast cell tumor and breast cancer. These studies involve the creation, evaluation and administration of gene therapy vectors and novel biological molecules, and the assessment of patient progress, as well as detailed laboratory assessments of the impact of the therapy. The latest genetic approaches may be used to understand the basis of components of the disease. Projects involve the use of a wide variety of techniques including RNA and DNA isolation, quantitative PCR amplification, cell culture and flow cytometry as well as animal handling, phlebotomy, tissue biopsy and necropsy.

**Dr. Anne Wooldridge:** My lab is interested in using combined biomaterials and stem and progenitor cells for regenerative medicine applications in the horse. We collaborate closely with Dr. Elizabeth Lipke in the Department of Chemical Engineering. This summer we will continue work on an ongoing project that utilizes equine endothelial progenitor cells in combination with a hydrogel material for treatment of distal limb wounds in the horse. The summer scholar will be involved in care of horses, creation of the wound model, and laboratory bench work such as analysis of tissue samples and cell culture. The student will be working with myself, Dr. Fred Caldwell, and Dr. Randoloph Winter from Clinical Sciences and the team from Dr. Lipke’s lab in Chemical Engineering. We are looking for a student with some horse experience, great work ethic, and interest in both clinical and basic science research.

**Dr. Frederik Van Ginkel:** Our research is focused on measuring and inducing mucosal and systemic immunity to infectious bronchitis virus, an avian pathogen that causes considerable economic losses in the poultry industry despite vaccination. We are analyzing the role of age of vaccination on the ability of IBV vaccines and IBV vaccine vectors to generate protective immune responses in the mucosal and systemic immune compartments employing techniques such as quantitative RT-PCR, ELISA, ELISPOT assays and peptide arrays. Furthermore, the presence of plasmocytoid dendritic cells is analyzed using FACS analysis and expression of pathogen-associated molecular pattern (PAMP) receptors is measured using quantitative RT-PCR in order to achieve a better understanding of the induction of adaptive immunity in chicken.

**Dr. Robert Judd:** Nonalcoholic fatty liver disease (NAFLD) is characterized by excessive accumulation of triglycerides in hepatocytes, inflammation, and progression to nonalcoholic steatohepatitis (NASH). Studies in rodents have demonstrated that adiponectin prevents progression to NASH. Niacin, a drug that decreases plasma triglycerides and increases
adiponectin, prevents hepatic steatosis in rodents and inhibits fat accumulation and inflammation in human hepatocytes. However, the role of adiponectin in niacin’s ability to inhibit the development of NASH is not known. To address this question, we are currently using male adiponectin knockout mice fed either a chow or high fat diet (HFD) to induce obesity and NASH. Students will have the opportunity to take part in this study by not only treating the mice with vehicle or niacin during obesity development, but also analyzing blood and tissues for various analytes and pathological changes.

Dr. Dean Schwartz: Cancer patients taking doxorubicin are at a much higher risk for developing irreversible heart failure. One of the reasons for this heart failure is that doxorubicin increases oxidative stress in the heart. Oxidative stress occurs when too many free radicals are generated that can lead to cell death and mechanical dysfunction. There are currently no non-invasive means to detect these free radicals in the heart. Students involved in the summer research program will be involved in studying our newly developed MRI contrast agents to detect free radical accumulation as an early warning signs of cardiotoxicity in doxorubicin treated rats.

Dr. Tatiana Samoylova: Our research group is focused on development of phage- and DNA-based vaccines for contraception of wild and feral animals. These are multidisciplinary studies that involve approaches and methods in molecular and cellular biology, microbiology, biochemistry, reproductive biology, and nano-materials. It also requires working with animals, mice, cats, or dogs.

Dr. Beth Spangler: Evaluation of the impact of various intravenous infusions on platelet function. This work will be completed in collaboration with Drs. Bacek and Christopherson. The goal of this study is to determine how platelet function is affected by various substances that are commonly administered to patients as intravenous infusions (crystalloids, colloids, lipid). Our model will use whole blood collected from healthy dogs that is combined in vitro with the compounds under investigation, and platelet function will be assessed in whole blood samples using an impedance platelet function analyzer (Multiplate™). This work will be completed in the Clinical Pathology laboratory and may include the opportunity to use other methods for analysis of coagulation and platelet function.

Dr. Aime Johnson: This summer we will be evaluating a new vaccine technology that incorporates the target antigen into nanoparticles. This technology would allow the controlled release of the vector at predetermined time points so a single injection would serve as both an initial and a booster injection. The interested student would be working with Dr. Johnson testing the release properties of this vaccine in mice. Although working with mice would be the main project for the summer, this student would also be able (encouraged) to assist in another experiment using similar technology looking at GnRH suppression in horses.

Dr. Sarah Zohdy: Disease Ecology in Madagascar
The island of Madagascar is home to thousands of species (including lemurs) that live nowhere else on earth. However, the growing human population relies on slash-and-burn agricultural
practices, and therefore all endemic wildlife is threatened due to habitat loss. In addition to the loss of ecosystem resources, slash-and-burn agriculture may increase vector-borne disease risk by altering nutrient enrichment and watershed dynamics on a local scale. The goal of this project is to examine the ecological drivers of disease at the human-animal interface in this ecosystem, and to evaluate interventions that may simultaneously improve human health and wildlife conservation, through a One Health approach. I am looking for students to participate in survey design and implementation, field work in Madagascar, and data entry and analyses.

Dr. Wei Liu, Rehabilitation and Disability Research (http://www.auburn.edu/~wzl0022/): Currently research projects are combining aspects of Motor Control Theory, Biomechanics Modeling approach and Imaging technique such as Electroencephalogram (EEG) to develop improved treatment interventions for individuals with disability. Our research areas are focusing on: 1, Applying advanced biomechanical model and study the contribution of net joint moments and individual muscle forces to the control of human movement and the performance of activities of daily living. 2, Applying neural imagine technique such as EEG or f-MRI to study the motion analysis data and neuroanatomical substrates of functional movement in real time. 3, Providing better understandings of underlying mechanism of how physical activity optimizes individual's physical performance, and developing of effective treatment strategies for people with disability such as multiple sclerosis, breast cancer and knee OA. We are collaborating with variety of clinical experts in orthopedics surgery, neurology and surgical oncology to develop independent research programs.

Drs. SeungWoo Jung and Randolph Winter: Cardiac troponin I (cTnI) is a highly sensitive and specific cardiac biomarker for myocardial cell death. It is known that there is a strong correlation between cTnI concentration and the severity of heart disease. It is also well documented that a high degree of variability exists in serum and plasma cTnI concentrations in normal dogs and cats. Individual biological variability should be considered when interpreting the concentrations of cardiac biomarkers. However, the normal biological variability of serum and plasma cTnI concentration has not been investigated in the normal horse. Day-to-day or within-day variability of cTnI concentrations could potentially result in inaccurate diagnosis of myocardial injury by creating false-positive or false-negative results. The purpose of the study is to determine the normal biological variability of serum and plasma cTnI concentrations in the normal horse. Opportunities for a student via the Merial Veterinary Scholars Program involve study design, animal handling, sample collection, exposure to statistical analysis of data, and manuscript writing toward publication.

Dr. Nancy Merner: Identifying Genetic Risk Factors of Breast Cancer. A range of risk factors contributes to the development of the breast cancer (BC); some individuals inherit genetic risk variants that contribute towards disease onset. Such variants are divided into broad categories of penetrance that indicate the probability of resulting in BC. There are three general categories that confer variable amounts of relative risk (RR). High penetrant variants are associated with a RR >4; moderate penetrant variants and low penetrant variants account for RRs between 2-4 and around 1.5, respectively. Genes harboring BC risk variants are called BC susceptibility genes. Families with high penetrant variants have multiple cases of BC, early ages of onset, bilateral BC,
and male BC cases. Interestingly, only 25% of families with a strong predisposition to BC have a high penetrant variant in a known BC susceptibility gene. An additional 2-3% of BC families have moderate penetrant BC variants. Thus, Dr. Merner aims to identify novel genetic variants that increase risk of hereditary BC. She uses both human and canine models for her studies. Dr. Merner currently has over 110 human DNA samples from 56 cancer families that have been recruited through her hospital or community-based recruitment protocols. She has also acquired 85 canine BC DNA samples (59 blood and 26 swab extracted) from the CHIC DNA repository of the Orthopedic Foundation of Animals. This includes 31 different canine breeds; the most represented breeds are Golden Retrievers (n=20), Siberian Huskies (n=8), and Standard Schnauzers (n=7). The canine cohort also includes 3 male BC cases as well as several cases from the same kennel, all of which potentially represent familial BCs. Dr. Merner uses several next-generation sequencing approaches to identify BC risk variants. The human and canine cohorts can be studied separately but, ultimately, variants discovered in one model will be genetically validated in the other. This is a unique one-health approach that will aid in a better understanding of both human and canine BCs.

**Dr. Dawn Boothe:** *Control of Pain.* This summer, among our other activities, the laboratory will continue its focus on the role of cannabinoids in the treatment of pain and/or epilepsy. Techniques will range from collecting data for a clinical trial, to development of analytical techniques to molecular work in terms of receptor identification. Other activities will focus on the development and validation of assays for the detection of biological signals to drug.