

VIMES 2018

Science in Service to AnimalsSM



Respiratory Disease in
Commercial Poultry

42nd Annual Report



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Respiratory Disease in Commercial Poultry
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UNIVERSITY OF
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V VMES 2018

Science in Service to Animals

42nd Annual Report

July 1, 2017 to June 30, 2018

The Veterinary Medical Experiment Station (VMES) was established as a budgetary entity by the state legislature in July 1976 following approval by the University of Georgia Board of Regents in 1973.

MISSION

The VMES mission is to coordinate research on animal disease problems of present and potential concern to Georgia's livestock and poultry industries.

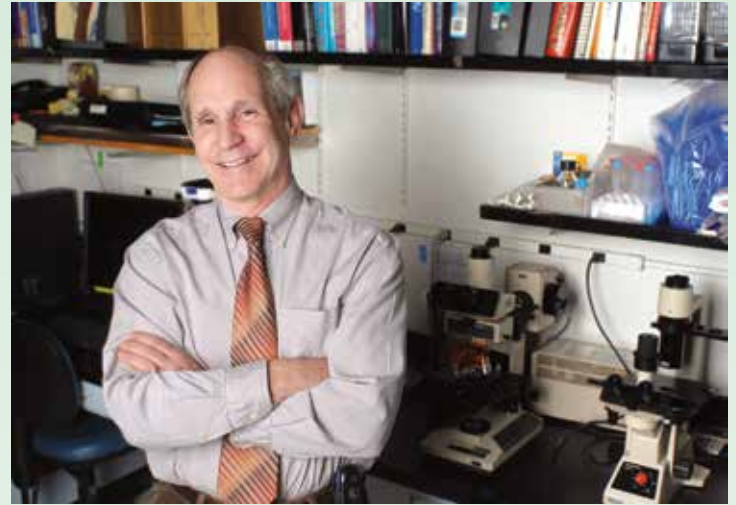
SPECIFIC VMES OBJECTIVES ARE:

- To improve the health and productivity of domestic livestock, poultry, fish, and other income-producing animals and wildlife through research;
- To assist in preventing disease epidemics by providing laboratory resources and highly skilled scientific personnel;
- To assist in protecting human health through the control of animal diseases transmissible to man;
- To improve the health of companion animals, which serve to enrich the lives of humankind;
- To train new scientists in animal health research in order to provide continuity and growth in this vital area of veterinary medicine.

The Veterinary Medical Experiment Station is committed to enhancing animal production, profitability, and well-being by improving animal health.

All programs and activities of the Veterinary Medical Experiment Station are conducted without regard to race, color, national origin, age, sex, or handicap.

I am pleased to introduce the 42nd Annual Report that continues our documentation of the long and productive history of the Veterinary Medical Experiment Station (VMES). In this year's lead article, Dr. Mark Jackwood and his colleagues at the Poultry Diagnostic and Research Center (PDRC) provide an overview of their work on respiratory pathogens, which cause the most significant infectious disease losses in commercial poultry production. It is important to note that the VMES was established as a budgetary entity by the state legislature in order to provide funding for our College's translational research on diagnostics, therapeutics and vaccines against the infectious diseases that constantly threaten the poultry industry in the State of Georgia. Today, the PDRC's research and veterinary training programs, such as the Masters in Avian Medicine, are recognized as the best in the nation and the world. VMES' mission of protecting our state's food animal resources has been successfully carried out and our impact expanded over the past 42 years by careful stewardship and use of VMES funds.



This Annual Report provides an overview of peer-reviewed, competitive projects and new faculty start-up projects conducted during fiscal year 2018 (July 1, 2017 – June 30, 2018). Projects supported by VMES state funding, and those supported by United States Department of Agriculture 1433 Capacity Grant funds are reviewed by veterinary scientists for quality of science and focus on relevant animal health issues or disease problems. The research must be innovative and applicable to the improvement of animal health. This work is especially critical because of the strong inter-relationship between animal and human health and the limited funding targeted for animal disease research. Thus, VMES research is integral to our College's vision to: "Create a world in which healthy animals and people enhance each other's lives."

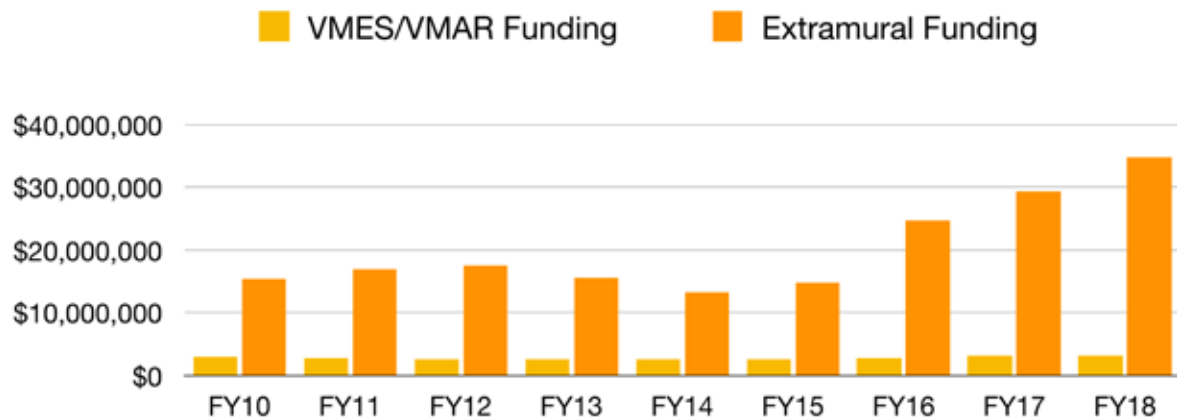
Further information about the projects highlighted in this year's Report is available by contacting the VMES office staff by phone, e-mail or website, or the investigators themselves. A list of peer-reviewed publications is provided, which represent a selection of VMES-supported work and other research by the faculty of the UGA College of Veterinary Medicine. This has been a record year for research productivity in the college, as more than \$30 million in extramural funding was attained. This is a testament to the quality of our faculty, staff, and students in the College of Veterinary Medicine.

As in previous years, we list in the VMES Annual Report the names of 36 individuals who received graduate degrees in 2018 after completing a comprehensive training program that includes original, hypothesis-driven research conducted under the mentorship of a College researcher. These students are attracted to our programs for the excellent research experiences and mentoring that they find here. The training of future researchers is of utmost importance to fulfillment of the mission of the Veterinary Medical Experiment Station and to meeting the future animal and public health needs of our state, nation and world. I am proud to have served as director for the last 21 years and will work to facilitate the transition of VMES leadership after my retirement next year.

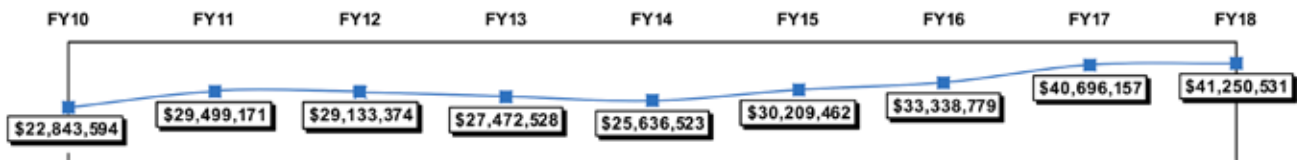
Harry W. Dickerson

Financial Tables

Research Dollars Leveraged

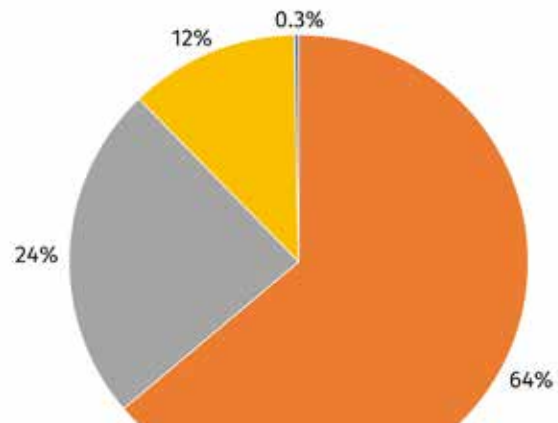


Research Expenditures



Budget Category	Amount	% of Budget
Personnel-Researchers/Techs/Research Staff	\$2,061,607	64%
Research Materials & Equipment	\$767,479	24%
Personnel-Research Administration & Accounting	\$370,488	12%
Travel	\$9,954	0.3%

A summary of the College's research funding is provided in the charts above. During FY2018, approximately \$10.85 research dollars were leveraged for each VMES dollar invested. Expenditures are from all sources including State Appropriations, Extramural Research Funding, and Donations. These expenditures include all budget categories including personnel costs.



Respiratory Disease in Commercial Poultry

UGA scientists work to identify and control these everchanging pathogens

Dr. Mark Jackwood



Drs. Naola Ferguson-Noel, Daniel Perez, Daniela S. Rajão, Mark Jackwood, Holly Sellers, Brian Jordan and Maricarmen García

The Poultry Diagnostic and Research Center (PDRC) is part of the Department of Population Health, which has as one of its missions to conduct basic and applied research on the diagnosis and control of economically important diseases of poultry. By far, the diseases that cause the most losses in commercial poultry are respiratory diseases. It is estimated that respiratory disease alone can cause losses in the billions of dollars annually in the USA.

Respiratory diseases in poultry are extremely difficult to control because the pathogens that cause them spread rapidly and are difficult to differentiate because they can outwardly appear very similar. Control strategies include biosecurity and vaccines, but those efforts are not always effective due to the ever-changing nature of the viruses and mycoplasmas causing disease. Researchers at the PDRC use state-of-the-art procedures to study poultry respiratory pathogens with the goal to develop more efficacious vaccines, and more specific and sensitive diagnostic tests. Following is a brief description of some of the on-going research being conducted by PDRC scientists for the most devastating respiratory pathogens in poultry, which include Avian Influenza Virus, Infectious Bronchitis Virus, Infectious laryngotracheitis Virus and Avian Mycoplasma.



Avian Influenza

Dr. Daniel Perez and Dr. Daniela S. Rajão

Influenza is one of the most devastating respiratory diseases of poultry.

Avian influenza is a viral disease caused by influenza A viruses that affect the respiratory, digestive, and nervous systems of several bird species, including domestic poultry and wild aquatic birds. The number of outbreaks of avian influenza has increased in the past few

decades, and have led to devastating economic losses to the poultry industry due to direct effects of the infection, as well as trade limitations and public opinion repercussions. This disease also has public health implications, in particular zoonotic strains that have emerged in Southeast Asia with the ability to cause lethal infections in humans and, therefore, are of great pandemic concern. In 2014-2015, a highly pathogenic avian influenza virus caused the largest poultry outbreak in U.S. history, resulting in the death or destruction of more than 50 million birds. The outbreak led to losses of 8 and 12% of turkey and egg-laying chicken inventories, with great impacts on egg and turkey productions in the country. The U.S. government allocated almost \$1 billion for response/preparedness activities and indemnity payments, and total cost to the U.S. economy is estimated to be \$3.3 billion.

Although developed countries rely on stamping out as the method of choice during avian influenza outbreaks, vaccination is routinely used in other countries where typical approaches either are insufficient to control spread, may cause an irreversible impact on the poultry industry or pose a threat to the food supply. Due to the changing nature of influenza viruses, vaccines must be constantly updated and reformulated. Current vaccines and vaccination strategies are simply not good enough to control and contain influenza viruses in poultry. One of the major goals of our laboratory is to develop more effective vaccines and vaccination regimens that overcome current limitations. Our studies with genetically modified live, attenuated influenza vaccine platforms that have the potential to be used in avian and mammalian species, including humans, have shown great efficacy against highly pathogenic influenza viruses in a variety of animal models, including poultry. Our efforts on vaccine development are complemented by efforts to rapidly characterize field isolates directly from clinical samples using the latest next generation sequencing technologies. Overall, our laboratory offers a balanced blend of basic and applied research that uniquely positions us to address the pressing needs of the poultry industry as well as animal and public health.



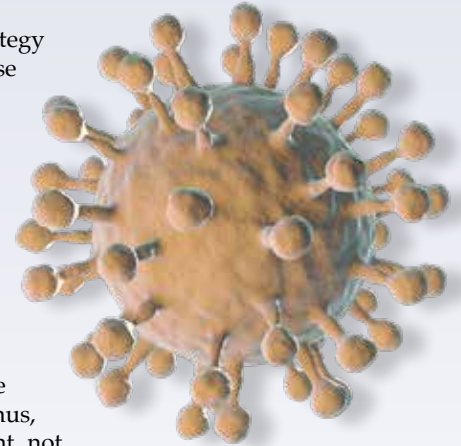
Avian Infectious Bronchitis

Dr. Mark W. Jackwood, Dr. Brian Jordan and Dr. Holly Sellers

Avian infectious bronchitis virus (IBV) is a coronavirus that causes a highly contagious upper-respiratory tract disease in chickens much like the common cold in humans. Other well-known coronaviruses include Severe Acute Respiratory Syndrome (SARS) virus in humans, Transmissible Gastroenteritis virus in pigs and Canine Coronavirus, which causes kennel cough in dogs. The American Association of Avian Pathologists consistently lists IBV as the number one research priority for commercial poultry because it is associated with severe production losses in broilers, layers and breeders. Avian IBV is world-wide in distribution and is extremely difficult to control because there are many different types of the virus that cause the disease. Much like the common cold in humans, the different types of the virus do not cross protect, making diagnosis extremely important.

A tremendous amount of progress aimed at quickly identifying and typing IBV isolates has been made through the use of biotechnology and PDRC scientists are at the forefront of that research. Our laboratory has developed a real time quantitative reverse transcriptase-polymerase chain reaction (qRT-PCR) test for IBV that rapidly detects all IBVs identified to date. We have also developed serotype specific qRT-PCR tests for Arkansas, Mass, Conn, and DE/GA98, GA07, GA08 and DMV1639 type viruses, which are the most common types currently affecting commercial poultry. Before the availability of these tests, it would take days or even weeks to identify just one IBV type. With the addition of these new tests, we can now test hundreds of samples and identify which IBV type is causing disease in a matter of hours. This allows poultry clinicians to rapidly react to the outbreak and implement effective control measures.

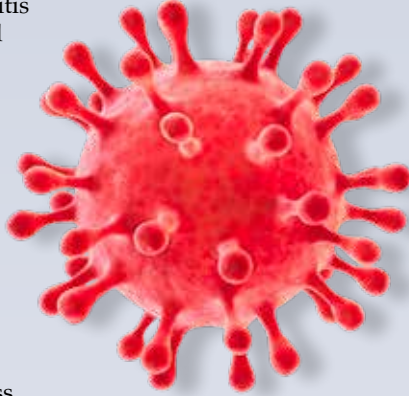
Currently, the best strategy for control of this disease is the use of modified live IBV vaccines. There are multiple serotypes and variants of the IBV virus, which arise due to mutations and recombination events during replication. Compounding this situation is the ability of IBV to rapidly change and adapt to the host. Thus, it is extremely important not only to rapidly identify the IBV type causing disease, but also to choose an appropriate vaccine. Our laboratories have been involved in developing conventional live attenuated vaccines against IBV, and several of those vaccines have been patented and licensed for use in commercial poultry. However, we are also developing innovative vaccines against IBV using new methodologies. Molecular analyses of field strains of the virus are being conducted to identify the emergence of new virus types and to follow the evolution of genes within the virus that code for important immunogenic proteins. That information is being used to produce recombinant vaccines against emerging viruses more rapidly than has been possible in the past. Because of the highly infectious nature of the virus, our other approach is to rapidly respond when outbreaks occur.



Infectious Laryngotracheitis

Dr. Maricarmen García

Infectious laryngotracheitis (ILT) is a very serious and widespread respiratory disease of chickens caused by infectious laryngotracheitis virus (ILTV), an avian herpesvirus. The virus mainly replicates in the upper respiratory tract of chickens and in the conjunctival epithelium causing severe respiratory distress and conjunctivitis. The most widely used methods for diagnosis



of ILT is through detection of lesions and viral antigens in tracheal and conjunctival tissues as well as detection of the viral genome. Re-emerging epidemics of ILT have a devastating impact on producers across the country, particularly in areas of dense poultry production. The overall economic damage caused by ILT is difficult to estimate, but the reduction in income for one affected poultry company in 2010 was estimated to exceed \$2 million. The disease is mainly controlled by vaccination and biosecurity. Our laboratory is at the forefront of the evaluation of new ILTV vaccination strategies for the administration of gene deleted strains of ILTV. This approach utilizes *in ovo* vaccination in order to provide early flock protection. Because there is a lack of information regarding the nature of the immune responses elicited by ILTV infection, we are currently evaluating interactions between ILTV and mucosal immune cells in the chicken. This information is fundamental for the future development of effective vaccines and vaccination strategies. As we learn more about the nature of the protective immunity elicited by vaccination, a long-term goal of our research is to improve the ILTV challenge model to better assess the effectiveness of new ILTV vaccines.

Our laboratory also serves as a national and international reference laboratory for the genetic typing of ILTV isolates. This approach has allowed poultry companies to identify the origin of circulating viruses, modify vaccination strategies accordingly, and resolve disruptions in biosecurity. We have also developed diagnostic tests based on real-time PCR that help the poultry industry trace live attenuated vaccines in flocks. This allows poultry veterinarians to accurately assess how effective the delivery of the vaccine was in the flock. This is important because the effectiveness of vaccine delivery is closely related to its performance in flocks.

Avian Mycoplasma

Dr. Naola Ferguson-Noel

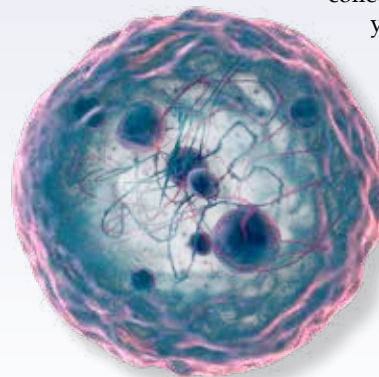
Mycoplasmas (or mollicutes) are bacterial pathogens that infect a variety of animal and plant species; *Mycoplasmas* are very host specific, which means that there are different *Mycoplasma* species for each host species. In chickens and turkeys, the most important *Mycoplasma* species are *Mycoplasma gallisepticum* and *Mycoplasma synoviae*. While the *Mycoplasmas* that affect poultry can result in severe, chronic respiratory disease, some species also may cause a wider spectrum of clinical signs ranging from joint problems to egg quality and egg production issues. Control of *Mycoplasma*

in commercial poultry has been very important to the overall success and profitability of the industry worldwide. The disease can be transmitted vertically through eggs from infected hens to their progeny, and so the infection can be very difficult to control and become quickly widespread when genetic and breeding stocks become infected. In the United States, the National Poultry Improvement Program was implemented in the 1930's to help the industry control certain economically important diseases, and avian *Mycoplasmas* were included in the program early in its inception.

Our overall goal with respect to avian *Mycoplasma* research at PDRC is to improve the diagnosis and control of the disease. We approach this goal in several ways – one is through the development of improved diagnostic tests. As part of this effort, we have developed molecular assays to rapidly and reliably detect low levels of infection and to characterize the strains involved in different outbreaks. We also are using comparative genomics to identify targets for epidemiological tracking, antimicrobial resistance and potential virulence factors. We also have studied optimal ways to collect, transport and test different samples to get the best results while keeping animal welfare in mind. Millions of chickens are screened for *Mycoplasma* on a routine basis in diagnostic laboratories throughout the country and we work closely with the National Poultry Improvement Program to train personnel and approve the laboratories using these procedures.

Although *Mycoplasma* control programs are often based on biosecurity, early detection, quarantine and elimination of positive flocks, vaccination is also good option for disease control in some circumstances. At PDRC we have developed new efficacious *Mycoplasma* vaccines that can reduce or eliminate the need for antimicrobial treatment of infected flocks. Using this approach, we can help reduce the dependence of poultry producers on antibiotics during a *Mycoplasma* outbreak. We also work with commercially available vaccines to optimize administration and design of vaccine programs to get the best results. We have developed molecular tools to study the pathogenesis of the disease in greater depth and identify immune mechanisms important for the development of safe and efficacious vaccines. Because the precise genetic basis for attenuation of avian *Mycoplasma* vaccines has not been fully established, we are focused on understanding this important mechanism with the goal of producing safer more effective vaccines. Our laboratory is unique among all others because we have access to hundreds of avian *Mycoplasma* isolates

collected over more than 40 years, including vaccine strains and genetically related pathogenic and avirulent re-isolates of the vaccine strains. Those resources are being fully utilized to develop control measures that will benefit the poultry industry for years to come.



Program summary

Although discussed separately above, two or more of those respiratory pathogens can come together in the same bird to cause even more severe disease and even higher economic losses. Because this is not uncommon in commercial poultry, the faculty at PDRC have developed close working relationships designed to study the multifactorial etiology of poultry respiratory diseases. This is indeed unique compared to other institutions and a significant strength of the research program at PDRC.

Another unique aspect of the research programs at PDRC is the balance we maintain between basic research that furthers our fundamental knowledge about a poultry pathogen and applied research that seeks to solve current disease problems in commercial poultry. Basic science findings usually take years to transition into the market place. Because our basic and applied research programs at PDRC constantly work together, we can push the boundaries of science, which leads to new and unique discoveries that can be transitioned to products and processes that directly benefit the poultry industry. We share this information with the scientific community, poultry clinicians, poultry producers and the general public through our scientific and lay publications, as well as by hosting workshops and training seminars. This work has resulted in over half a dozen patents and numerous vaccines and diagnostic tests being used in commercial poultry operations and diagnostic laboratories around the world.

Challenges for poultry health research programs going forward are already forming due to new disease situations associated with changes in how we raise chickens. The high demand for poultry raised with no antibiotics ever, for organic chicken and eggs, and for free-range chicken and eggs present new challenges to controlling respiratory disease in poultry. Scientists at PDRC will continue to conduct basic and applied research to help producers grow healthy chickens. That translates into more nutritious, wholesome and less expensive poultry products for all.



Evaluation of an Herbal Compound Used for Management of Lower Urinary Tract Disease in Healthy Cats

FELINE DISEASE

Lower urinary tract disease occurs commonly in cats, and urolithiasis accounts for 15 to 30% of these cases. Importantly, 80 to 90% of feline uroliths are composed of calcium oxalate or struvite. In young adult cats, struvite occurs more commonly while in older adult cats calcium oxalate occurs more commonly.

Cats with urolithiasis are managed by increasing water intake and urine volume to reduce urinary concentrations of calculogenic minerals and potential initiators of urinary bladder pain and inflammation. These larger urine volumes also increase urine transit time and voiding frequency, which reduce retention time for crystal formation and growth or for diffusion of noxious substances across the bladder uroepithelium. Feeding cats a canned food is the most practical means of increasing water intake and lowering calcium oxalate urine saturation and concentration of potential initiators of bladder pain. The goal is to dilute urine to a specific gravity of < 1.030 .



Dr. Joe Bartges

In addition to conventional therapy using modified diets, traditional Chinese and Western herbs have been recommended. Although Choriecto decreased the risk of struvite formation in young adult cats, no benefit was found in another study of three commonly used herbal treatments, San Ren Tang, Wei Ling Tang, and Alisma. The purpose of this study was to evaluate the efficacy of an herbal supplement containing extracts from multiple plants. We hypothesized that the supplement would be associated with increased urine volume and decreased urine saturation for calcium oxalate and struvite when compared with placebo.

A pilot study was performed to evaluate the supplement on risk of struvite and calcium oxalate crystal formation in healthy cats. Seven healthy, male cats, aged between 8 months and 5 years, were evaluated using a randomized placebo cross-over study in a pairwise fashion, each cat receiving treatment every 12 hours for a two-week period. A 24-hour voided urine sample was collected at the end of each treatment period. Samples were analyzed for electrolytes, minerals, and other compounds, and relative supersaturation for calcium oxalate and struvite was estimated using an iterative computer program. Data were assessed for normal distribution and statistical significance.

Data from 6 cats were used due to incomplete urine collection from 1 cat. Urine saturation for struvite was significantly lower when cats received supplement compared with placebo (supplement = 0.36 ± 0.19 , placebo = 1.57 ± 1.28 ; $p = 0.04$) and 24-hour urinary excretion of phosphorous was lower when cats received supplement compared with placebo (supplement = 44.9, range = 24.4 – 61.3 mg/kg/24h; placebo = 50.8, 41.4 – 63.5 mg/kg/24h; $p = 0.04$). There were no differences in other analytes, body weight, or urine volume.

The significant decrease in struvite supersaturation even with the small number of healthy cats, suggest that determination of relative supersaturation is a better determinant of risk of urolith formation than electrolyte and mineral concentrations or their excretion. The herbal supplement may be beneficial for managing struvite-associated lower urinary disease in cats.

Funding Agency
Principal Investigator
Co-investigators

New Faculty Startup, NHV Pet Products, Inc.
Dr. Joe Bartges
Mr. Cook English, Ms. Ashley Shaw, Dr. Sherry Cox

Comparison of Fresh and Frozen Equine Platelet Rich Plasma and Fresh and Frozen Equine Serum to Inhibit Matrix Metalloproteinases in Equine Tears

EQUINE DISEASE

Dr. Kathryn Diehl



Ulcerative keratitis is a common and potentially severe disease in horses. Corneal ulcers (abrasions of the clear front part of the eye) that become infected with either bacteria or fungi, or have an excess of proteolytic enzymes that break down protein, are likely to degrade, a process called keratomalacia (i.e., softening of the cornea). Two enzymes, matrix metalloproteinases (MMP 2 and MMP 9), are present in

the equine tear film and, when in excess, contribute to degradation of the cornea. MMP 2 is present in healthy corneas and may increase when the cornea is damaged. In contrast, MMP 9 has only been detected in unhealthy corneas. When severe keratomalacia occurs, aggressive topical therapy is recommended, and in some cases surgery may be necessary. In addition to using antimicrobials, topical application of a variety of compounds are used to reduce proteolytic activity. Two of these options are serum and platelet rich plasma (PRP). Serum is used as it is easy to obtain, minimally invasive, cost effective, and can be used immediately or stored frozen for later use.

A popular form of therapy for tendon and ligament injuries in horses is injection of PRP into the affected tissues. As a result, kits for collecting PRP stall-side that do not require centrifugation are available, making PRP more readily available than serum. Because PRP contains high levels of growth factors, ophthalmologists recently have used PRP to promote corneal wound healing in people. Currently, there are no studies evaluating corneal MMP levels after treatment with PRP. Therefore, our study was performed to evaluate the effects of fresh and frozen PRP compared to fresh and frozen serum on MMP levels in tears from horses with keratomalacia.

Tears were collected from eyes of 7 horses with keratomalacia (study group), and the opposite normal eyes of these same horses (control group). Study and control group samples were respectively pooled to provide the volume needed to measure MMP levels in a fluorimetric ELISA assay. Blood for serum and PRP were collected from healthy UGA research herd horses not receiving any medications. Once processed, half of the samples were refrigerated (fresh serum and fresh PRP) and half were stored frozen in a -80C freezer (frozen serum and frozen PRP). Serum and PRP samples were used within 48 hours.

Baseline MMP 2 and 9 levels were measured in both the study and control groups. MMP 2 and 9 levels were also measured in keratomalacic tears (study group) after the addition of either fresh serum, fresh PRP, frozen serum or frozen PRP. MMP-2 levels decreased from study group baseline values by 91% and by 78% after addition of fresh PRP and fresh serum, respectively. MMP-2 levels increased from study group baseline values by 3% and 32% after addition of frozen PRP and frozen serum, respectively. MMP 9 was not detected in the study group tears alone nor in these tears after the addition of frozen PRP. However, low levels of MMP 9 were measured in keratomalacic tears after the the addition of fresh PRP, and fresh and frozen serum.

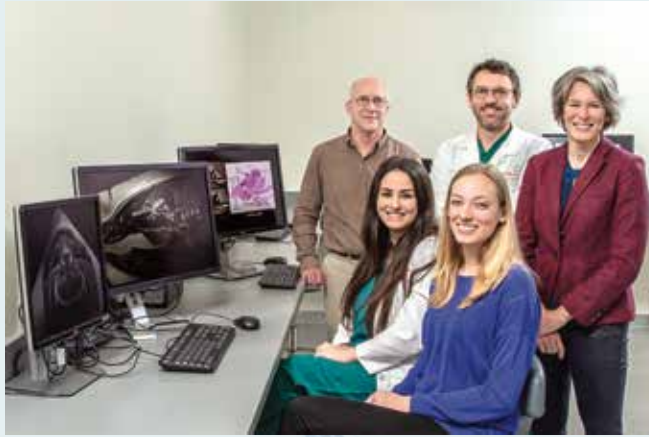
Based on these results, fresh PRP and serum appear to reduce MMP 2 levels better than frozen PRP and serum, with fresh PRP being more effective then serum. Because frozen samples increased MMP 2 levels, freezing and thawing PRP and serum for later use may be contraindicated.

Funding Agency **New Faculty Startup for Dr. Kathryn Diehl/ American Quarter Horse**
Principal Investigator **Dr. Silvia Pryor**
Co-investigators **Drs. Kathryn Diehl and Kathern Myrna**

Magnetic Resonance Imaging of the Fish Brain – Feasibility, Technique and Inter-Species Anatomic Differences

FISH IMAGING

Drs. Al Camus, Jessica Comoli, Jennifer Lynn Ruby, Steven Divers, and Karine Gendron



Recent advances in aquatic animal medicine and growth of the fish hobbyist and aquaculture communities have increased interest in antemortem diagnostic imaging of aquatic species. The aims of this study were to determine whether advanced neuroimaging can be safely achieved in living fish, optimize imaging parameters, and develop a comparative MRI-histology atlas of a few fish species of economic or research

value. Healthy male and female channel catfish (*Ictalurus punctatus*) and koi (*Cyprinus rubrofuscus*) at least 12 inches in length were individually anesthetized for MRI evaluation of the brain. All fish achieved an adequate anesthetic level for prolonged immobilization during imaging, were successfully recovered from anesthesia, humanely euthanized and immediately processed for brain histopathology. Although spatial resolution was best in larger fish, diagnostic quality images were obtained on all subjects. Imaging protocols were optimized for standard neuroimaging sequences (T2 and T1-weighted, fat saturation), and excellent spatial and contrast resolution were obtained with 1.5-2mm slices at usual echo (TE) and repetition (TR) times. Careful planning of the study using numerous scout images was necessary; obtaining a dorsal plane sequence in T2w early on in the series resulted in better appreciation of the axis of the forebrain, helped adjust slice orientation, if needed, and provided superior visualization of the optic and olfactory nerves.

Proton-density (PD) sequences, which yield superior signal distinction between fluid, hyaline cartilage, grey and white brain matter in mammals, resulted in moderately useful images with sharply defined anatomy but only average contrast, which we believe are related to the histologic and molecular makeup of the fish brain. Due to time constraints of anesthesia, no further attempts were made to improve them. Additionally, inversion times for fluid-attenuation inversion recovery (FLAIR) sequences were adapted to the high protein content of fish CSF, resulting in best attenuation of this fluid with inversion times (TI) of 1500ms. STIR sequences failed to attenuate fat signal in the lymphatic fatty tissue present in the cranium at inversion times (TI) of 220ms.

Diffusion-weighted tractographies (DTI) were attempted but did not result in diagnostic images. Double TE SE T2w sequences were obtained in three fish, which will allow for quantification of brain transverse relaxation times. A comparative MRI and histology atlas will be created of these species' brain once histologic preparations are complete. A research permit was obtained recently for the inclusion of two normal grass carp (*Ctenopharyngodon idella*); it is our plan to perform imaging and comparative anatomy on this species. It is our belief that images of this quality may be diagnostically useful in research and in the workup of select neurological disease in pet fish.

Principal Investigator
Co-principal investigators
Co-investigators

Dr. Karine Gendron
Drs. Jennifer Lynn Ruby and Al Camus
Drs. Steven Divers and Jessica Comoli

Genetic Variation in Melanocortin Receptors in Equine Pituitary Pars Intermedia Dysfunction

EQUINE DISEASE

Pituitary Pars Intermedia Dysfunction (PPID), or equine Cushing's Disease, is an age-related, progressive disorder affecting the pituitary gland and brain. PPID can affect up to one-third of older horses, and shares similarities with Parkinson's Disease in people. All breeds of horses and ponies can develop PPID, though some studies suggest that certain breeds of ponies may be predisposed to the condition. Exactly how the disease develops or why certain breeds might be at a greater risk, are not known.



Dr. Kelsey Hart and Ms. Sarah Vaughn

Horses and ponies with PPID have higher blood levels of several pituitary gland hormones that act by binding to a target receptor called melanocortin receptor on cells throughout the body. One specific melanocortin receptor called MC1R is involved in three key factors in PPID, namely chemical signaling in the brain, inflammation, and immune function. We suspect that breed and age-related predisposition to PPID in some animals result from differences in how the MC1R functions.

Recent work in people and rodent models have revealed that mutations in the genes that code for MC1R are associated with disease presentations similar to aspects of PPID in horses. However, the genes coding for MC1R in horses have not been examined to date. Thus, the objectives of this project were: 1) to determine if there are genetic differences in MC1R between breeds predisposed to develop PPID (Welsh Ponies) and non-predisposed breeds of horses; and 2) to determine if genetic differences in MC1R exist between ponies with PPID and ponies without the disease.

For this study, we first developed and validated the necessary genetic tools to purify the MC1R gene from equine DNA samples. We did this using the polymerase chain reaction (PCR), which is a way to make many copies of a short piece of DNA. This process allowed us to copy and amplify the MC1R gene in blood samples from horses and ponies. Doing this allows us to do more detailed analyses and look for mutations in ponies or animals with PPID. For this study, we used archived DNA samples from horses and ponies collected for a previous multi-breed study conducted by our collaborator, Dr. Molly McCue at the University of Minnesota. We are in the final stages of amplifying MC1R DNA from 29 healthy ponies, 25 healthy horses, and 36 ponies with PPID. Once that DNA amplification is complete, we will compare the specific genetic code for MC1R among the healthy ponies, the healthy horses and the animals with PPID to see if there differences exist.

This work will increase our understanding of the possible contribution of genetic differences in MC1R to the development of PPID, and could lead to better diagnosis, treatment and even prevention of this important and common disease. Additionally, this work may be relevant to the development of similar diseases in elderly people, such as Parkinson's disease.

Principal Investigator
Co-investigator

Dr. Kelsey Hart
Ms. Sarah Vaughn

Is Anthelmintic Resistance in the Nematode Parasites of Poultry an Undiagnosed and Looming Problem?

POULTRY DISEASE

Intestinal roundworms of poultry (*Ascaridia galli* and *A. dissimilis*) are two of the most common and economically important nematode parasites infecting chickens and turkeys, respectively. Effects of infection are usually mild, causing only reduced feed efficiency and weight gain, but in more severe cases also can cause intestinal blockage, severe enteritis with diarrhea, and in some cases death.



Dr. Ray Kaplan

To control infections with *Ascaridia*, turkey operations routinely administer dewormers, often at intervals as short as three weeks. Fenbendazole (SAFE-GUARD®) is the most commonly used drug, with an expected efficacy of >99%. However, several veterinarians have recently reported large numbers of worms being present in turkeys at slaughter despite receiving multiple treatments of fenbendazole. This led us to believe that drug resistance of *A. dissimilis* to fenbendazole may be an emerging problem.

To test our hypothesis that resistance is emerging, we performed a controlled clinical trial using *A. dissimilis* parasites isolated from four turkey farms. Three of the farms had suspected resistance based on reports of worms seen at slaughter, and one farm was randomly selected based on being an “organic” operation. This farm was meant to serve as a drug-susceptible control. Infective *Ascaridia* eggs from these 4 farms were used to infect 4 pens each of 2-week old turkey poults. Two separate rooms were used to house the birds, with a replicate of each experimental group in each room. One month later, turkeys in half of the pens were treated for 5 consecutive days with fenbendazole (SafeGuard® Aquasol, 1.25 mg/kg), while the other half were left as untreated controls. One week after treatment, birds were humanely euthanized and all worms were recovered and counted.

Interestingly, on the three farms with “suspected” resistance, treatment reduced worm numbers by 99.2%, 100%, and 100%, respectively. In contrast, the isolate from the organic farm demonstrated only 63.9% reduction. Similar results were seen in the replicate groups in the two separate rooms. These results suggest that the apparent lack of efficacy reported for the three farms was not due to drug resistance, but rather was likely due to high re-infection rates and inadequate delivery of the drugs to the birds. However, the results from the organic farm clearly indicate drug resistance is present on that farm. Although this farm is currently managed organically with no use of commercial dewormers, this change was made just a few years ago. Thus, the *Ascaridia* worms on the organic farm must have already developed resistance before the use of fenbendazole was discontinued. These unusual results have important implications. The organic farm sample was randomly collected and was assumed to be “drug-susceptible”. The fact that our one randomly selected farm had resistant worms, and that this was a farm that had not used dewormers recently, suggest that fenbendazole resistance in *A. dissimilis* is likely a much larger problem than is currently recognized.

This study demonstrated definitively, for the first time, the existence of fenbendazole-resistant *Ascaridia* in poultry. Given these results, further studies are required to determine both the prevalence of fenbendazole resistance on poultry farms in the US, as well as the economic impact that drug-resistant worms have on turkey productivity.

Principal Investigator
Co-investigators

Dr. Ray M. Kaplan
Drs. Brian Jordan, Luke Baldwin, Claude Hebron and
Mr. James B. Collins

FELINE SURGERY

Dr. Mandy Wwallace



In a small number of dogs and cats, abnormal blood vessels are present from birth that allow blood from the gastrointestinal tract to bypass the liver and directly enter the bloodstream. These abnormal vessels, which are called extrahepatic portosystemic shunts, make it impossible for the liver to remove toxins created during digestion of food in the gastrointestinal tract. This leads to a build-up of toxins in the brain, causing signs such as

abnormal mentation, seizures and vomiting. Surgical treatment to close the abnormal vessel allows affected dogs and cats to have an excellent quality of life and normal lifespan.

Surgical placement of a medical device that slowly closes the abnormal vessel over 1-2 months has become the standard of care, as this allows the liver to adjust to the increase in the volume of blood it receives after closure of the abnormal vessel. These gradual occlusion devices typically work by causing inflammation around the vessel which causes blood flow through the vessel to cease. One such gradual occlusion device utilized to close portosystemic shunt vessels is cellophane. Cellophane, or thin film, banding is a procedure by which a piece of sterilized cellophane is wrapped around the abnormal vessel and secured with clips to prevent it from slipping off. While studies in research dogs have shown vessel closure in most cases within 1-2 months, no such study has been performed in cats. Clinical studies in cats have shown variable results with up to 44% of cats having continued liver dysfunction 3 months after surgery. This has caused concern that the cellophane banding procedure might be unreliable in cats. The objective of our study was to determine if the cellophane band would lead to full closure of a vessel within the abdomen of cats over an 8 week period.

In our study, a cellophane band was placed around an abdominal vessel that was of similar size to most portosystemic shunt vessels in six cats. This allowed us to replicate what would happen in the abdomen of a cat with a naturally-occurring portosystemic shunt. The cats underwent computed tomographic (CT) scans with contrast material injected into the vessel before and after surgical placement of the cellophane band, as well as every 2 weeks thereafter until the band had been in place for 8 weeks. The band was then surgically removed. At the end of the study, cats were adopted to members of our UGA veterinary college community.

All six cats tolerated the band placement, and follow-up CT scans without complication. After eight weeks, only one cat had complete closure of the vessel as determined by CT scan. Three of the six cats had progressive closure of the vessel, followed by the vessel re-opening over the 8 week period. The remaining two cats had initial partial closure of the vessel; however, those vessels did not progress to complete closure by the end of the study.

Based on this study, we determined that use of cellophane banding for closure of portosystemic shunt vessels in cats leads to incomplete and inconsistent closure. While the effect of incomplete vessel closure in cats with portosystemic shunts is unknown, it is possible that cats may continue having decreased liver function if the vessel does not close completely. Based on our findings, other gradual occlusion devices should be recommended for use in cats with portosystemic shunts.

Principal Investigator
Co-investigators

Dr. Mandy L. Wallace
Drs. Kristin Freund and Scott Secrest

Selected Extramural Contracts & Grants

Banovic,Frane. Canine model of IgE-induced atopy – dose response determination. Industry Sponsor. \$99,676
Effect of Lokivetmab on Molecular Signature of Canine Atopic Dermatitis using RNA Sequencing..AKC Canine Health Foundation. \$9,747
Establishment of a Canine IL-31 Induced Pruritus Model to Evaluate Therapeutic Candidates for Atopic Dermatitis. Industry Sponsor. \$61,123
How to appropriately perform a skin bacterial culture? Investigation of staphylococcal diversity in canine superficial pyoderma. American College of Vet Dermatology. \$12,204
Immunomodulatory effects of recombinant hookworm anti-inflammatory protein-2 (AIP-2) on peripheral blood mononuclear cell function in healthy and atopic dermatitis canine patients. Industry Sponsor. \$68,318
Barber,Renee. Targeting the T helper cell inflammatory pathway in meningoencephalomyelitis of unknown etiology. AKC Canine Health Foundation. \$8,845
Bartges,Joseph. Efficacy of an Herbal Therapy for Canine Pituitary-Dependent Hyperadrenocorticism: A Pilot Study. Industry Sponsor. \$25,632
Evaluation of an Herbal Compound on Urinary Saturation for Calcium Oxalate in Dogs that Have Formed Calcium Oxalate Uroliths. Industry Sponsor. \$45,448
Evaluation of an Herbal Therapy for Naturally Occurring Hyperthyroidism in Cats: A Pilot Study. Industry Sponsor.\$26,735
Influence of Diet and Time on Serum Levels of Advanced Glycation End-Products (Ages) and Receptor for Advanced Glycation End-Products (Rages) in Dogs-Phase 2. Industry Sponsor. \$105,119
Baxter,Gary. Hill's Veterinary Nutrition Technician 2017. Industry Sponsor. \$40,000
Brown,Corrie. Animal Health Technical Assistance. US Dept. of Agriculture. \$13,145
The Effect of Passive Surveillance Training on Animal Health Parameters, Northern Ethiopia.
University of Florida as flow through from USAID. \$16,391
Brown,Scott. Engaging Students in Diabetic Kidney Disease: An Interactive Inquiry Approach. National Institutes of Health. \$10,793
Chen,Shiyu. Dedicator of Cytokinesis 2 in smooth muscle phenotype modulation. National Institutes of Health. \$448,716
Novel Mechanisms of Smooth Muscle Phenotypic Modulation and Vascular Remodeling. National Institutes of Health. \$375,000
Smad2 in vascular smooth muscle homeostasis. National Institutes of Health. \$479,218
Credille,Brenton. Impact of Combination Antibiotic Therapy on Killing of Mannheimia haemolytica.
GA Commodity Comm for Beef. \$15,000
Czaja,Krzysztof Vagal Influence on Brainstem Plasticity and Neural Coding of Taste. National Institutes of Health. \$618,205
Epstein,Kira. Equine Safety Study: Stableplate RX Equine. Industry Sponsor. \$50,890
Ferguson-Noel,Naola. Development of a Live Mycoplasma gallisepticum Vaccine in Chickens. Industry Sponsor. \$67,916
Improvements in molecular diagnostics for mycoplasma, infectious laryngotracheitis virus, and other relevant avian respiratory pathogens. US Poultry & Egg Association. \$62,278
Fischer,John. Cooperative Agreement for CESU-affiliated Partner with USGS-Piedmont South Atlantic Coast Cooperative Ecosystem Studies Unit. US Department of Interior. \$30,000
Diagnostic, Field and Training Assistance for Wildlife Health and Disease Monitoring. US Department of Interior. \$10,000
Feral Swine Diseases Information and Training. US Department of Agriculture. \$50,000
Relationships Involving Wildlife, Livestock, and Poultry and Exotic Arthropod Surveillance. US Department of Agriculture. \$504,302
Franklin,Samuel. Assessment of canine ACP Cellular and Growth Factor Content; Pilot Canine Testing of the Thrombinator Device. Industry Sponsor. \$16,391
Fu,Zhen. PIKA Vaccine Testing. Industry Sponsor. \$171,514
Giguere,Steeve. Deciphering the molecular mechanisms and transmission of macrolide resistance in Rhodococcus equi. Morris Animal Foundation. \$100,000
Epidemiology of drug-resistant R. equi at horse farms. Grayson-Jockey Club Rsch Fndtn. \$117,990
Firocoxib in equine pregnancy and placentitis. University of Florida as flow through from Grayson-Jockey Club Rsch Fdtn. \$41,869
Host-Directed Prevention of R. equi Pneumonia in Foals. Texas A&M University as flow through from Grayson-Jockey Club Rsch Fndtn. \$44,264
Guo,Tai. SHRP Incentive Award - Prevention of type 1 diabetes by genistein, daidzein and soybean oil. United Soybean Board. \$10,000
Guo,Xia. Dedicator of cytokinesis 2 in atherosclerosis. National Institutes of Health. \$108,853
Harvill,Eric. Analysis of Bordetella pertussis vaccine antigens. Center for Disease Control. \$15,000
The Microbiota Pathogen Competition. National Institutes of Health. \$382,308
A Novel Polysaccharide Structure that Mediates Transmission. National Institutes of Health. \$187,500
Bordetella Research Discussions. Industry Sponsor. \$1,950
Developing a Novel Vaccine against Whooping-Cough. Emory University as flow through from National Institutes of Health. \$60,000
He,Biao. A Novel Vaccine for Burkholderia pseudomallei and Burkholderia mallei..National. Institutes of Health. \$748,665
A parainfluenza virus 5 vector for CRISPR-Cas9 gene editing of CFTR locus. Cystic Fibrosis Foundation. \$101,481
Mucosal Protection Against HIV Generated by PIV5 Priming and VLP. Cincinnati Children's Hospital as flow through from National Institutes of Health. \$180,914
Pathogenesis of Jeilongvirus. National Institutes of Health. \$954,684
Howerth,Elizabeth. Improved Live Attenuated Brucella Vaccines to Reduce Human Disease. Texas A&M University flow through from National Institutes of Health. \$74,250
Jackwood,Mark. A Novel, Translational, Multidisciplinary Approach to Control Poultry Respiratory Diseases in the United States. Ohio State University as flow through from US Department of Agriculture. \$134,138
Jones,Arthur. Determining the Seroprevalence of Anaplasma marginale infected beef herds in Georgia. GA Commodity Commission for Beef. \$23,250
Jordan,Brian. Evaluation of protection against Ark IBV challenged broiler chickens vaccinated with CEVA Mass and GA08 type IBV vaccines. Industry Sponsor. \$18,133
Infectious bronchitis virus spike protein-pseudotyped virus particles for vaccine applications. US Poultry & Egg Association. \$60,057
Protectotype Experiment Evaluating Protection using the infectious bronchitis virus USA 4/91 vaccine strain and MA5 vaccine against Arkansas or GA08 Challenge. Industry Sponsor. \$87,360
Lafontaine,Eric. Brucellosis Prize Competition. GALVmed. \$100,000
Lee,Jae-Kyung. Evaluating the role of NK cells in PD pathology. Michael J. Fox Foundation. \$99,975
Logue,Catherine. Potential Impact of Litter Quality on E. coli-associated Cellulitis in Production Turkeys in Iowa. US Poultry & Egg Association. \$57,500
Maurer,John. Using a microbiome approach to reducing the resistome in poultry litter amended soils. USDA NIFA. \$1,199,752
Mead,Daniel. NDV Efficacy Study. Industry Sponsor. \$243,957
Arbovirus Surveillance through Dead Bird and Mosquito Pool Testing. Dekalb County Board of Health. \$9,900
Dekalb County Arbovirus Surveillance, Mosquito Pool Testing. Dekalb County Board of Health. \$9,900
Vector-Borne Disease Surveillance and Mosquito Diagnostic Support. Chatham County Board of Comm. \$86,250
Moore,James. Interactive Educational Materials for Veterinary Medicine. Industry Sponsor. \$40,000
Moorhead,Andrew. Furnish Bugia Malayi Adult Worms and Bugia Malayi Infective Larvae. National Institutes of Health. \$41,667
Pre-clinical models of infectious diseases-(IDIQ). National Institutes of Health. \$1,560,201
Production of B.Malayli Infective Larvae and Adult Worms. National Institutes of Health. \$308,195
Murdock,Courtney. Assess heartworm product. Industry Sponsor. \$37,837
Influence of temperature on malaria transmission and prospective vector control. Pennsylvania State, University as flow through from National Institutes of Health. \$5,857
The role of African Green Monkeys in the epidemiology of dengue and chikungunya on St. Kitts, West Indies. Ross University as flow through from National Institutes of Health. \$41,639

Myrna,Kathern. Comparison of fresh and frozen equine platelet rich plasma and fresh and frozen equine serum to inhibit matrix metalloproteinases in equine tears . American Quarter Horse Foundation. \$4,207

Nagy,Tamas. Endothelial cell tropism in the pathogenesis and host response against influenza viruses. University of Chicago as flow through from National Institutes of Health. \$16,442

Naikare,Hemant. FY17 NAHLN Member Lab Agreement-Tifton. USDA APHIS. \$120,693

Norris,Karen. Dysbiosis Impact on Lung Disease in HIV (DIMPL) Study. University of Pittsburgh as flow through from National Institutes of Health. \$27,621

Immunopathogenesis of HIV-associated pulmonary hypertension. National Institutes of Health. \$887,809

Molecular Drivers of Vascular Stiffness and Metabolic Dysfunction in HIV-Induced Pulmonary Arterial Hypertension. University of Pittsburgh as flow through from National Institutes of Health. \$429,194

Palomares,Roberto. Effect of administration of injectable trace minerals on the systemic and mucosal immune responses induced by intranasal modified-live virus vaccination in young dairy calves. Industry Sponsor. \$38,350

Perez,Daniel. Bioinformatics Resource Centers for Infectious Diseases. Industry Sponsor as flow through from National Institutes of Health. \$32,460

Drug Discovery Targeting the Influenza A Virus M2-S31N Proton Channel. University of Arizona as flow through from National Institutes of Health. \$70,618

Host dependence of influenza A virus reassortment. Emory University as flow through from National Institutes of Health. \$215,761

NAID CEIRS - Animal Influenza Surveillance in Argentina & Guatemala/Transmission of H9 and H7 Flu Viruses. Mount Sinai School of Medicine as flow through from National Institutes of Health. \$1,110,248

Vaccination of poultry against avian influenza viruses. Industry. \$251,135

Peroni,John. Foreign body reaction. Immunomodulatory properties of CXCL12. Industry Sponsor. \$63,650

Infrared Neuromodulation Reveals a New Understanding of Ganglion Organization. Case Western Reserve University as flow down from National Institutes of Health. \$89,646

Platelet lysate modulates systemic inflammatory responses in horses. American Quarter Horse Foundation. \$44,171

Platt,Simon Canine Immuno Neurotherapeutics. University of Alabama as flow through from National Institutes of Health. \$47,472

Quinn,Frederick. Detection of early-stage, active tuberculosis infection using a rapid, inexpensive and simple-to-use microneedle patch diagnostic platform. Georgia Institute of Technology as flow through from National Institutes of Health. \$52,500

Large-Scale Analysis of the Evolution of Organellar Social Networks. University of Pittsburgh as flow through from National Science Foundation. \$148,388

Rada,Balazs. Anti-NET autoantibodies in CF. Cystic Fibrosis Foundation. \$54,000

Anti-NET autoantibodies in cystic fibrosis. National Institutes of Health. \$187,500

Contribution of neutrophils to early airway disease in cystic fibrosis children. Emory University as flow through from National Institutes of Health. \$14,900

Neutrophil extracellular traps in cystic fibrosis. National Institutes of Health. \$661,024

The Role of Oxidative Epithelial Defenses in Influenza Infection. National Institutes of Health. \$225,000

Ritchie,Branson. Research Associate in Exotic/Zoo Infectious Disease and Pathology. Various-Non-Corp Grants. \$15,000

Ross,Ted. Assessing Influenza Vaccine Immune Responses. Industry Sponsor. \$1,258,656

COBRA: Cross-Reactive HA influenza vaccines. Industry Sponsor. \$3,800,000

Development of a Chikungunya Vaccine Candidate. Industry Sponsor. \$139,965

Emory-UGA CEIRS: Evaluating immune response in humans elicited to TIV vaccination in 5 consecutive years (Option 15). Emory University as flow through from National Institutes of Health. \$497,461

Omics-Based Predictive Modeling of Age-Dependent Outcome to Influenza Infection. New York University as flow through from National Institutes of Health. \$268,169

Structure-Guided Design of CD4 T cell Memory-Enhanced rHA H7N9 Influenza Vaccine. Industry Sponsor. \$508,764

Dengue Human Immunology Project Consortium (DHIPC) Zip. Mount Sinai School of Medicine as flow through from National Institutes of Health. \$67,401

Ruder,Mark. Southeastern Cooperative Wildlife Disease Study. Various Other States. \$541,000

Saba,Corey. Evaluation of progression free survival and immunological response to a vaccine administered to dogs receiving definitive surgery and adjuvant carboplatin chemotherapy for spontaneous appendicular osteosarcoma (Protocol 17-019). Industry Sponsor. \$50,000

Evaluation of the efficacy and safety of feline interleukin-2 immunomodulator (ALVAC IL-2) as a treatment for equine sarcoid tumors. Industry Sponsor. \$15,000

Saliki,Jeremiah. National Animal Health Laboratory Network: GA FY17. USDA NIFA. \$385,247

Schank,Jesse NfKB: A critical link between alcohol abuse and stress-sensitivity. National Institutes of Health. \$37,759

The Neurokinin-1 Receptor as a Mediator of Alcoholism and Depression Comorbidity. National Institutes of Health. \$337,500

Sanchez,Susan. One Health; Epidemiology of natural and deliberate contaminants (infectious and toxicities) in animals and animal food. US Department of Health and Human Services. \$31,500

Schmiedt,Chad. Comprehensive gene expression analysis of renal tissue from cats with naturally occurring feline chronic kidney disease using RNA-Seq. Industry Sponsor. \$52,644

Proposal to investigate 90-minute unilateral renal ischemia and 90-day contralateral nephrectomy in cats. Industry Sponsor. \$218,501

Stallknecht,David. Natural History of Influenza A Viruses in Wild Bird Populations: Understanding Reservoirs and Risks. St Jude Children's Research Hospital as flow through from National Institutes of Health. \$300,000

Tompkins,Stephen. Mechanisms Of Protection of Universal Therapeutic Antibodies To Influenza A. Baylor College of Medicine as flow through from National Institutes of Health. \$260,952

Thermostable Live Attenuated Influenza Vaccine for Nasal Delivery-Phase II. Industry Sponsor. \$249,967

Post-baccalaureate Training in Infectious Disease Research. National Institutes of Health. \$416,133

Trent,Michael. A High-Throughput Molecular Platform for Antimicrobial Discovery and Study. University of Texas at Austin as flow through from National Institutes of Health. \$25,001

Development of a novel vaccine platform: Surface Antigen/Adjuvant Vaccine Engineering (SAAVE). National Institutes of Health. \$597,338

Investigation of the lipid transport Mla pathway. National Institutes of Health. \$56,694

Molecular mechanisms required for the maintenance of the gram-negative outer membrane. National Institutes of Health. \$409,560

The Outer Surface of Vibrio Cholerae. National Institutes of Health. \$577,185

Tripp,Ralph. EMORY-UGA CEIRS. Emory University as flow through from National Institutes of Health. \$1,356,337

Uhl,Elizabeth. Codon Usage in Morbilliviruses: Evidence for Evolutionary Conservation and importance for Adaptation to New Hosts. US Department of Defense. \$220,989

Verocai,Guilherme. Procurement and molecular identification of parasites of veterinary importance from fecal specimens. Center for Disease Control. \$31,973

The Diroscope: validation of a novel cellphone-based video microscope for diagnosis of canine heartworm infection. American Heartworm Assn. \$16,008

Viveiros,Maria. Mechanisms of Spindle Assembly in Oocytes. National Institutes of Health. \$75,000

Wallace,Mandy. The Impact of Lidocaine Administration on Natural Killer Cell Populations in Canine Sepsis. AKC Canine Health Foundation. \$14,896

Wilkes,Rebecca. Targeted next-generation sequencing panel for detection of equine pathogens. Industry Sponsor. \$15,000

Wolstenholme,Adrian. Screening C. elegans mutant strains for new clues about ivermectin and its mode of action. National Institutes of Health. \$187,500

Yabsley,Michael. Comparison of Different Surveillance Methods for Modeling Dispersal of Ticks by Wildlife Hosts. US Dept of Agriculture. \$102,811

Experimental studies on dogs as hosts for Guinea Worm. Carter Center Inc. \$15,841

Spatial and temporal aspects of the distribution of Lyme disease Companion. Animal Parasite Council. \$79,922

Selected Publications

- Abente, E. J., Gauger, P. C., Walia, R. R., Rajao, D. S., Zhang, J., Harmon, K. M., Killian, M.L., Vincent, A. L. (2017). Detection and characterization of an H4N6 avian-lineage influenza A virus in pigs in the Midwestern United States. *Virology*, 511, 56-65. doi:[10.1016/j.virol.2017.08.021](https://doi.org/10.1016/j.virol.2017.08.021)
- Abongwa, M., Cho-Ngwá, F., Ayimele, G., Samje, M., Babiaka, S. B., Sakanari, J., Mostafa, E., Wolstenholme, A.J., Martin, R.J., Robertson, A. P. (2017). ACTIVITY OF CRUDE EXTRACTS AND CHROMATOGRAPHIC FRACTIONS OF DANIELLIA OLIVERI AND PSOROSPERMUM FEBRIFUGUM AGAINST ADULT BRUGIA PAHANGI. In *AMERICAN JOURNAL OF TROPICAL MEDICINE AND HYGIENE* Vol. 95 (pp. 152). Atlanta, GA: AMER SOC TROP MED & HYGIENE. Retrieved from <http://gateway.webofknowledge.com/>
- Acciani, M., Alston, J. T., Zhao, G., Reynolds, H., Ali, A. M., Xu, B., & Brindley, M. A. (2017). Mutational Analysis of Lassa Virus Glycoprotein Highlights Regions Required for Alpha-Dystroglycan Utilization. *JOURNAL OF VIROLOGY*, 91(18), 17 pages. doi:[10.1128/JVI.00574-17](https://doi.org/10.1128/JVI.00574-17)
- Acuff, N. V., LaGana, M., Nagy, T., & Watford, W. T. (2017). Severe Dermatitis Associated with Spontaneous Staphylococcus xylosus Infection in Rag(-/-)Tpl2(-/-) Mice. *COMPARATIVE MEDICINE*, 67(4), 344-349. Retrieved from <http://gateway.webofknowledge.com/>
- Acuff, N. V., Li, X., Latha, K., Nagy, T., & Watford, W. T. (2017). Tpl2 Promotes Innate Cell Recruitment and Effector T Cell Differentiation To Limit Citrobacter rodentium Burden and Dissemination. *INFECTION AND IMMUNITY*, 85(10), 13 pages. doi:[10.1128/IAI.00193-17](https://doi.org/10.1128/IAI.00193-17)
- Adams, E., & Ilha, M. R. S. (2018). Pathology in Practice.. *Journal of the American Veterinary Medical Association*, 252(10), 1227-1230. doi:[10.2460/javma.252.10.1227](https://doi.org/10.2460/javma.252.10.1227)
- Adetona, A. M., Adetona, O., Gogal, R. M., Diaz-Sanchez, D., Rathbun, S. L., & Naeher, L. P. (2017). Impact of Work Task-Related Acute Occupational Smoke Exposures on Select Proinflammatory Immune Parameters in Wildland Firefighters. *JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE*, 59(7), 679-690. doi:[10.1097/JOM.0000000000001053](https://doi.org/10.1097/JOM.0000000000001053)
- Adhikari, P., Cosby, D. E., Cox, N. A., Franca, M. S., Williams, S. M., Gogal, R. M., Ritz, C.W., Kim, W. K. (2018). Effect of dietary fructooligosaccharide supplementation on internal organs Salmonella colonization, immune response, ileal morphology, and ileal immunohistochemistry in laying hens challenged with Salmonella enteritidis. *POULTRY SCIENCE*, 97(7), 2525-2533. doi:[10.3382/ps/pey101](https://doi.org/10.3382/ps/pey101)
- Albanese, G. A., Tensa, L. R., Aston, E. J., Hilt, D. A., & Jordan, B. J. (2018). Evaluation of a coccidia vaccine using spray and gel applications. *POULTRY SCIENCE*, 97(5), 1544-1553. doi:[10.3382/ps/pey011](https://doi.org/10.3382/ps/pey011)
- Aldawsari, M. F., Lau, V. W., Babu, R. J., Arnold, R. D., & Platt, S. R. (2018). Pharmacokinetic evaluation of novel midazolam gel formulations following buccal administration to healthy dogs. *AMERICAN JOURNAL OF VETERINARY RESEARCH*, 79(1), 73-82. Retrieved from <http://gateway.webofknowledge.com/>
- Alexander, K., Northrup, N., Clarke, D., Lindell, H., & Laver, T. (2018). Engineering controls in veterinary oncology: A survey of 148 ACVIM board-certified oncologists and environmental surveillance in 20 specialty hospitals. *VETERINARY AND COMPARATIVE ONCOLOGY*, 16(3), 385-391. doi:[10.1111/vco.12390](https://doi.org/10.1111/vco.12390)
- Allen, J. D., & Ross, T. M. (2018). H3N2 influenza viruses in humans: Viral mechanisms, evolution, and evaluation. *HUMAN VACCINES & IMMUNOTHERAPEUTICS*, 14(8), 1840-1847. doi:[10.1080/21645515.2018.1462639](https://doi.org/10.1080/21645515.2018.1462639)
- Allen, J. D., Owino, S., Carter, D. M., Crevar, C. J., Reese, V. A., Fox, C. B., Coler, R.N., Reed, S.G., Baldwin, S.L., Ross, T. M. (2017). Broadened immunity and protective responses with emulsion-adjuvanted H5 COBRA-VLP vaccines. *VACCINE*, 35(38), 5209-5216. doi:[10.1016/j.vaccine.2017.07.107](https://doi.org/10.1016/j.vaccine.2017.07.107)
- Allen, J. D., Ray, S., & Ross, T. M. (2018). Split inactivated COBRA vaccine elicits protective antibodies against H1N1 and H3N2 influenza viruses. *PLOS ONE*, 13(9), 15 pages. doi:[10.1371/journal.pone.0204284](https://doi.org/10.1371/journal.pone.0204284)
- Ailing, C., Rae, D. O., Ma, X., Neumann, L., Lollis, L. G., Steele, E., Yelvington, J., Naikare H.K., Walden, H.S., Crews, J., Boughton, R. (2018). Systemic humoral immunity in beef bulls following therapeutic vaccination against Trichostrongylus axei. *VETERINARY PARASITOLOGY*, 255, 69-73. doi:[10.1016/j.vetpar.2018.03.028](https://doi.org/10.1016/j.vetpar.2018.03.028)
- Altizer, S., Becker, D. J., Epstein, J. H., Forbes, K. M., Gillespie, T. R., Hall, R. J., Hawley, D.M., Hernandez, S.M., Martin, L.B., Plowright, R.K., Satterfield, D.A., Streicker, D. G. (2018). Food for contagion: synthesis and future directions for studying host-parasite responses to resource shifts in anthropogenic environments. *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES*, 373(1745), 12 pages. doi:[10.1098/rstb.2017.0102](https://doi.org/10.1098/rstb.2017.0102)
- Anis, E., Holford, A. L., Galyon, G. D., & Wilkes, R. P. (2018). Antigenic analysis of genetic variants of Canine distemper virus. *VETERINARY MICROBIOLOGY*, 219, 154-160. doi:[10.1016/j.vetmic.2018.03.014](https://doi.org/10.1016/j.vetmic.2018.03.014)
- Avelar, E., Truong, Q. A., Inyangtor, D., Marfatia, R., Yang, C., Kaloudis, E., Tannenbaum, S., Rosito, G., Litwin, S. (2017). Effect of Adjuvant Chemotherapy on Left Ventricular Remodeling in Women with Newly Diagnosed Primary Breast Cancer A Pilot Prospective Longitudinal Cardiac Magnetic Resonance Imaging Study. *JOURNAL OF THORACIC IMAGING*, 32(6), 365-369. doi:[10.1097/RTI.0000000000000285](https://doi.org/10.1097/RTI.0000000000000285)
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2018 Fiscal Year CVM Graduates

Abreu, Rodrigo. Doctor of Philosophy – Infectious Diseases, Spring 2018
Alston, Jacob. Master of Science – Comparative Biomedical Sciences, Summer 2017
Aschenbroich, Sophie. Doctor of Philosophy – Veterinary Pathology, Fall 2017
Carter, Mackenzie. Master of Science – Comparative Biomedical Sciences, Spring 2018
Chasen, Nathan. Doctor of Philosophy – Infectious Diseases, Fall 2017
Crosby, Sydney. Master of Food Animal Medicine, Fall 2017
Dong, Kun. Doctor of Philosophy – Integrative Physiology & Pharmacology, Fall 2017
El Zowalaty, Ahmed. Doctor of Philosophy – Toxicology, Summer 2017
Jara, Amanda. Doctor of Veterinary Medicine / Master of Public Health (DVM-MPH), Spring 2018
Jones, Matthew. Doctor of Veterinary Medicine / Doctor of Philosophy (DVM-PhD), Spring 2018
Krunkosky, Madelyn. Master of Science – Comparative Biomedical Sciences, Fall 2017
Lau, Vivian. Master of Science – Comparative Biomedical Sciences, Summer 2017
MacLean, Mary. Doctor of Philosophy – Infectious Diseases, Summer 2017
Marcano, Valerie. Doctor of Philosophy – Veterinary Pathology, Fall 2017
Mason, Ashley. Master of Avian Health and Medicine, Spring 2018
McQuain, Callie. Master of Avian Medicine, Fall 2017
Naskou, Maria. Doctor of Philosophy – Comparative Biomedical Sciences, Spring 2018
Obadan, Adebimpe. Doctor of Philosophy – Comparative Biomedical Sciences, Spring 2018
Parker, Molly. Master of Avian Health and Medicine, Spring 2018
Rimet, Claire-Sophie. Master of Science – Comparative Biomedical Sciences, Spring 2018
Rossow, John. Doctor of Veterinary Medicine / Master of Public Health (DVM-MPH), Spring 2018
Sapp, Sarah. Doctor of Philosophy – Infectious Diseases, Spring 2018
Sarbacher, Carolyn. Master of Science – Comparative Biomedical Sciences, Fall 2017
Scharf, Alex. Doctor of Veterinary Medicine / Doctor of Philosophy (DVM-PhD), Spring 2018
Segovia Hinostroza, Karen. Doctor of Philosophy – Veterinary & Biomedical Sciences, Summer 2017
Shepherd, Eric. Master of Avian Medicine, Fall 2017
Slater, Meagan. Master of Avian Medicine, Fall 2017
Tensa, Laura. Master of Science – Comparative Biomedical Sciences, Spring 2018
Torres-Mendoza, Yari. Doctor of Veterinary Medicine / Master of Public Health (DVM-MPH), Spring 2018
Tucker, Samantha. Doctor of Philosophy – Infectious Diseases, Spring 2018
Villegas, Ana. Master of Science – Comparative Biomedical Sciences, Summer 2017
Wang, Yung-Chun. Doctor of Philosophy – Integrative Physiology & Pharmacology, Spring 2018
Williams, Robert. Doctor of Philosophy – Toxicology, Fall 2017
Wright, Lindsay. Doctor of Philosophy – Infectious Diseases, Spring 2018
Yeouroukis, Corry. Master of Science – Comparative Biomedical Sciences, Fall 2017
Zengel, James. Doctor of Philosophy – Infectious Diseases, Summer 2017

*The key to improved animal well-being is animal health.
The key to improved animal health is veterinary research.*



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