VMES 2012

Science in Service to Animals℠

Challenges and Promises of One Health

36th Annual Report

Contents

"One Health" at UGA current logo. Representing the interdisciplinary spirit of the program, "teaching, research and outreach" in a collaborative effort to improve people and animals and the environment.

Cover illustration by Brad Gilleland. Satellite image from NASA Visible Earth Project.

Director: Dr. Harry W. Dickerson
Managing Editor: Dr. Lari M. Cowgill
Associate Editors: Renita Anthony, Holly Snelling
Designer: Brad Gilleland
Photographer: Christopher Herron

The University of Georgia

VMES 2012

Science in Service to Animals℠

36th Annual Report

July 1, 2011 to June 30, 2012

Overview, Mission, & Objectives

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

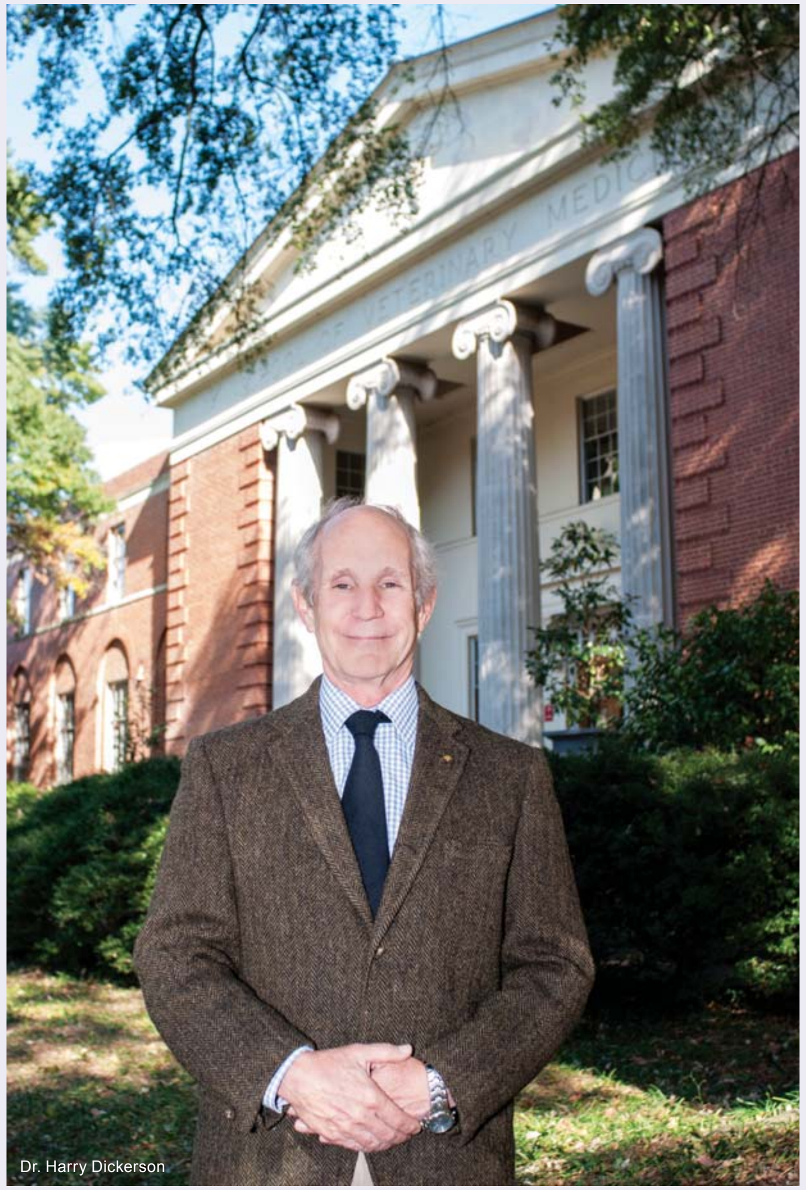
The Veterinary Medical Experiment Station (VMES) was established as a budgetary entity by the state legislature in July 1976 following approval by the University of Georgia Board of Regents in 1973.

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.



From the Director

When one examines the research portfolio of the University of Georgia College of Veterinary Medicine, it becomes clear that our investigators are actively engaged in the improvement of animal, human, and environmental health, a broad area of research collectively referred to as "One Health." The One Health concept is a natural fit for veterinary researchers, because our profession as a whole addresses health issues in diverse animal species and at multiple levels (e.g. epidemiological, medical, cellular, and molecular). In fact, the American Veterinary Medical Association has been a leading proponent of the One Health Initiative (http://www.avma.org/onehealth), and has been well-represented at meetings and symposia focused on this area. A number of colleges of veterinary medicine and universities (including the University of Georgia) are developing One Health programs with the goal of enhancing collaborative health-related research among physicians, public health practitioners, veterinarians and environmental ecologists.

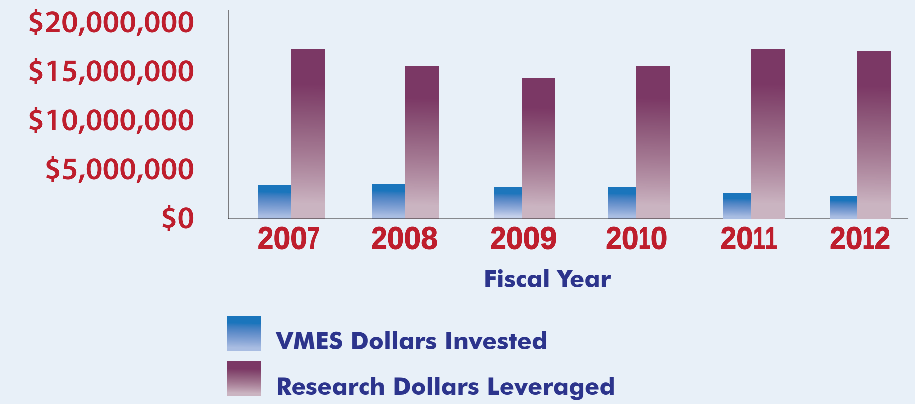
Nevertheless, because One Health is so broad and encompasses such diverse areas of research it can be a challenge to grasp the concept and to define specific outcomes and endpoints. To address this, Dr. Susan Sanchez provides an overview in the cover article of this year's annual report. Also, if one peruses past issues of the VMES Annual Report it is possible to find illustrations of research targeted toward specific outcomes of improving animal, human and environmental health. Examples include original work on avian and swine influenza to develop better diagnostics, therapeutics, and vaccines to prevent and/or reduce economic disruption in the face of outbreaks (see VMES 2005, 2007 and 2009).

As in previous reports, the 36th VMES Annual Report provides an overview of peer-reviewed, competitive projects and new faculty start-up projects conducted during fiscal year 2012 (July 1, 2011 – June 30, 2012). Projects supported by VMES funding, which is provided by the State of Georgia, and those funded with 1433 Formula funds provided by the United States Department of Agriculture are reviewed by veterinary scientists to ensure quality of the science and guarantee that they address important disease problems. The research must be innovative and applicable to improving animal health. Additional information on any of these projects can be requested by contacting the VMES office by phone, e-mail or website, or directly from the investigators themselves. A list of publications is provided. These peer-reviewed papers represent a selection of VMES-supported work and other scholarly research by faculty at the College of Veterinary Medicine.

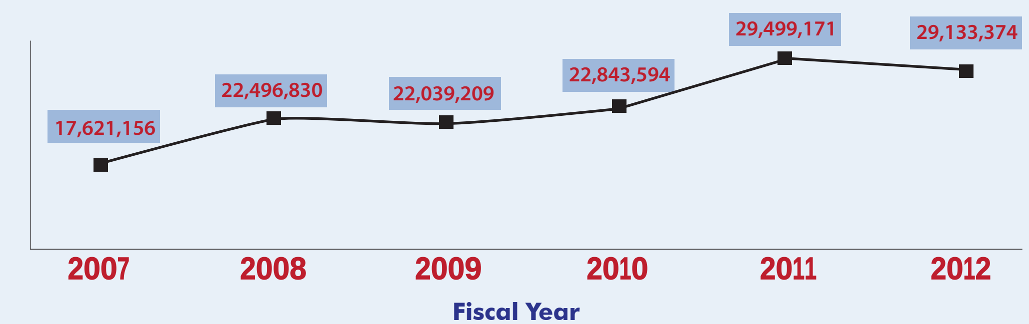
In this year's report we also list the names of 39 individuals who received graduate degrees in 2012 through original research conducted in the College. The training of future researchers is of utmost importance in order to fulfill the mission of the state funded Veterinary Medical Experiment Station and to meet the objectives of the One Health initiative of the University, the United States, and the world.

Financial Tables

Research Dollars Leveraged



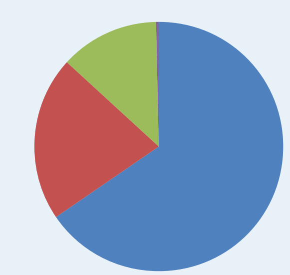
College Research Expenditures



A summary of the College's research funding is provided above. Over the past year approximately six research dollars were leveraged for each VMES dollar invested. Expenditures are from all sources including State Appropriations, Extramural Research Funding, Donations - Includes all expenditures including personnel costs.

VMES Expenditures by Category

Budget Category	Amount	% of Budget
Personnel - Researchers/Techs/Research Staff	$1,648,595	65.43%
Research Materials & Equipment	$538,106	21.36%
Personnel – Research Administration & Accounting	$323,947	12.86%
Travel	$8,842	0.35%



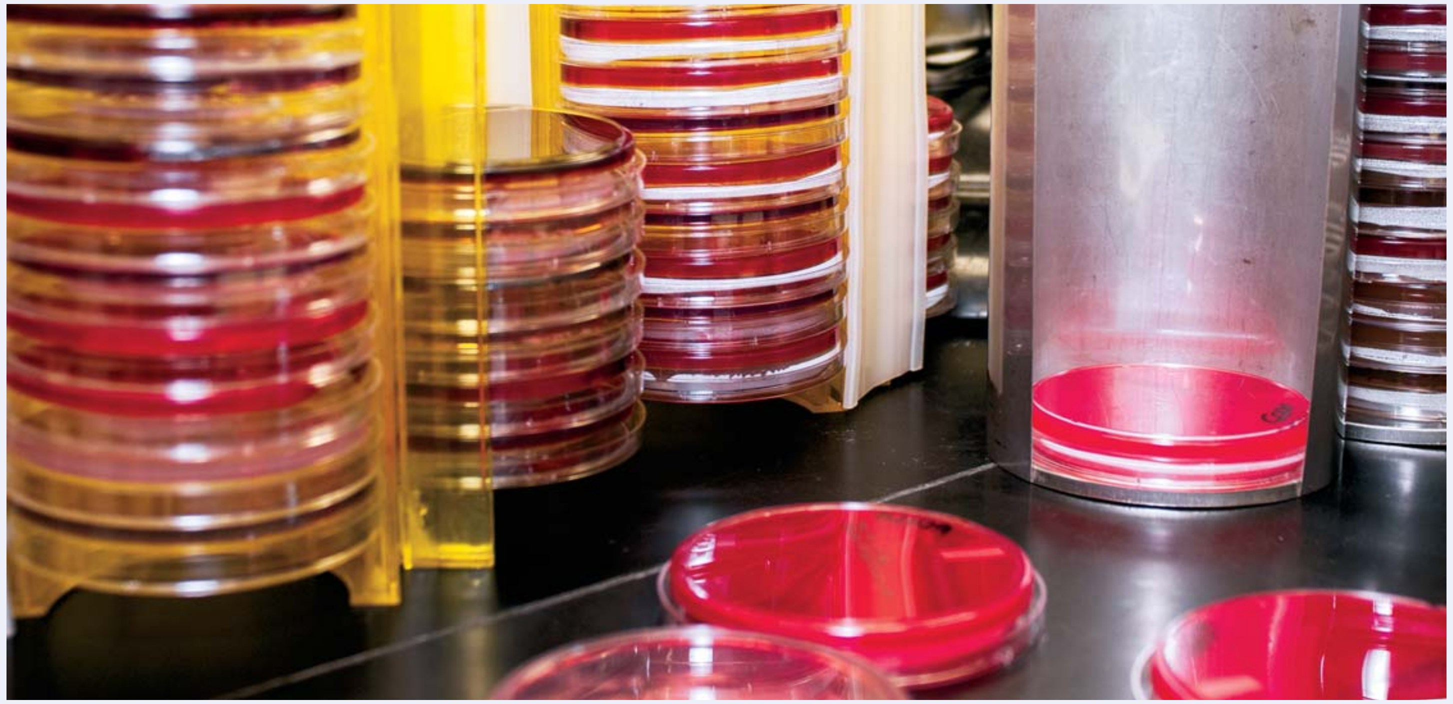
Challenges and Promises of One Health

“Mankind is still sitting on an environmental powder keg” (Comparative Medicine in Transition, 1960)

The interconnection of human, animal, and environmental health has been recognized for centuries, but the increased complexity of the modern world was unimaginable 50 years ago when the above “environmental powder keg” analogy was first articulated. The stakes are now much higher and the volatility of the situation has been boosted tremendously. Consider, for example, the following volatile ingredients of a “powder keg” mix: outbreaks of vector-borne human and animal encephalitis that become endemic and sometimes produce fatal disease; an epidemic of a pustule rash in pet owners; chronic poverty and lack of educational opportunities in sub-Sahara Africa; and unscrupulous profiteering combined with poor surveillance of imported commodities. The interrelationship among animals, humans, and the environment are intimate, significant and far-reaching; studying them effectively requires a somewhat novel approach. This multidisciplinary approach to studying and understanding health issues at the nexus of human, animal, and environmental health is today called “One Health.” One Health not only encourages interdisciplinary collaborations, but constitutes a departure from the current emphasis on the clinical care of individual human and veterinary patients to one of disease prevention and health promotion at a meta-ecosystem level.

Arguably, the greatest One Health threat is emerging infectious disease. Emerging infectious disease (EID) events have been on the rise since we have been able to describe them. Animal reservoirs of pathogens have existed and continue to exist everywhere in the world with specific areas more at risk of harboring such reservoirs; these are called “hot spots” for disease emergence. “Hot spot” is a relatively new term in disease ecology. Although the term is new, what it refers to is not. In no uncertain terms, we were warned two generations ago of the danger of such areas: “Should the host-parasite environmental relationships in any of these areas be disturbed, pathogens could spill over into the human population with dramatically terrifying and unpleasant consequences.” (Comparative Medicine in Transition, 1960) From 1940 - 1960 there was an unprecedented increase of EIDs (mostly zoonotic) associated with wildlife reservoirs. Veterinarians of the time were not only aware of the potential issues for livestock, but understood the repercussions for human health. While the direct effects to human health are easy to grasp, man’s physical, mental, emotional, social, economic and political well-being directly affected by animal diseases are not well understood.

The world is not what it was in 1960. Globalization has placed us into the midst of one of the most revolutionary changes that mankind has experienced. This globalization has greatly increased economic, political, and cultural interactions between many parts of the world. This phenomenon has grown to the point of true global interdependence fueled by commerce and aided by advances in transportation and telecommunication. These advances in global interactivity are remarkable, but, when it comes to disease transmission, they can become distinct liabilities. For example, the ease and rapidity with which people, animals, and materials can travel, even from the remotest locations on the planet, has made the movement of diseases across continents more likely, including diseases with short incubation periods. Vectors and/or reservoirs of disease can “hitchhike” on flights or imported goods. Moreover, food is no longer solely produced in the country where it is consumed, but from all over the globe. Today we have become accustomed to filling our shopping carts with our favorite type of fruit and vegetables all year around. The availability of such seasonal fruits and vegetables depends on their import from other parts of the world. Growing shares of US imports are due to agricultural product processing industries based in the United States that import ingredients produced and processed in foreign markets. Unintentional contamination of such products due to poor processing practices or intentional adulteration due to greed are troublesome and difficult to control since the US does not have the capability of testing all imported commodities in a reasonable time frame, particularly for perishable goods. New gourmet delicacies, such as bush meat, are joining contraband fruits and cured meats challenging our overworked customs officials. Similarly, growing interest and availability of exotic pets



Dr. Susan Sanchez

has increased the legal and contraband importation of these animals. That the trade in these animals put people at risk is evidenced by the recent example in the US where 71 people in different states became victims of monkeypox in 2003. This zoonosis not only managed to jump from its natural host, a Gambian giant rat (*Cricetomys* sp.), to prairie dogs housed in close proximity in the importers facilities, but also jumped from sick prairie dogs to people who had just adopted them or who worked in premises where the infected animals had been kept. This is not only an example of a foreign disease importation, but also an animal-to-animal cross-species transmission and ultimately zoonotic transmission to humans. We were fortunate this time that there was not more person-to-person transmission. Nonetheless, the frightening part is that, of the 762 African rodents that came from Ghana in the same shipment, 178 of them could not be traced beyond their point of entry into the country. Had any of them been infected, they could have started a cycle of transmission from person-to-person that could have been much harder to control and could have entered a wildlife reservoir potentially becoming endemic. Monkeypox is an endemic zoonotic disease in many regions of Africa where it has a mortality rate in people of 1-10%. Furthermore, because of the similarity in clinical appearance to smallpox, an epidemic of monkeypox in the US could create panic.

The West Nile virus is another well-known example of EID zoonosis with its roots in the fertile mix of modern travel, changing climate, extending vector ranges, and exotic and endemic wildlife. Now endemic in the US and currently causing an epizootic with ground zero in Texas (September, 2012), it first emerged in 1999 in New York City. Initially detected by a veterinary pathologist at the Bronx Zoo where it was responsible for the deaths of a number of birds in their collection. It was then identified as the cause for encephalitis of hitherto unknown etiology in humans. The virus was likely introduced by an infected bird(s) or mosquitoes and aided in its spread in the US by unusual mosquito hybrids and changes in climate. In a little over two decades this disease has gone from unknown to widespread in the US and is impacting human and animal health and well-being with ripple effects in the economy, the practice of veterinary medicine, and the environment.

There are two well-known predictors that appear as repeating themes in many EID hotspots: human crowding and wildlife species richness. Anthropogenic pressure and fast economic growth in developing countries are putting people in contact with unknown pathogens from wildlife due to encroachment into previously undeveloped land or crowding them in mega-slums where people live without adequate sanitation and very little or no access to health care. In these conditions zoonotic pathogens abound and there is concomitant selection pressure for pathogens that are multidrug resistant. It is clear from recent studies that high population density is a sharp predictor of emerging infectious diseases in general (significant increase from 1940-2000), while wildlife species richness is a predictor of zoonotic emerging infectious diseases (60.3% of all EIDs are of zoonotic origin). These areas of high wildlife richness are located in lower latitude developing countries where surveillance and monitoring are scarce or non-existent. These are fundamental challenges for One Health practitioners.

The concept of One Health is reflected in the veterinary oath “…the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge.” There are not only obvious challenges for the veterinary profession in realizing the promises of One Health, but also many opportunities to create real advances in human and animal health and well-being as well as improving environmental health.

A vivid example of the potential far-reaching impact of One Health success is seen in sub-Saharan Africa where subsistence goat production is the main responsibility of women. The animals provide nutrition for children and whatever is left over may be sold to generate income. That small income allows the family to send children, especially the girls, to school. Having a healthy goat means that a girl could attend school and research has shown that primary school educated girls in this area have fewer children and are more likely to send their kids to school. Education in this region of the world lowers mortality, increases longevity, reinforces democratization and political stability, decreases poverty, reduces inequality, and lowers crime rates. Contagious caprine pleuropneumonia is a disease with mortalities reaching 100%. Many girls' dreams are shattered due to the lack of a vaccine that is cheap, readily available, and capable of withstanding rigorous weather conditions without spoiling. If One Health practitioners could produce such a vaccine, the benefits to animal health and human well-being in this region would be extensive. And, if this type of advance could be iterated by a legion of One Health practitioners, the effects could be felt worldwide.

Table 1. One Health and US Federal Agencies that currently have a One Health Office or group

- Centers for Disease Prevention and Control (CDC) – www.cdc.gov/onehealth
- National Park Service- www.nps.gov/public_health/di/di.htm
- US Agency for International Development - www.usaid.gov/our_work/global_health/news/ai_docs_emerging_threats.pdf
- US Department of Agriculture (USDA) - www.aphis.usda.gov/animal_health/one_health/

Table 2. US Interagency One Health Working Group Composition. Working together to identify ways to improve collaboration and making One Health a stable proposition.

- CDC
- USDA
- FDA Food and Drug Administration
- NIH National Institutes of Health
- DHS Department of Home Land Security
- White House National Security Staff
- EPA Environmental Protection Agency
- HHS ASPR Associate Secretary for Pandemic Response
- USGS US Geological Survey
- DoL Department of Labor
- DoS Department of State

There are numerous challenges to realizing the possibilities of One Health. Many obstacles are external to veterinary medicine and beyond the control of the profession; however, there are significant obstacles that are internal to veterinary medicine that must and can be surmounted. Several recent blue-ribbon panels charged with evaluating the veterinary workforce have made similar observations and recommendations that resonate with those made 50 years ago: ***the veterinary profession must retool to produce professionals that address a broad range of societal needs rather than an unbalanced emphasis on the clinical care of individual animals***. In the last 50 years veterinary medicine has drifted from its agrarian roots with a strong emphasis in public health. In response to changing societal needs to care for companion animals, veterinary medicine changed curricula and produced exquisitely well-trained pet physicians. This came at a cost to other essential responsibilities to society. Now, with serious unmet needs for more veterinarians trained to address new and re-emerging societal needs combined with unequaled economic difficulties, these professional services seem to some as a luxury rather than a necessity. When it comes time to making difficult decisions on how to spend public funds, legislators are not seeing investment in veterinary medicine as a necessity for securing public health. Without advocates in the legislature, budgets for veterinary schools, diagnostic laboratories, and other veterinary agricultural services are at risk of losing out to other priorities. There is an imperative need to communicate to our students the need for veterinary practitioners and scientists that truly understand and confidently embrace their role in public health and the progress of medical knowledge. From clinicians who understand zoonotic pathogens and can effectively communicate the ramifications of these infections to their clients and employees, to veterinary scientists capable of conducting innovative biomedical research, and to trans-disciplinary veterinarians who can marry conservation, ecology, and medicine, we need more One Health veterinarians!

Figure 1. Educational posters produced for customers purchasing mail order chicks, and a collaborative effort between the CDC, USDA-APHIS and the producers.

Fortunately, some progress is being made. Several of our federal agencies (Table 1 and 2) have realized that working in silos only leads to confusion and missing important issues or time goals. One Health offices have been established to enhance interagency collaboration. A recent example of these improved collaborations is the new procedures dealing with a cute and fuzzy public health problem: mail order chicks. The chicks are very popular with kids but most, if not all, of the chicks carry *Salmonella*. Many kids in a number of states have become ill after contact with these adorable birds. Investigations of these illnesses have been carried out by the CDC to the point where they can tell the genetic fingerprint of the culprit, *Salmonella*, and trace it back to the chicks. But that was all that could be done within the CDC's purview; meanwhile, the USDA's main concern was with production animals and these chicks fell out of their regulatory sphere. Now that USDA has embraced One Health as part of their new roadmap, they are working side-by-side with the CDC to trace back these birds to the hatcheries; then both agencies work with the chick producers on educational materials for the public to help them understand the risks inherit to owning such little cute birds (Figure 1). This is an illustration of successful adaptation to the challenges to the veterinary profession and the advantages for all in the new One Health paradigm.

The UGA College of Veterinary Medicine is playing its part at the forefront of One Health through a variety of mechanisms both inside and outside the veterinary curriculum. During their first year, our students are offered a perspective on the versatility of the veterinary degree through the course, Career Opportunities in Veterinary Medicine. There are several courses in the curriculum that touch on different aspects of One Health. Later, students can opt for electives that address One Health topics as well as engaging in a corporate track and explore careers in research, federal government, industry, and other alternative career tracks. Nonetheless, there is still a need for a unifying view of all of these various elements under a One Health umbrella, possibly by offering a One Health certificate that documents competency. During the summers, the rising second and third year students have the opportunity to participate in our renowned Georgia Veterinary Scholars Program. The unifying theme of the program is One Health. Students are placed for 12 weeks in the laboratory of a research mentor at UGA and further appreciate the subject through a journal article series and seminars from leaders in the profession. This program at UGA is funded by NIH, Merial, and VMES. The National Veterinary Scholars Program is a nation-wide program with over 400 students enrolled yearly and UGA has been a leader in this program from its inception. Dual degree programs at UGA have been making inroads into One Health. During the past five years the college has been offering a combined DVM/MPH where our students carry out simultaneous studies at the new College of Public Health at UGA. The DVM/PhD program allows students that are committed to research careers to complete graduate school and veterinary school with guidance from the college and university graduate faculty. Finally, our yearly Science of Veterinary Medicine Day is the culmination of our veterinary and graduate students' efforts where their research is showcased in an event that releases veterinary students from regular classes and where they are given credits for their attendance at the seminars and poster sessions.

In the past five years, the University of Georgia has added the School of Ecology, the College of Public Health, and a Medical Campus to the already very powerful basic research enterprise which includes the College of Veterinary Medicine that is a leader among its peers. Through its established core and the trans-disciplinary research already in place, UGA is extremely well positioned to embrace One Health as an integral part of its research, teaching, and outreach missions. One Health @ UGA is an initiative that serves as a keystone in linking and fortifying many of these efforts and facilitates One Health opportunities at UGA (Figure 2). This program is home based in the Biomedical Health Science Institute as the Division of One Health.

The history of One Health is an inspiring drama. No less inspirational is the scientific discovery that has driven its progress. Through the ages, medical men and women of vision and foresight have always believed that all medical sciences are based on the same fundamental principles and that the idea of "human medicine" and "veterinary medicine" is a false dichotomy. The truth is that human medicine, veterinary medicine, and a variety of related disciplines serve to inform, enlighten and reinforce each other through an interdisciplinary collaboration of all health sciences – this is One Health at its core. The One Health drama has been complete with soaring successes and achievements as well as the "terrifying and unpleasant consequences" (Comparative Medicine in Transition, 1960) of its failures. The changing world demands that we now focus our attention and imbed the One Health ethos deeply within veterinary medicine; a mere superficial rebranding of the profession is not going to cut it. We truly face bigger and nastier "powder kegs" than any envisioned only one or two decades ago. A robust One Health culture can reduce the volatility and defuse potentially catastrophic events as well as enhance environmental health and animal and human welfare. Have we finally come to the point of no return, where the One Health approach to health is finally here to stay? We sure hope so.

Dr. Susan Sanchez, Professor of Infectious Diseases
Dr. Christopher King, Professor of Population Health

Figure 2. "One Health" at UGA current logo. Representing the interdisciplinary spirit of the program, "teaching, research and outreach" in a collaborative effort to improve people and animals and the environment.

One Health Information sites. Further reading on One Health:

- One Health Initiative: http://www.onehealthinitiative.com/about.php
- One Health Commission: http://www.onehealthcommission.org/
- EcoHealth Alliance: http://www.ecohealthalliance.org/
- Ahead: http://www.wcs-ahead.org/index.htm
- UC Davis One Health Institute/ Educational Center of Expertise in One Health: http://www.vetmed.ucdavis.edu/ohi/ceoh/index.cfm
- UC Global Health Institute: http://www.ucghi.universityofcalifornia.edu/coes/one-health/index.aspx
- One Health Talk: http://www.onehealthtalk.org/

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Veterinary Services 2015 Project. One Health Strategic Direction: Safeguarding Animal, Human and Environmental Health; USDA-PAHIS, 2010. www.aphis.usda.gov/animal_health/one_health/

VMES & USDA Formula Grant Funded Projects

Serum Free Cortisol Fraction In Horses With Endocrine Disease

Pituitary pars intermedia dysfunction (PPID, Equine Cushing's Disease) and Equine Metabolic Syndrome (EMS) are the most common equine endocrine (hormonal) disorders, and together affect up to 30% of horses and ponies. Laminitis is a hallmark of both these diseases and results in life-threatening lameness in many cases. The pathogenesis of laminitis in these diseases is not fully understood, but insulin resistance (similar to type II diabetes in people) is purported to play a key role. Excessive levels of the steroid hormone cortisol have been theorized to contribute to insulin resistance and laminitis in PPID and EMS, but most affected horses do not have increased total blood cortisol levels. However, total cortisol assays measure both the cortisol that is free in the blood and that is bound to transport proteins, but only the 5-10% of circulating cortisol that is free in the blood (free cortisol) is actually biologically active. It is possible to have changes in the amount of active, free cortisol without measurable changes in total (bound and free) cortisol. Thus, measurement of total cortisol, as has been done in previous equine studies, may inaccurately characterize active cortisol status in patients with endocrine disease.

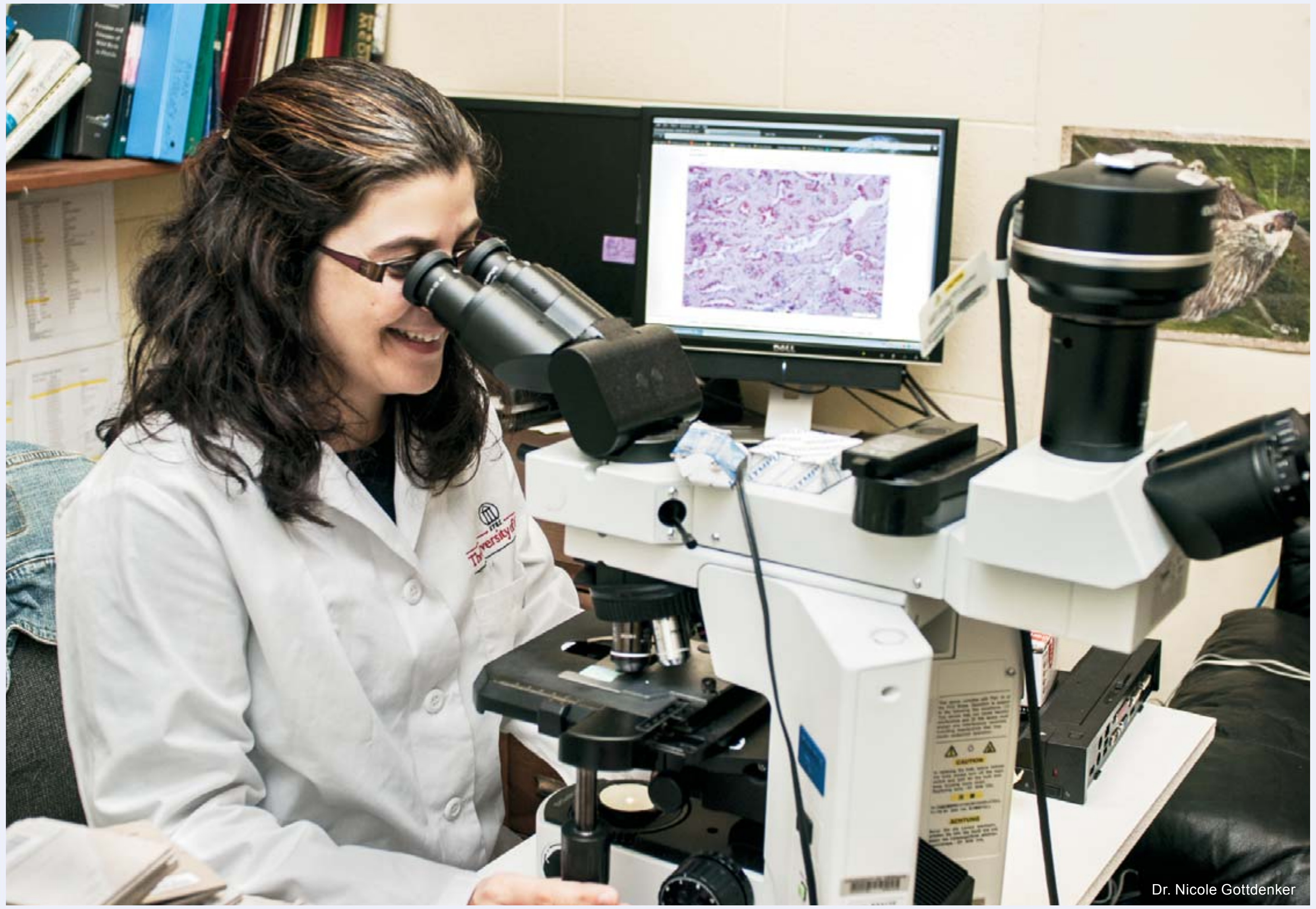
Recent studies in people have documented increased free – but not total – cortisol levels in patients with endocrine diseases analogous to PPID and EMS. In addition, these studies have shown strong correlations between increased free cortisol and insulin resistance in these patients. To date, free cortisol has not been assessed in horses with endocrine disease or insulin resistance due to previous cumbersome methodology. However, our lab has recently optimized and validated a straightforward assay for measurement of equine free cortisol, and now aim to further investigate the role of free cortisol in many equine endocrine diseases. This overall goal of this study is to further our understanding of the pathophysiology of PPID, EMS and insulin resistance in horses, with hopes of improving diagnosis and management of these common and important equine diseases. We also anticipate that the horse may also prove to be a viable model for future study of comparable endocrine diseases in people.

Dr. Kelsey Hart

The objectives of this specific study were threefold: first, to determine if age, sex, season, and obesity affect free cortisol in healthy horses as in people; second, to compare free cortisol levels between horses with endocrine disease and healthy horses; and third, to determine if free cortisol and insulin resistance are associated in horses as in people. Here at UGA, we determined body condition scores (BCS) and collected blood every 3 months for 1 year from 57 healthy horses aged 1-26 years old. Collaborators at Auburn University, Oklahoma State University and Tufts University provided archived blood samples from horses previously diagnosed with PPID and EMS. We measured the levels of insulin, total cortisol, and free cortisol in all the blood samples, and statistically compared hormone levels between groups of healthy horses and healthy horses with PPID and EMS.

Our data analysis is currently underway, but preliminary results show that healthy horses that are overweight (BCS 6-9/9) have significantly higher insulin and free cortisol levels than horses that are not overweight, similar to findings in people. In addition, free cortisol levels are significantly higher in horses with PPID (9%) and EMS (12%) than in healthy horses (5%). Finally, insulin concentrations are 3-fold higher in horses with PPID and 12-fold higher in horses with EMS than in healthy horses. These data suggest that cortisol-binding dynamics may be altered in horses with obesity and endocrine disease, and that free cortisol might be associated with insulin resistance in horses as in people. Future studies are now needed to determine if alterations in free cortisol directly impact insulin sensitivity in horses and in people.

Principal Investigator: Dr. Kelsey Hart
Co-investigators: Dr. Dianne McFarlane (Oklahoma State University); Dr. Anne Wooldridge (Auburn University);
Dr. Nicholas Frank (Tufts University)


Dr. Nicole Gottdenker

Bowhead Whale Disease Surveillance and Histologic Analysis

Bowhead whale (*Balaena mysticetus*) is a flagship species of the Arctic Ocean and integral to the culture and subsistence of Inupiat communities. However, anthropogenic disturbance such as global climate change and offshore oil drilling, threaten present and future survival of their populations. Long term health surveillance is essential in order to predict both individual physiologic and population level responses to ecosystem stressors. As part of developing a comprehensive health surveillance program in bowhead whales, baseline reference data on normal anatomy and histology and pathology of various organs is needed to better characterize pathogen or toxin-induced changes. Accordingly, the objectives of this study are a) Do a comprehensive pathology-based disease survey of lesions, pathogens, and parasites of the bowhead whale b) Create a comprehensive digital histology and histopathology atlas of bowhead whales. This atlas will be a much needed reference for distinguishing normal from abnormal tissue and will be an important component of long-term, interdisciplinary integrated health surveillance strategies for bowhead whales.

In collaboration with Inupiat hunters and other teams of researchers who are studying varying aspects of bowhead whales, we took gross photos of organs (normal and abnormal) and representative samples from various organs for histologic analysis during the Spring 2011 and Fall 2011 hunting seasons. Tissue samples from representative organs, frozen at -80 C, and duplicate samples were stored in 10% formalin and processed for routine histopathology. Key pathologic findings in animals included an enterocolitis in one animal and moderate interstitial pulmonary fibrosis in another. Slides of unusual tissue in the scala tympanum of the ear are currently being evaluated in more detail, and we are in the process of further characterization of the enterocolitis in the juvenile male animal. Additionally, a web-based online atlas of normal histology of the bowhead whale was created. This atlas features a searchable database that is organized by tissue, organ system, and pathologic process (normal, abnormal). Currently, the atlas is password protected and shared between UGA and the North Slope Borough of Wildlife Management. We have completed photomicrographs of normal tissues and will be including tissues with lesions in the future. This atlas provides a crucial, centrally located, and easily accessible database that is useful for comparing normal 'baseline' tissue morphology to pathologic processes for researchers involved with long-term monitoring of bowhead whale health and sustainable resource use.

Acknowledgements: North Slope Borough of Wildlife Management, Craig George, Cyd Hanns, Raphaela Stimmelmeyer. Kevin Manchonu was responsible for the putting the web atlas online. Geary Ryan Smith and Annie Page assisted with photomicrograph preparation. The Histology lab at UGA processed the tissues and prepared the slides.

Principal Investigator: Dr. Nicole Gottdenker
Co-Investigator: Murali Pai, North Slope Borough Department of Wildlife Management


Dr. Roy Berghaus

Management Practices for Salmonella Reduction on Broiler Breeder Farms

Extension Specialists from four Southeastern states (i.e., Alabama, Arkansas, Georgia, and North Carolina) visited broiler breeder farms from 3-5 companies in each state on two occasions to document farm management practices and perform environmental sampling for *Salmonella* detection. Forty-nine farms were enrolled in the initial phase of the study and complete follow-up information was available for 39 farms. Some of the farms that were initially enrolled in the project were no longer in production at the time Extension Specialists re-visited their respective companies for the second time, accounting for the attrition in farm enrollment between the first and second visits.

Salmonella was detected in 88% of the broiler breeder houses that were sampled, and was identified on all 49 farms enrolled. Many management characteristics were consistent across the different states and companies. Multi-level analysis was used to evaluate management characteristics as risk factors for *Salmonella* prevalence and to estimate the proportion of variance residing at the different hierarchical sampling levels. Management characteristics associated with increased *Salmonella* prevalence included treatment of the flock for any disease, having dusty conditions in the house, having dry conditions under the slats, and walking through the house more than one time per day to pick-up dead birds. When evaluated by sample type, the overall prevalence of culture-positive drag swabs, boot socks, litter samples, slat sponges, and egg belt sponges were 58.8%, 52.6%, 56.2%, 32.5%, and 16.0%, respectively. Relatively high intra-class correlations for samples collected from the same house (0.27) and for samples collected from different houses on the same farm (0.24) suggest that farm-level clustering is an important consideration when evaluating Salmonella prevalence in poultry.

Principal Investigator: Dr. Roy Berghaus

Dr. A. L. Hurley-Bacon

Molecular Analysis of Poultry Litter Following the Utilization of Different Commercially Available Probiotics

Historically, commercial poultry producers have fed low levels of antibiotics in their poultry ration to negate the negative impact of pathogen growth on feed conversion ratio and weight gain; however, because of consumer pressure, many of these companies are establishing antibiotic-free programs for their products. Competitive exclusion preparations have been shown, in some studies, to prevent the establishment of pathogens in the intestinal tract of chickens, thus increasing weight gain, feed conversion ratio, and livability. The probiotic, prebiotics and competitive exclusion products used in this study are antibiotic alternative products that have the potential to replace or reduce antimicrobial use, while still positively affecting production parameters; however, controlled research studies have have been limited to one production cycle. A compelling application of these products is their potential to reduce pathogen populations by altering the environmental bacterial community within the flock through use during multiple grow-outs utilizing a built up litter system. The majority of environmental organisms, in this case litter microflora, have not been isolated due to inadequate culture techniques. It is known that selective media is often not as specfic in some instances and too selective to allow certain bacteria to be detected. The objectives of this study were: 1) to molecularly profile the house litter microflora composition over four consecutive production cycles after using various commercially available probiotic products employing 16S ribosomal DNA (rDNA) sequencing and 2) to evaluate the impact of various commercially available probiotic products on feed conversion, weight gain, and livability of the broiler chickens.

Principal Investigator: Dr. A. L. Hurley-Bacon
Co-Investigators: Drs. A. J. Sinclear, A. Pedrosa, S. R. Collett, M. D. Lee

Highlighted Research Activities

Biomarkers for Spontaneously Occurring Osteoarthritis

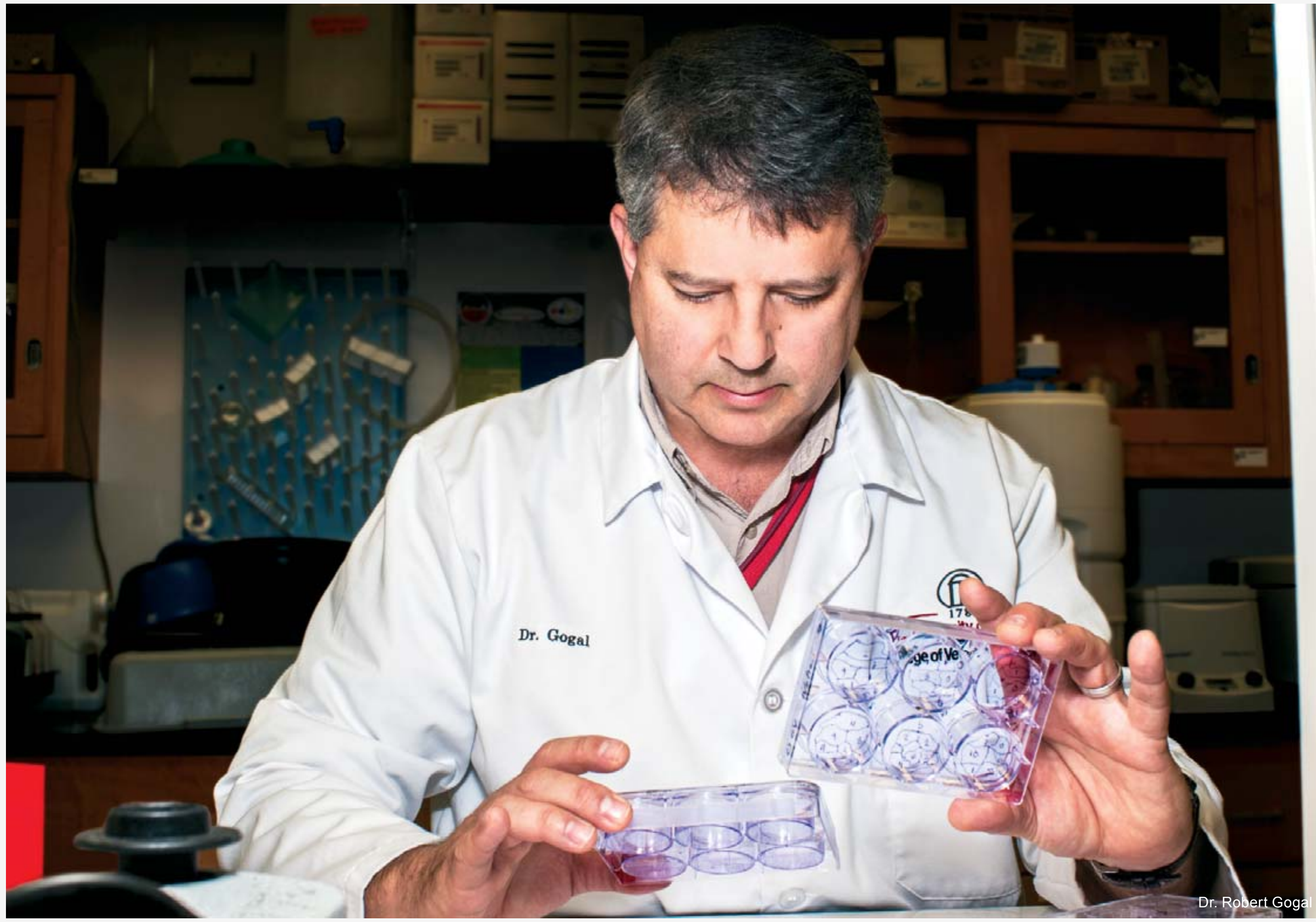
Dr. Bridget Garner

Osteoarthritis (OA) is a progressive disease characterized by morphologic, molecular, biochemical and biomechanical abnormalities in the articular cartilage and other articular tissues. OA is the most common form of arthritis, and it affects both human and veterinary patients. OA was historically regarded as a non-inflammatory arthritis, but there is now cumulative evidence that inflammation has a prominent role. Signals, including those associated with pro-inflammatory cytokines, can be sent and received among articular tissues, thus creating a “cross-talk” environment. Even with this information much of the pathogenesis of OA remains unknown, and diagnosis early in the disease course is rare. Currently, physicians and veterinarians treating OA are limited to medical and surgical interventions that only provide palliative relief instead of an absolute cure. The need for more sensitive, specific, feasible and noninvasive methods for the diagnosis and longitudinal monitoring of OA in dogs is critical, thus the desire to develop an early OA diagnostic biomarker panel, a process which could also have profound ramifications on treatment and prevention of this disease, has exploded. Searching the synovial fluid, serum or urine of osteoarthritic individuals for joint tissue degradation markers or cell signaling cascade molecules has become an increasingly common method of looking for diagnostic biomarkers. Numerous diagnostic biomarkers for humans and dogs have been investigated, but currently there is no single biomarker for OA diagnosis, staging, monitoring and determination of treatment efficacy. The development and validation of a panel of biomarkers is likely needed to have real clinical effectiveness, similar to use of a blood chemistry panel for assessment of liver pathology. Even if such a panel of biomarkers is not identified and validated immediately, the investigative process will likely prove beneficial as it will enrich our understanding of the pathogenesis of OA. While the development of a canine OA biomarker panel is the primary goal of this research, opportunities for translational application in human patients are available. The dog is considered a nearly ideal species for translational investigation of human OA; therefore, any biomarker candidate that is identified in dogs may ultimately be of use in humans suffering from OA.

Previous work has shown that changes in cytokine and chemokine concentrations occur within canine synovial fluid following surgical destabilization of the knee joint and may be useful for differentiating osteoarthritic versus normal knees. Furthermore, we have confirmed changes in the same three cytokines and chemokines occur in synovial fluid from dogs with naturally occurring OA and the elevations in these markers decline once the joint is surgically stabilized. These findings suggest the incorporation of chemokines into a diagnostic or even treatment efficacy biomarker panel may prove useful, especially given their apparent involvement in clinical OA. Although these markers were not as useful in the serum or urine, the use of synovial fluid biomarkers has important clinical application based on the relative ease in obtaining samples, the associated costs, and the joint specific nature of these evaluations.

The current study will characterize alterations in the synovial fluid cytokine, chemokine and matrix metalloprotease profiles of osteoarthritic canine elbows, shoulders and hips compared to normal and determine the sensitivity and specificity of individual markers or combinations of markers for diagnosis or disease staging of naturally occurring OA. Given that results obtained in the previous surgery model and naturally occurring OA studies were largely consistent, it is likely the elbow, shoulder and hip joints will exhibit similar fluctuations in synovial fluid chemokines and matrix metalloproteases. Once conclusions have been made regarding the utility of these markers in the elbow, shoulder and hip joints with established OA, prospective studies can be designed to further evaluate the temporal changes in these markers prior to the development of clinical OA.

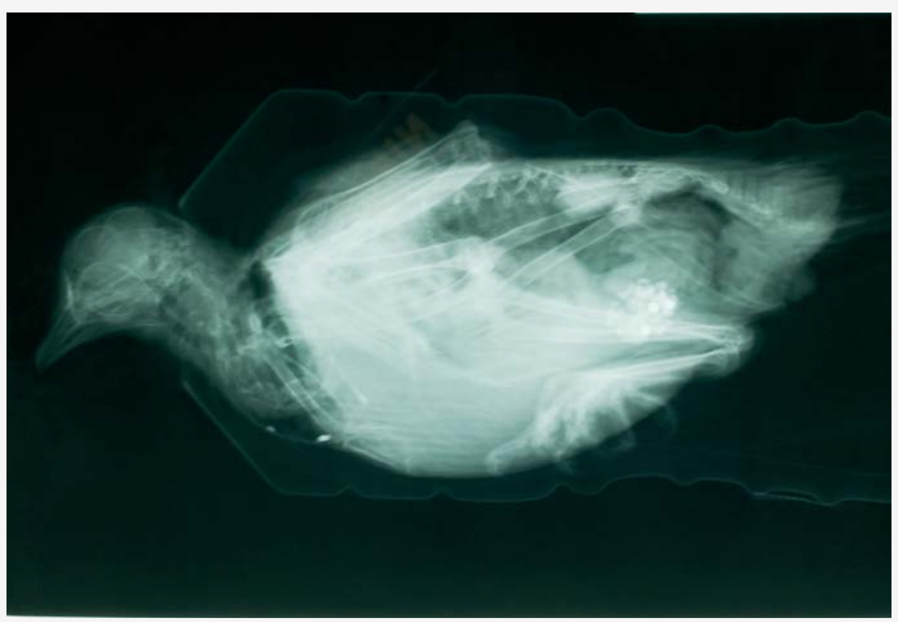
Principal Investigator: Dr. Bridget C. Garner



Dr. Robert Gogal

Oral Pb Pellet Exposure in Domestic Pigeons: A 28 day toxicity study

Avian wildlife and domestic species commonly ingest lead (Pb) spent shot or bullet fragments as grit or mistakenly as food. In previous studies in our laboratory and others, the toxicity varied based on the diet as well as type and quantity of Pb ingested. In the current study, domestic pigeons were gavaged with 1, 2, or 3 Pb pellets and then followed with weekly radiographs and blood physiologic endpoints for 28 days. Pellet retention decreased by roughly 50% per week as pellets were either absorbed or excreted, except for week 4 where pellet number no longer was diminished. Size of retained pellets visually decreased over retention time. Birds dosed with a single pellet showed mean blood Pb levels over 80 times higher than those of the controls, verifying Pb pellet absorption from the gut. Unlike our previous quail studies, no overt clinical signs of toxicity were detected in comparably dosed pigeons. However, similar to the Pb pellet-exposed quail, plasma-aminolevulinic acid dehydratase (ALAD) activity remained depressed, suggesting an altered hematological function in the Pb pellet-exposed pigeons.


Radiograph of a domestic pigeon with 3 spent lead pellets in the gizzard.

Principal Investigator: Dr. Robert Gogal
Co-Investigator: Dr. Susan Williams

Use of Non-Human Primates to Better Understand *Burkholderia mallei* Pathogenesis and Vaccine Efficacy

Burkholderia mallei and *B. pseudomallei* are gram-negative bacteria that are category B select agents and may cause a rapidly fatal disease in humans. The primary reservoir of *Burkholderia mallei* is infected equids (e.g., horses and donkeys), which are a source of disease to humans. In contrast, *B. pseudomallei* are primarily a soil microorganism that can infect humans if inhaled, ingested, or introduced into the skin. Both bacteria are endemic in certain parts of the world, with *B. pseudomallei* infection being widespread throughout Southeast Asia and northern Australia. Indeed, the range of *B. pseudomallei* appears to be increasing, with endemic infections now documented in India, China, Brazil, and parts of Central America. The mortality rate for humans infected with *B. pseudomallei* is over 90% if untreated and approaches 50% even with antibiotic therapy.

Several features of *Burkholderia* make these particularly dangerous pathogens relative to other bacterial agents. Both bacteria are extremely virulent when inhaled, inducing rapidly fatal pneumonia; and both can also cause oral and cutaneous infections. In addition, both organisms exhibit high levels of intrinsic antibiotic resistance, thereby limiting treatment choices to only a few antimicrobials, and can be resistant to common disinfectants. In humans, *Burkholderia* readily establishes a persistent, disseminated infection in lymph nodes, spleen, liver, skin, brain and joints, and may persist for decades before reactivation of infection. Prolonged, aggressive and high-dose therapy is required to fully eradicate these organisms from an infected human. Notably, *B. pseudomallei* can be readily cultured from soil and water in endemic regions, making it very easy to obtain cultures of the organism. Thus, *Burkholderia* possess a number of unique features that make these bacteria particularly dangerous pathogens and high-risk bioweapons.


Dr. Mark Estes

Given the challenges associated with relying strictly only on antimicrobial therapy, vaccination is a logical approach to reducing the risk of deliberate or accidental *Burkholderia* exposure. There have been several attempts to develop *Burkholderia* vaccines, with most of the efforts directed towards vaccines against *B. pseudomallei*. To date, most work on *Burkholderia* vaccines has focused on use of live-attenuated bacterial vaccines. While live, attenuated vaccines generally induce more effective immunity than subunit or killed bacterial vaccines, live attenuated vaccines are more difficult to produce and store and entail risks related to reversion to virulence and adverse effects in immunosuppressed individuals. There have been fewer attempts to develop subunit vaccines against *B. pseudomallei*, though successful protection has been achieved with a vaccine that used the ABC transporter protein LolC, with dendritic cells pulsed with heat-killed *Burkholderia*, and with a DNA vaccine encoding flagellin.

Development of a new, cross-protective vaccine for Burkholderia would be greatly facilitated by better knowledge of the immune mechanisms necessary to control acute *Burkholderia* infection. At present, we do not have a full understanding of the role of adaptive and innate immune responses in controlling *Burkholderia* infection. Since *Burkholderia* exists primarily as an intracellular pathogen, it is likely that cellular immunity plays an important role in control of early infection. We began to examine the roles of different effector immune cells using a BALB/c mouse model of disease. For example, a role for CD4+ T cells in protection against both *B. pseudomallei* and *B. mallei* following immunization has been suggested. There is also some evidence that CD8+ T cells are required for effective immunity against *B. pseudomallei* infection but the organism may block class I antigen presentation. In addition, a role for antibodies and B cells in *B. mallei* immunity has also been suggested from studies conducted by our group. In collaborative studies, we recently reported that activated monocytes played a key role in early innate immune protection from *B. mallei* infection. Therefore, it seems likely that a combination of both humoral and cellular immunity may be required for generating effective immunity against *Burkholderia* infection. Appropriately designed studies to fully elucidate these immune protective mechanisms will provide valuable information for identifying immune correlates of protective immunity and designing vaccine trials. Therefore, we investigated a novel model of *B. mallei* infection, and infected marmosets, which are non-human primates. Marmosets challenged with *B. mallei* by intranasal inoculation survive to at least 6-7 days post infection depending on the challenge dose. Antibiotic treatment is effective in reducing bacterial burden in this model and a febrile response is developed by 24 hours post infection. Future plans will evaluate efficacious *Burkholderia* vaccines from the mouse model in marmosets.

Principal Investigator: Dr. Mark Estes
Co-Investigators: Dr. Matthew J. Sylte and Dr. R. Jeff Hogan

Dr. Jo R. Smith

The effect of dexamethasone or synthetic ACTH on endogenous ACTH concentrations in healthy dogs

Background – Spontaneous hyperadrenocorticism (HAC) is a common canine endocrinopathy and causes hypercortisolemia. Common screening tests for HAC include ACTH stimulation and low dose dexamethasone suppression (LDDS) tests. Different underlying stimuli drive excess cortisol secretion, specifically excess endogenous ACTH (eACTH) secretion from the anterior pituitary in pituitary-dependent HAC (PDH), or autonomous eACTH-independent adrenal secretion in adrenal-dependent HAC (ADH). After a positive screening test, differentiation between PDH and ADH is recommended because this distinction may have both therapeutic and prognostic implications. Measuring the eACTH concentration allows discrimination between PDH and ADH; the concentration should be high or low, respectively.

Technical advancements have reduced time between obtaining definitive screening results and initiation of discriminatory testing. However, the effect of these screening tests on eACTH is poorly characterized. Identifying the impact screening tests may have on eACTH would allow development of appropriate protocols for combining diagnostic screening and differentiation tests for canine HAC.

Objective – To determine the effect of dexamethasone and synthetic ACTH (sACTH) administration on canine endogenous ACTH (eACTH) and the duration of any response.

Animals – 10 healthy, staff-owned, neutered dogs. Inclusion criteria included informed owner consent, > 4.0 kg bodyweight, normal physical examination and minimum data base. Exclusion criteria included having a current/pre-existing disease or receiving any medications (including oral, topical, or injectable corticosteroids) <30 days prior to enrollment.
Method – Randomized, controlled crossover study. Each dog received dexamethasone (DEX) 0.01mg/kg, synthetic ACTH (sACTH) 5 mcg/kg, or 0.9% saline (SAL) 0.5 ml IV at 30 day intervals.

Fasted serum cortisol concentrations were measured before and 1 hour after sACTH and SAL and 8 hours after DEX with a previously validated solid-phase chemiluminescent immunoassay. The assay limit of detection was <0.2 mcg/dL; results reported in this range were as assigned a value of 0.19 mcg/dL.

Fasted plasma eACTH concentrations were measured before and 1, 8, 12, and 24 hours after drug administration using a previously validated 2-site chemiluminescent enzyme immunometric assay. The assay limit of detection was <10 pg/mL; results reported in this range were assigned a value of 9.9 pg/mL. Suppression of eACTH was defined as a >50% decrease from baseline values of 19.9 pg/mL or greater, or a >25% decrease from baseline values <19.9 pg/mL.

Data analysis was performed using SAS. A repeated measures model, that recognized multiple observations as belonging to the same dog, tested for differences in eACTH following sACTH or DEX administration compared to SAL at 1, 8, 12 and 24 hours. Endogenous ACTH was compared to baseline at 1, 8, 12 and 24 hours. Multiple comparisons were adjusted for using Bonferonni's correction. An unstructured covariance structure was used in all repeated measures models. All hypothesis tests were 2-sided and the significance level was $\alpha = 0.05$ divided by the number of simultaneous tests performed.

Results – Participants mean age was 6.9 ± 3.7 years and mean body weight was 16.36 ± 10.56 kg. Demographics were: small/medium breed aged 2-3 years (n = 2), large breed aged 2-4 years (n = 2), small/medium breed aged 9-10 years (n = 4), and large breed aged 10-11 years (n = 2).
Serum cortisol analysis confirmed effective exogenous drug administration (Figure 1).

Following sACTH administration, all dogs (n=10) had 1 hour cortisol concentrations consistent with stimulation (mean increase 10.8 ± 4.1 mcg/dL) (Figure 1). Two dogs had 1 hour cortisol concentrations above the reference interval. These participants lacked any evidence of HAC and both suppressed normally following DEX administration. Following DEX administration, all patients had cortisol concentrations consistent with suppression at 8 hours (Figure 1). Saline administration caused no significant serum cortisol change after 1 hour (Figure 1).

Dexamethasone significantly suppressed eACTH at 8 and 12 hours, although the individual pattern and duration of suppression varied (Figure 2). Synthetic ACTH administration significantly suppressed eACTH at 8 hours (Figure 2). Saline administration had no significant effect on eACTH (Figure 2).

Conclusions – DEX and sACTH administered IV at doses used to test for hyperadrenocorticism cause significant and transient suppression of eACTH in healthy dogs. Although the number of patients assessed in this pilot study was small, our data suggest that pharmacologic manipulation of the HPA axis to test for HAC may alter eACTH concentrations. Repetition of this study in dogs with HAC is necessary before applying these findings to the diagnostic work-up of clinically-affected dogs to avoid incorrect diagnoses of AD-HAC and/or the need for additional testing. However, these data do suggest samples for measuring eACTH should be obtained > 8 hours after initiation of an ACTH stimulation or >12 hours after a LDDS test.

Principal Investigator: Dr. Jo R. Smith
Co-Investigators: Dr. Andrew Bugbee and Dr. Cynthia R. Ward

Therapy of Pneumonia Caused by *Rhodococcus equi* in Foals

Dr. Steeve Giguère

Photo by Sue Myers Smith

The bacterium *Rhodococcus equi* is a common cause of pneumonia in young horses and has a major financial impact on the equine-breeding industry. *R. equi* is also an opportunistic pathogen of immunocompromised humans, especially those infected with the human immunodeficiency virus (HIV). Infections caused by *R. equi* are difficult to treat because the pathogen has the ability to survive and multiply in a type of cell called a macrophage, where most antibiotics cannot enter. The combination of a macrolide (erythromycin, azithromycin, or clarithromycin) and rifampin has been the mainstay of therapy in foals infected with *R. equi* since the early 1980s with only isolated reports of resistance.

Although *R. equi* can be cultured from the environment of virtually all horse farms, the clinical disease in foals is sporadic on some farms but endemic on others. Over the past decade, control of *R. equi* infections at many farms where the disease is endemic has relied on early detection of subclinical pulmonary disease using thoracic ultrasonography and initiation of treatment with antimicrobial agents prior to development of clinical signs. This approach appears to have decreased mortality due to *R. equi* pneumonia at some farms, although controlled studies are lacking. However, this approach is costly and not without risks as the resulting increase in antimicrobial drug use may lead to development of resistance. In a recent study, we documented emergence of resistance to macrolides and rifampin amongst *R. equi* isolates obtained from a horse breeding farm several years after initiation of an ultrasonographic screening program with resulting widespread use of these drugs in foals with subclinical pulmonary lesions. On that farm, 25% to 40% of the *R. equi* isolates from pneumonic foals were resistant to macrolides and rifampin. Resistant isolates were also identified in the environment. We identified macrolide resistance genes in *R. equi* and documented conjugal transfer of macrolide resistance genes from *R. equi* to other bacterial species. These data support the hypothesis that macrolide-resistant environmental *R. equi* act as a reservoir for transfer of antimicrobial resistance genes.

In a separate randomized placebo-controlled study on a large horse farm, we showed that the proportion of foals with ultrasonographic pulmonary lesions associated with *R. equi* infection that recovered was not significantly different between foals treated with azithromycin and rifampin and foals administered a placebo. Moreover, treatment of affected foals with antimicrobial agents did not significantly hasten recovery compared to administration of a placebo. These surprising finding, combined with the apparent increase in macrolide- and rifampin-resistance, support the need to stop the practice of mass macrolide treatment of subclinically infected foals on horse breeding farms. The goal should be to more accurately identify, of the many subclinically infected foals, which few are likely to go on to develop disease and hence require treatment. However, in the short to medium term, there is a need for a safe and effective antimicrobial agent for the treatment of foals with severe pneumonia caused by macrolide- and rifampin-resistant isolates of *R. equi*. The drugs that are the most active against both macrolide-susceptible and macrolide-resistant isolates of *R. equi* in vitro are water-soluble and, as a result, have poor intracellular penetration which likely explains their reported lack of efficacy against *R. equi* in vivo. Work on the development of delivery systems to enhance intracellular delivery of these drugs is currently being performed. A delivery system that could enhance intracellular uptake of antimicrobial agents may prove more effective than conventional therapy.

Principal Investigator: Dr. Steeve Giguère
Co-Investigators: Drs. Marilyn Roberts, Noah Cohen, and Robert Arnold

Extramural Contracts & Grants

Barton, Michelle. Cardiovascular function in horses with acute gastrointestinal disease. American Quarter Horse Foundation. $35,700.00
Brainard, Benjamin. Assessment of the Effects of Two Formulations of Hydroxyethylstarch on Cardiovascular Parameters and Platelet Function in Normal Horses. Abbott Laboratories. $67,175.00
Brainard, Benjamin. Evaluation of Catachem quantative ethylene glycol reagent for the Hitachi P module in dogs and cats. Catachem, Inc. $1,484.00
Brown, Corrie. Animal Health Technical Assistance. USDA. $72,815.00
Brown, Corrie. Consortia for Promotion of Understanding of Environmental and Public Health Issues. US Dept. of Education via sub-award from Michigan State University. $46,708.00
Brown, Corrie. Pathogenesis of selected Newcastle disease virus field isolates and recombinants. USDA ARS. $22,000.00
Budsberg, Steven. Single site assessment of the COX-1/COX-2 ratio for commonly used NSAIDS in dogs. Merial. $95,214.00
Chen, Shiyou. Response gene to complement 32 in smooth muscle differentiation. American Heart Association. $50,360.00
Chen, Shiyou. Smooth muscle differentiation and maturation. NIH. $371,250.00
Coffield, Julie. Neural Cell-Based Biosensor. Aruna Biomedical, Inc. $73,298.00
Corn, Joseph. National Feral Swine Mapping System. USDA. $25,221.00
De La Fuente, Rabindranath. Role of chromatin remodeling proteins in chromosome instability of canine mammary gland carcinomas. Morris Animal Foundation. $4,000.00
Dickerson, Harry. Animal Health Formula Grant. USDA-NIFA. $104,868.00
Dickerson, Harry. Emerging and Re-emerging Infectious Disease Residency/PhD ProgrAmer. Merial Limited. $90,000.00
Dickerson, Harry. The University of Georgia Veterinary Scholars Program: A Research Training Experience for Veterinary Medical Students. Merial. $20,000.00
Estes, Don Mark. Develop a rapid neutralizing antibody platform for FMDV which elicits potent mucosal IgA responses. Dept. of Homeland Security via sub-award from Kansas State University. $80,000.00
Estes, Don Mark. Develop immunomodulators in support of PIADC FMD Vaccine Development. Dept. of Homeland Security via sub-award from Texas Agrilife Extension Service. $98,530.00
Estes, Don Mark. Non-Invasive Optical Imaging of Select Agent Bacteria in Non-Human Primates. NIH. $2,329,038.00
Ferguson, Naola M. Effect of sample collection and Handling on the Detection of Mycoplasma gallisepticum and M. synoviae by real-time PCR. U. S. Poultry & Egg Association. $16,100.00
Ferguson, Naola M. The Safety and Efficacy of Mycoplasma gallisepticum Vaccine Strains in Chickens. Venkateshwara Hatcheries, Ltd. $46,052.00
Fischer, John. Relationships that may simultaneously involve wildlife, domestic livestock and poultry. USDA. $350,000.00
Fischer, John. Southeastern Cooperative Wildlife Disease Study. Various Other States. $566,376.00
Fischer, John. USDA/APHIS Wildlife Services Disease Training. USDA. $90,000.00
Fischer, John. Wildlife Disease related assistance provided by SCWDS to federal/state wildlife agencies: southeastern US and the conservation community at large. US Dept. of Interior. $231,500.00
Fu, Zhen. Therapeutic Antibodies for Rabies. Trellis Bioscience, Inc. $100,000.00
Fu, Zhen. Virus Clearance from the Central Nervous System. NIH via sub-award from Thomas Jefferson University. $574,000.00
Garcia, Maricarmen. Molecular pathogenicity Mareks Disease Virus and Infectious laryngotracheitis virus. USDA. $4,000.00
Giguère, Steeve. Disposition of ampicillin trihydrate in plasma, uterine tissues, lochial fluid, and milk following intramuscular injection of Polyflex to postpartum dairy cows. Boehringer Ingleheim Vetmedica, Inc. $66,735.00
Giguère, Steeve. Liposomal Gentamicin for the treatment of *R. Equi*. Grayson-Jockey Club Research Foundation. $46,830.00
Giguère, Steeve. Steady-state concentrations of desfuroylceftiofur acetamide following weekly intramuscular administration of Excede to adult horses. Pfizer Animal Health. $28,545.00
Gottdenker, Nicole. Investigating the effect of multiple hosts on the transmission dynamics and evolution of canine parvovirus in raccoon populations. American Museum of Natural History. $3,000.00
Harn, Donald. Effect of Helminth Infection on HIV-1 Vaccines. NIH-NIAID. $363,862.00
Harn, Donald. Prophylactic Vaccine for Schistosomiasis. NIH. $26,998.00
Harris, R. Keith. National Animal Health Laboratory Network: GA. USDA-NIFA. $182,000.00
He, Biao. AKT as a target to anti-RSV therapy. NIH via sub-award from University of South Florida. $120,000.00
He, Biao. Developing a novel mumps virus vaccine. NIH. $371,250.00
He, Biao. Developing a Paramyxovirus-Based H5N1 Vaccine. NIH. $651,692.00
He, Biao. Developing PIVS as a Vector for HIV. Emory University. $25,000.00
Hines II, Murray E. 2011 NAHLN Member Laboratory Agreement. USDA. $55,000.00
Hines II, Murray E. 2012 Classical Swine Fever Surveillance. USDA. $6,050.00
Hines II, Murray E. 2012 NAHLN Member Laboratory Agreement. USDA. $55,000.00
Hines II, Murray E. 2012 Pseudorabies Surveillance. USDA. $5,830.00
Hines II, Murray E. Central Processing Facility for the JDIP Diagnostic Project. USDA-NIFA. $100,308.00
Hines II, Murray E. Combined Vaccine Efficacy Study and Validation of a Caprine Johne's Disease Challenge Model. USDA via sub-award from Pennsylvania State University. $288,125.00
Hines II, Murray E. Diagnostic Services Relative to the Control, Diagnosis, Treatment, Prevention and Eradication of Livestock FY2012. Georgia Department of Agriculture. $1,742,292.00
Hofacre, Charles. Pilot Testing Project for Animal Narms Sampling. USDA. $35,000.00
Hondalus, Mary K. *M. tuberculosis* genes required for pulmonary survival revealed by TraCS. NIH. $74,250.00
Hondalus, Mary K. Vitamin D and Innate Immunity in the Horse. Grayson-Jockey Club Research Foundation. $49,942.00
Jackwood, Mark. First International Avian Respiratory Conference. USDA, ARS. $2,000.00
Kaplan, Ray. Anthelmintic Effect of MBS-001 against the Filarial Nematode Parasite *Brugia malayi*, Using an Invitro Model System. Microbes Biosciences, Inc. $12,493.00
Kaplan, Ray. Characterization of anthelmintic resistance in small ruminant gastrointestinal nematodes in the mid-Atlantic US. Delaware St. Univ. $32,500.00
Keel, Kevin. Applied Research Designed to Assist Mitigation of White-nose Syndrome in Bats. US Department of Interior. $115,000.00
Koenig, Amie. Evaluation of continuous glucose monitoring in dehydrated dogs. Medtronic. $25,392.00
Lawrence, Jessica. COTC018: Evaluation of iniparib in tumor bearing dogs to define its pharmacokinetic profile and biological activity. Sanofi-Aventis. $18,900.00
McManamon, Rita. National Leadership Grant: Collaborative Planning Grant for Great Ape Heart Disease. Zoo Atlanta. $8,177.00
Mead, Daniel. Vector-Borne Disease Surveillance. Chatham County. $41,250.00
Mead, Daniel. Vector-Borne Disease Surveillance. Dekalb County Board of Health. $9,900.00
Mead, Daniel. Vector-Borne Disease Surveillance. Fulton County. $1,650.00
Mead, Daniel. Vector-Borne Disease Surveillance - Wild Bird and Mosquito Diagnostic Support. Ga Dept. of Public Health. $10,000.00
Moore, Julie. Immunopathogenesis of Severe Malaria During Pregnancy. NIH. $55,267.00
Moore, Julie. Trophoblast Immune Responses to Placental Malaria. NIH. $16,706.00
Moorhead, Andrew. Animal Models of Infectious Diseases. NIH. $1,113,939.00
Moorhead, Andrew. Furnish *Brugia malayi* adult worms and/or *B. malayi* infective larvae. NIH. $292,690.00
Northrup, Nicole. Maddie's Shelter Medicine Externships. Maddie's Fund Foundation. $6,000.00
Overton, Michael. Development and Implementation of a National Center of Excellence in Dairy Production Medicine Education for Veterinarians. USDA as sub-award via Univ. of Minnesota. $42,000.00
Peroni, John. Drug-Eluting Bioresorbable Polymer Scaffolding for Treatment of Aortic Aneurysms. NIH-SBIR via sub-award from Medshape Solutions, Inc. $152,000.00
Peterson, David. Pfizer Animal Health-Morris Animal Foundation Fellowship, Infectious Disease Research. Morris Animal Foundation. $160,000.00
Quinn, Fred. Development of a diagnostic for latent TB. US Department of Health & Human Services. $371,250.00
Radlinsky, Maryann. Canine OHE using a bipolar vessel sealing device. Covidien. $19,355.00
Rapoport, Gregg. Pharmacokinetic evaluation of a delayed-release procainamide preparation in dogs. ACVIM (Cardiology Resident Grant). $7,000.00
Ritchie, Branson. Research Associate in Exotic/Zoo Infectious Disease and Pathology Postgraduate ProgrAmer. Zoo Atlanta. $10,000.00
Saba, Corey. Phase II Evaluation of GS-9219 in Canine Cutaneous Lymphoma. Colorado State University Animal Cancer Center. $6,306.00
Sakamoto, Kaori. Determining the Role of Genetic Variation in a Macrophage Scavenger Receptor in Responses to *Mycobacterium tuberculosis*. American Lung Association. $39,197.00
Sakamoto, Kaori. Role of MARCO in susceptibility and resistance to tuberculosis. NIH/NIAID. $404,817.00
Sakamoto, Kaori. Role of the Respiratory Syncytial Virus Fusion Protein in Airway Dysfunction. NIH via sub-award from Emory University. $13,581.00
Saliki, Jeremiah T. 2011 Classical Swine Fever Surveillance. USDA-APHIS. $6,050.00
Saliki, Jeremiah T. 2012 Classical Swine Fever Surveillance. USDA-APHIS. $5,500.00
Saliki, Jeremiah T. BSE Surveillance Testing. USDA. $72,936.00
Saliki, Jeremiah T. Diagnostic Services Relative to the Control, Diagnosis, Treatment, Prevention and Eradication of Livestock FY2012. Georgia Department of Agriculture. $1,067,857.00
Saliki, Jeremiah T. FY12 BSE Surveillance Testing. USDA. $33,678.00
Saliki, Jeremiah T. SIV (Swine Influenza Virus) Surveillance. USDA. $3,825.00
Sanchez, Susan. Georgia Veterinary Scholars Research ProgrAmer. NIH. $42,496.00
Sanchez, Susan. *Salmonella* in pets in GA. DHHS-FDA. $60,000.00
Stallknecht, David. Collaborative influenza research ASC/SCWDS. US Department of Interior. $24,988.00
Stallknecht, David. National Center of Excellence for Zoonotic and Emerging Animal Disease Defense. Kansas State University. $31,185.00
Stallknecht, David. Natural History of Avian Influenza Viruses in Wild Bird Populations: Understanding Reservoirs and Risks. Minnesota Center for Influenza Research and Surveillance. NIH via sub-award from University of Minnesota. $1,447,880.00
Tripp, Ralph. Immune Mechanisms of Virus Control (U01/U19): Manipulating Natural Host Immunoregulation via IDO During Viral Infection. NIH via sub-award from GA Health Sciences University. $301,643.00
Tripp, Ralph. Improved Vaccine Technology to Eradicate Polio. Anonymous. $222,442.00
Tripp, Ralph. NIAID Centers for Excellence for Influenza Research and Surveillance. NIH/NIAID via sub-award from Emory University. $2,655,246.00
Tripp, Ralph. RSV Nanocapsule Vaccine Engineered with a G Protein Peptide Payload. NIH. $602,330.00
Tripp, Ralph. Synthetic Nanoparticle Vaccines for RSV. Artificial Cell Technology. $77,220.00
Viveiros, Maria M. Control of Meiotic Spindle Assembly in Mammalian Oocytes. NIH. $445,500.00
Watford, Wendy. Tp12-dependent IFN-g production: contribution to host defense and autoimmunity. NIH-NIAMS. $162,000.00
Wolstenholme, Adrian. Can drug targets from parasitic nematode be usefully expressed in C. elegans? NIH/NIAID. $234,625.00
Wolstenholme, Adrian. Cholinergic receptors on the nematode *Pharynx suum*. NIH via sub-award from Iowa State University. $76,448.00
Wolstenholme, Adrian. Is there an immune component to ivermectin killing of D. immitis larvae? Merial. $61,220.00
Wolstenholme, Adrian. Localization of glutamate-gated chloride channels in *Dirofilaria immitis* larvae. Merial. $65,760.00
Wolstenholme, Adrian. Modulation of Levamisole Receptors: Pharmacological Diversity of Clade III nAChRs. NIH via sub-award from Iowa State University. $70,105.00
Woolums, Amelia. Prevalence of Bacteremia in Dairy Cattle with Acute Puerperal Metritis. Boehringer Ingelheim Vetmedica, Inc. $10,000.00
Ye, Xiaoqin. Molecular mechanism of LPA_3 - mediated uterine receptivity. NIH/NICHD. $315,563.00

Selected Publications

Infectious Diseases

Andersen, L. E., Meliopoulos, V. A., Brooks, P. M., Bakre, A., Yan, X., Coleman, J. K., Tompkins, S. M., and R. A. Tripp. MicroRNA regulation of human protein kinase genes required for influenza virus replication. PLoS ONE, 2011.

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Bell, D. R., Berghaus, R. D., Patel, S., Beavers, S., Fernandez, I., and S. Sanchez. Seroprevalence of tick-borne infections in military working dogs in the republic of Korea. Vector Borne Zool. Dis., 2012**.**

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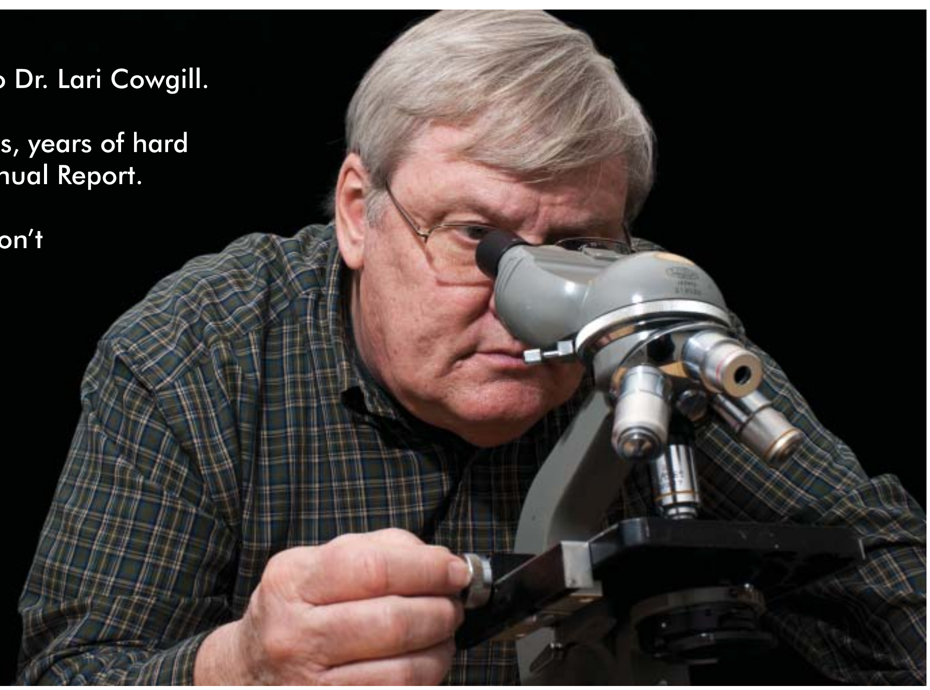
2012 Fiscal Year CVM Graduates

Adams, Laura Elizabeth. Doctor of Veterinary Medicine/Master of Public Health (DVM-MPH), Spring 2012
Aitcheson, Tiffany Ann Weldon. Master of Science – Veterinary & Biomedical Sciences, Fall 2011
Anderson, Lauren Elizabeth. Doctor of Philosophy – Infectious Diseases, Fall 2011
Barber, Renee Marie. Doctor of Philosophy – Infectious Diseases, Fall 2011
Brinson, Denise Leigh. Master of Avian Medicine, Fall 2011
Cadet, Valerie Elisabeth. Doctor of Philosophy – Infectious Diseases, Spring 2012
Casey, Christine Lynn. Master of Science – Veterinary & Biomedical Sciences, Summer 2011
Charles, Roxanne Albertha. Master of Science – Veterinary & Biomedical Sciences, Summer 2011
Chelko, Stephen Patrick. Doctor of Philosophy – Physiology, Fall 2011
Choi, Youngjoo. Doctor of Philosophy – Infectious Diseases, Spring 2012
Chong, Mina. Master of Science – Veterinary & Biomedical Sciences, Spring 2012
Coulson, Garry Brian. Doctor of Philosophy – Infectious Diseases, Summer 2011
Custer, Koren Moore. Doctor of Veterinary Medicine/Master of Public Health (DVM-MPH), Spring 2012
Driskell, Elizabeth Ann. Doctor of Philosophy – Pathology, Summer 2011
Durairaj, Vijay. Doctor of Philosophy – Infectious Diseases, Spring 2012
Earnest, James Thomas. Master of Science – Veterinary & Biomedical Sciences, Summer 2011
Edwards, Jessica Faye. Master of Science – Veterinary & Biomedical Sciences, Fall 2011
Espinosa, Rodrigo Alfredo. Master of Avian Medicine, Fall 2011
Evans, Christopher Charles. Master of Science – Veterinary & Biomedical Sciences, Summer 2011
Gabbard, John David. Doctor of Philosophy – Infectious Diseases, Spring 2012
Gordy, James Tristan. Master of Science – Veterinary & Biomedical Sciences, Spring 2011
Grosse-Siestrup, Benjamin Tobias. Doctor of Philosophy – Infectious Diseases, Spring 2012
Jelesijevic, Tomislav Prvoslav. Doctor of Philosophy – Pathology, Fall 2011
Kerr, Richard Peter. Doctor of Philosophy – Pathology, Spring 2012
Kwon, So Young. Doctor of Philosophy – Veterinary & Biomedical Sciences, Fall 2011
Maxted, Angela Marie. Doctor of Philosophy – Infectious Diseases, Fall 2011
McGraw, Sabrina Nicole. Doctor of Veterinary Medicine/Doctor of Philosophy (DVM-PhD) – Pathology, Summer 2011
Meliopoulos, Victoria A. Doctor of Philosophy – Infectious Diseases, Fall 2011
Mooney, Alaina Jones. Doctor of Philosophy – Infectious Diseases, Spring 2012
O'Kane, Peter Michael. Master of Avian Medicine, Spring 2011
Pavlicek, Rebecca Lou. Doctor of Philosophy – Infectious Diseases, Summer 2011
Phillips, Jamie Evelyn. Doctor of Philosophy – Infectious Diseases, Fall 2011
Pickens, Jennifer Ann. Doctor of Philosophy – Infectious Diseases, Fall 2011
Roebling, Allison. Doctor of Veterinary Medicine/Master of Public Health (DVM-MPH), Spring 2012
Ruder, Mark Gregory. Doctor of Philosophy – Pathology, Spring 2012
Sherlock, Ceri Elinor. Master of Science – Veterinary & Biomedical Sciences, Summer 2011
Susta, Leonardo. Doctor of Philosophy – Pathology, Fall 2011
Teat, Stephanie Vande Ven. Master of Science – Veterinary & Biomedical Sciences, Fall 2011
Thor, Sharmi Webb. Doctor of Philosophy – Infectious Diseases, Fall 2011

We would like to dedicate this issue to Dr. Lari Cowgill.

Thank you for your many contributions, years of hard work, and dedication to the VMES Annual Report.

The College of Veterinary Medicine won't be the same without you!



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