

CENTER OF EXCELLENCE IN
**LIVESTOCK DISEASES
+ HUMAN HEALTH**
2016 ANNUAL REPORT



THIS REPORT IS PRODUCED BY
THE UNIVERSITY OF TENNESSEE

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ABOUT THE INSTITUTE

The **University of Tennessee Institute of Agriculture (UTIA)**, through its colleges, research and education centers, and county extension offices, serves the people of Tennessee and beyond through the discovery, communication, and application of knowledge. **UTIA**, working with the University of Tennessee, Knoxville, is committed to providing undergraduate, graduate, and professional education programs in a diverse learning environment that prepares students to be leaders in a global society. The institute's delivery of education, discovery, and outreach contributes to the economic, social, and environmental well-being of all Tennesseans and focuses on contemporary problems faced by Tennessee, the nation, and the world.

AgResearch is an integral partner in teaching programs throughout the Institute. **AgResearch** faculty conduct world-class research programs in a variety of areas including crop breeding and genetics, soil conservation, no-till crop production, cattle reproduction, wood product development, and many others. **AgResearch** is also a key funding source for graduate assistantships and research that graduate students undertake in their degree programs. The internship program of **AgResearch** offers undergraduates unparalleled field experience. The unit's 10 branch research facilities serve as field laboratories for faculty and students, while allowing the public to evaluate research trials and experience gardens and arboretums. Technologies developed by UTIA's researchers benefit producers and consumers alike.

The **College of Agricultural Sciences and Natural Resources (CASNR)** welcomes students from across Tennessee, the nation, and the world. It offers academic programs in a variety of natural and social science based disciplines that apply to the food, fiber, and natural resources systems. For students in the college, learning is personal and often hands-on. Student teams provide opportunities for self-directed study, leadership development, and a lot of fun. A new honors research and creative achievements program challenges students to excel. International study tours give graduates an edge in the increasingly connected world of global markets.

The **College of Veterinary Medicine (CVM)** is one of only 30 veterinary colleges in the nation. The central mission of the College is in education of professional DVM students seeking a career in some aspect of veterinary medicine ranging from clinical practice to research. The college also serves the public in providing referral medical services to pet owners, zoos and the livestock industry through our veterinary medical center; protects public health; enhances medical knowledge through research and education of graduate students; and generates economic benefits to the state and nation. Outreach programs engage an array of citizens and their animals in learning programs that explore the animal-human bond and promote wellbeing.

UT Extension has an office in every county of Tennessee. Educational programs offered by **University of Tennessee Extension** touch the life of every citizen in Tennessee every day. **UT Extension** delivers research-based programs that improve lives, build stronger families, and strengthen communities. As a partner with local, state, and national agencies and through its statewide presence, **extension** provides educational programming and assistance in areas of agriculture, natural resources and resource development, family and consumer sciences, and 4-H youth development.



LETTER

FROM THE

DEAN

DR. MICHAEL M^CENTEE

ASSOCIATE DEAN FOR RESEARCH

DR. JIM THOMPSON

DEAN, COLLEGE OF VETERINARY MEDICINE

DR. TIM CROSS

CHANCELLOR, INSTITUTE OF AGRICULTURE

ADMINISTRATION

We are pleased to present the 2016 annual report for the Center of Excellence in Livestock Diseases and Human Health.

Within this report, you will see highlights of 17 faculty research projects funded by the center in fiscal year 2016. These faculty members have made significant advancements in cancer biology, molecular pathophysiology, host defense, regenerative medicine, and disease transmission. Center faculty also made significant advancements in the prevention and treatment of infections and non-infectious livestock diseases that affect agricultural productivity.

The 2016 return on investment, as the ratio of research expenditures to the state appropriation for the center, was 5.1:1. Benchmark data can be found on page 4 and include fiscal years 2012–2016.

Center faculty continue to garner national and international recognition for their research and scholarship. During the 2015 calendar year, center faculty published 47 peer-reviewed articles and gave 66 presentations at regional, national, and international meetings.

Despite increased fiscal challenges faced by our center faculty, we are incredibly proud of their efforts and continued successes. We hope you enjoy this summary presentation of center activities and accomplishments.



DR. JIM THOMPSON | DEAN
UT COLLEGE OF VETERINARY MEDICINE



SUMMARY OF ACCOMPLISHMENTS

Despite the persisting, sluggish funding environment, center faculty continue to make excellent progress in ongoing projects, gaining national and international recognition for their expertise and accomplishments. Details of current faculty research are provided in the Faculty Reports section (pp. 24–57).

During the 2015 calendar year, the 17 center faculty averaged three peer-reviewed publications (56 total) and two presentations at prestigious national and international meetings (63 total).

BENCHMARK DATA	2016 17 FACULTY	2015 14 FACULTY
	n*	n†
Publications	50	83
<i>Peer-reviewed articles</i>	47	82
<i>Books/chapters/others</i>	3	1
Presentations	66	34
<i>International</i>	16	19
<i>National</i>	36	8
<i>State or local</i>	14	7
Research Monies		
<i>External funding</i>	\$ 4,654,148	\$ 2,643,146
<i>Research expenditures</i>	\$ 2,536,980	\$ 1,632,146
Return on investment	5.1:1	3.2:1

*Publications and presentation numbers based on 2015 calendar year; research monies based on 2016 fiscal year.

†Publications and presentation numbers based on 2014 calendar year; research monies based on 2015 fiscal year.

Particularly noteworthy articles in 2015 were by Drs. David Anderson, Madhu Dhar, and Hwa-Chain Robert Wang. Drs. Anderson and Dhar published articles in the journal *Drug Metabolism Review*. Dr. Wang's work was published in *Free Radical Biology and Medicine*. These journals have an impact factor above 5.25. The impact factor is frequently used as a measure of a journal's importance in its field. The higher the number, the more times articles published in the journal have been cited in a particular year.

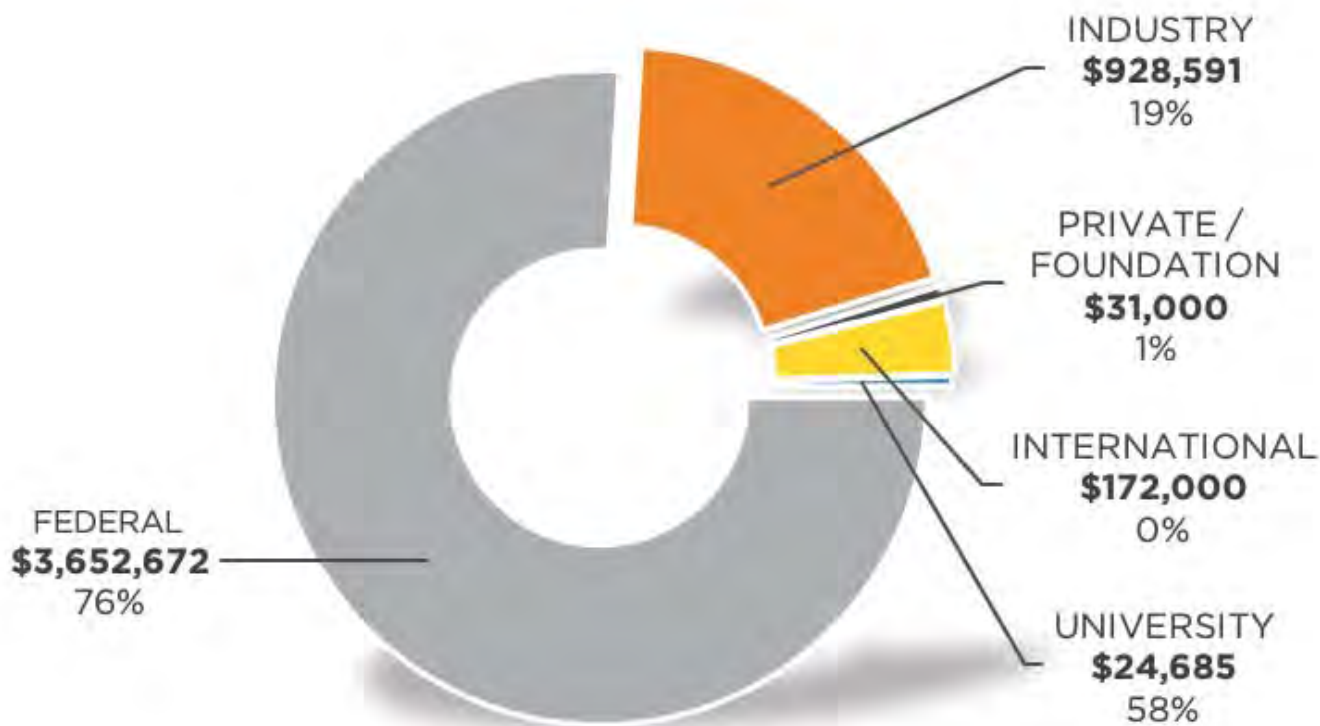


Fig. 1 FY16 external funding by source.

The return on the state’s investment in the center was 5.1:1, calculated as a ratio of expenditures from external funding to center appropriation. This calculation means that for every \$1 of center funds spent, center faculty returned \$5.10 in external funding. External funding totaled \$4,654,148 this year, while expenditures for the year were \$2,536,980. The funding includes new, multi-year awards for Drs. David Anderson, Stephen Kania, and Elizabeth Lennon totaling \$2,877,652, and new 1-year awards for Drs. David Anderson, Marc Caldwell, Stephen Kania, and Travis Mulliniks, totaling \$185,639. See “Research Funded Externally” and “Research Expenditures” on page 7 for the fiscal year 2016 data summary.

OUR MISSION

- Promote interdisciplinary activities designed to improve the quality of human life through better animal health
- Expand livestock disease research capabilities in the CVM and the UTIA
- Identify and characterize animal diseases that are similar to human diseases
- Develop new strategies for the diagnosis, treatment, and prevention of disease



PROGRAM REPORT

The Center of Excellence was launched in 1984 and has developed successful programs to improve understanding, treatment, and prevention of livestock and human diseases. Programs focus predominately on approaches to infectious diseases, tissue regeneration, host defense, molecular genetics, and carcinogenesis through cellular and *in vivo* research.

Since its inception, the center has developed investigative areas in **Animal Models and Comparative Medicine** and **Mechanisms of Disease, Pathogenesis, and Immunity**. Innovative, sophisticated, and contemporary, developments have played critical and unique roles within the University of Tennessee College of Veterinary Medicine (UTCVM) as well as the Institute of Agriculture (UTIA).

These areas of research often overlap to address problems in animals, people and the environment and embody the “One Health” concept.



Research Funded* Externally - FY 2016

Investigator	Federal	Industry	Foundation / Private	University	International	Total
Almeida, Raúl		\$ 571,239				\$ 571,239
Anderson, David	\$ 2,659,522	\$ 100,000				\$ 2,759,522
Caldwell, Marc	\$ 45,466	\$ 16,972				\$ 62,438
Cekanova, Maria		\$ 142,368				\$ 142,368
Kania, Stephen	\$ 25,000	\$ 74,030	\$ 31,000	\$ 24,685	\$ 17,200	\$ 171,915
Lennon, Elizabeth	\$ 126,900					\$ 126,900
Mulliniks, Travis	\$ 134,646	\$ 23,982				\$ 158,628
Rouse, Barry	\$ 475,464					\$ 475,464
Wang, Hwa-Chain Robert	\$ 185,674					\$ 185,674
Totals	\$ 3,652,672	\$ 928,591	\$ 31,000	\$ 24,685	\$ 17,200	\$ 4,654,148

*Represents FY 2016 receipts for active grants.

Research Expenditures - FY 2016

Investigator	Federal	Industry	Foundation / Private	University	International	Total
Almeida, Raúl	\$ 430,030	\$ 308,957				\$ 738,987
Anderson, David	\$ 108,552	\$ 16,265				\$ 124,817
Caldwell, Marc	\$ 28,565	\$ 40,799				\$ 69,364
Cekanova, Maria	\$ 100,555	\$ 116,326				\$ 216,881
Cui, Mei-Zhen	\$ 155,766					\$ 155,766
Dhar, Madhu					\$ 11,612	\$ 11,612
Kania, Stephen	\$ 13,075	\$ 5,141	\$ 3,299	\$ 4,091	\$ 43,047	\$ 68,653
Lennon, Elizabeth	\$ 78,713					\$ 78,713
Mulliniks, Travis	\$ 235,259	\$ 14,441				\$ 249,700
Rouse, Barry	\$ 687,067					\$ 687,067
Wang, Hwa-Chain Robert	\$ 135,031		\$ 389			\$ 135,420
Totals	\$ 1,972,613	\$ 501,929	\$ 3,688	\$ 4,091	\$ 54,659	\$2,536,980

CRITERIA FOR FUNDING

SCIENTIFIC MERIT

POTENTIAL TO LEAD TO EXTERNAL FUNDING

RELEVANCE TO THE CENTER'S OBJECTIVES

FUNDING ALLOCATION

The Center of Excellence in Livestock Diseases and Human Health supports investigators and promotes research based on the criteria. Even though this funding is not a researcher's primary source of funds, the center facilitates established investigators' efforts to maintain and expand their research programs. The center also promotes new investigators' potential in order to develop competitive research programs and foster new collaborative ventures in their efforts.

The center faculty are made up of senior and junior members. Senior members (featured in Faculty Reports, pp. 24–57) have research interests that correspond directly with center objectives and have strong histories securing external funding through center funds. Junior members (featured in Start-Up Funds, pp. 8–9) receive start-up funding or bridge funding. Junior members are expected to actively pursue, and eventually secure, external funding.

BRIDGE FUNDS

Bridge funds are short-term grants, which serve as a "bridge" at times when researchers are between major externally-secured awards. Such funds are important and necessary on occasion for any academic researcher, but particularly in the current times due to a national trend of low funding success rates.

DR. SEUNG BAEK received bridge funding this year along with his research award. Dr. Baek directs the Environmental Carcinogenesis

Laboratory in the Department of Biomedical and Diagnostic Sciences.

DR. XUEMIN XU was awarded \$30,000 in Center bridge funding with a match from the Biomedical and Diagnostic Sciences department to sustain his research program through August 2016, at which point his newly awarded NIH grant will carry his laboratory forward.

START-UP FUNDS

JEFFERY BISKUP

Cranial cruciate ligament repair using an intra-articular allograft (\$10,000)



AMY HODSHON

Investigating the role of infection in chronic intervertebral disc herniations in dogs (\$5,000)

CASSIE LUX

MRI characteristics of splenic tumors, advanced training in interventional radiology, and new laparoscopic surgery equipment (\$10,000)



CHIKA OKAFOR

Epidemiology of the use of antimicrobials in animals (\$5,000)

DEANNA SCHAEFER

Hematology and biochemical reference interval calculation for alpacas using two hematology systems, including evaluation for optimal settings in automated hematology assessment (\$5,000)





JOHN SCHAEFER

Diagnostic techniques for toxoplasmosis, a zoonotic protozoal disease of particular risk to pregnant women and immunocompromised individuals (\$2,500)

miscellaneous supplies, printing, and rentals.

The Center provided infrastructural support by helping to equip the College's newly installed BSL-3 laboratory, the purchase of an **Amersham chemiluminescence detection instrument** for high-resolution digital imaging of protein and DNA samples in gels and membranes (**\$21,000**), a **refrigerated table top centrifuge** (**\$11,860**), and a **microplate spectrophotometer** (**\$11,030**).

MEE-JA SULA

Diagnostic investigation of clinical cases that characterize reproductive disease in non-domestic felids (\$15,000)



INFRASTRUCTURE & SUPPLIES

The center promotes the research infrastructure for the UTIA as well as the UTCVM through the purchase and maintenance of essential research equipment. Faculty submit requests to the Research Advisory Committee. The committee then reviews the requests based on three criteria: justification of need, current availability of equipment, and number of investigators who would benefit from new equipment.

In support of the UTCVM's research enterprises in 2016, the center funded a service contract for an **Optima XL-100K Ultracentrifuge** (**\$3,927**) for use by the college. An ultracentrifuge is optimized for spinning a rotor at very high speeds.

Additionally, **\$23,122** was used to maintain a **cell sorter**. Cell sorters are used to isolate cells according to their properties. The ability to sort cells by type within organs and tissues can often help establish principles suggested by researchers.

Miscellaneous service contracts and agreements constituted **\$9,924** of center spending. Another **\$166** was spent on



Optima XL-100K Ultracentrifuges

COMPARATIVE & EXPERIMENTAL MEDICINE & PUBLIC HEALTH RESEARCH SYMPOSIUM

The center has been a major sponsor of the Comparative and Experimental Medicine and Public Health Research Symposium, which brings together researchers from 13 different departments for a 2-day event, focusing this year on *One Health - Animal, Human, & Environmental Well-Being*. The symposium provides a venue for students and new investigators to gain experience showcasing their work as oral presentations and gathers university investigators with varied backgrounds and interests to create new ideas, collaborations, and networking to enhance health-related research on the Knoxville campuses.

Forty-four presentations were given during the 2-day event, culminating in an awards ceremony. The symposium remains an entirely unique, cross-campus, cross-disciplinary venue for presenting new research data on the Knoxville campuses of the university. This year's featured speakers included:

DR. SUSAN KUTZ

Associate professor of ecosystem public health and faculty of veterinary medicine at the University of Calgary

DR. JONATHAN M. IRISH

Assistant professor in the Department of Cancer Biology at Vanderbilt University

DR. SUZIE ALLARD

Associate dean for research for the College of Communication and Information and professor in the School of Information Sciences at the University of Tennessee

DR. KURT LAMOUR

Professor in the Department of Entomology and Plant Pathology at the University of Tennessee Institute of Agriculture



AWARD RECIPIENTS

(from left to right)

DR. EMILY GOULD

1st, Graduate Student Category
Comparative and Experimental Medicine

DR. ELLEN FLEETWOOD

3rd, Graduate Student Category
Comparative and Experimental Medicine

DR. CARRIE DAVIS

Intern/Resident Award of Excellence
Department of Small Animal Clinical Sciences

DR. CHELSI CASSILLY

2nd, Graduate Student Category
Department of Microbiology

DR. CHEN HU

Research Associate Award of Excellence
Department of Biomedical and Diagnostic Sciences

(not pictured)

MANASI BALACHANDRAN

Phi Zeta Award for Excellence in Animal Health Research
Comparative and Experimental Medicine

Faculty are encouraged to share their research through speaking engagements for professional groups, community groups, and civic groups. A complete list of faculty publications and presentations for the 2015 calendar year accompanies each faculty report (pp. 24–57).

To promote the research of faculty and graduate students, as well as to encourage networking and collaboration, the center sponsors opportunities to present research results at national and international conferences. During the fiscal year (2016), the center funded six individuals (\$4,250):



CHELSEI CASSILLY

Presented research at the 13th Annual American Society for Microbiology Conference on *Candida* and Candidiasis in Seattle, Washington, in April 2016. Her presentation was entitled “The Role of Phosphatidylserine Synthase in Shaping the Phospholipidome of *Candida albicans*.” Cassilly is a graduate student in the Department of Microbiology. Her travel was funded through an award given at the 2015 Comparative & Experimental Medicine and Public Health Research (CEMPH) Symposium. (\$1,000)

KUSUM RATHORE

Was funded to attend the American Association for Cancer Research Workshop on Translational Cancer Research for Basic Scientists. (\$1,000)



EMILY GOULD

Presented research at the American College of Veterinary Internal Medicine Forum in Denver, Colorado, in June 2016. Her presentation was titled “Evaluation of the effect of omeprazole on serum calcium, cobalamin, gastrin and bone in cats.” Gould is a graduate student in Comparative and Experimental Medicine. Her travel was funded through an award given at the 2015 CEMPH Research Symposium. (\$500)



CAROLINE GRUNENWALD

Presented research at the Wildlife Disease Association Conference in Cortland, New York, in July and August 2016. Grunenwald is a graduate student who was funded by an award given at the 2015 CEMPH Research Symposium. (\$250)

JENNIFER MICHAELS

Is a neurology resident who also attended the American College of Veterinary Internal Medicine Forum in Denver, Colorado, in June 2016 with Emily Gould. (\$1,000)



BRITTANY OVERSTREET

Presented research at the National American College of Sports Medicine in Boston, Massachusetts, in May 2016. Overstreet is a graduate student who was funded by an award given at the 2015 CEMPH Research Symposium. (\$500)

DISSEMINATION OF RESEARCH

14 STATE PRESENTATIONS

6 PRESENTATIONS GIVEN IN
KNOXVILLE

5 PRESENTATIONS GIVEN IN
NASHVILLE

3 PRESENTATIONS GIVEN IN
CROSSVILLE

36 NATIONAL PRESENTATIONS

10 PRESENTATIONS GIVEN IN
CHICAGO, IL

7 PRESENTATIONS GIVEN IN
BOSTON, MA

3 PRESENTATIONS GIVEN IN
MONTEREY BAY, CA

1 PRESENTATION GIVEN IN

AUBURN, AL
FLAT ROCK, NC
FORT COLLINS, CO
FORT WORTH, TX
HERSHEY, PA
LAS VEGAS, NV
LEESBURG, VA
LITTLE ROCK, AR
LOUISVILLE, KY
MIAMI, FL
MORRILTON, AR
OMAHA, NE
ORLANDO, FL
PHILADELPHIA, PA
PITTSBURGH, PA
SAN DIEGO, CA

16 INTERNATIONAL PRESENTATIONS

8 PRESENTATIONS GIVEN IN
CHINA

2 PRESENTATIONS GIVEN IN
ARGENTINA
SPAIN
TAIWAN

1 PRESENTATION GIVEN IN
AUSTRALIA
MEXICO

POPULAR PRESS & MEDIA

In addition to faculty speaking engagements, the UTCVM issues press releases to state, regional, and national media, resulting in numerous television and print features, many of which relate directly to research conducted through the center.

The UTCVM has a recurring spot on local NBC affiliate WBIR, Channel 10's "Live at Five at Four" news show. The college has also launched a Facebook page, a VolVet Connect alumni e-newsletter, and a quarterly referring DVM newsletter. As of mid-August 2016, the Facebook page had been liked by 7,347 people from 45 different countries. Page administrators post clinical and research information for users. Posts reached over 28,100 individuals with an average reach per post of over 3,000 people.

VolVet Connect contains items of note aimed at DVM alumni, including UTCVM research news, and continuing education and networking opportunities. In each issue of the newsletter for referring veterinarians, a Comparative and Experimental Medicine graduate student's research focus is present. UTCVM is also on Twitter (3,278 followers), has a YouTube channel with 134 subscribers and 65,544 views since its inception in 2012, and a Pinterest presence with 242 followers. The Instagram account has 460 followers.

VolVetVision is a yearly magazine that explores the research, teaching, and outreach services of the UTCVM. The magazine underwent a revamping process and resumed publication in fall 2015.

Dr. Marc Caldwell on "Live at Five at Four"



SUMMER STUDENT RESEARCH PROGRAM

In an effort to foster interest in careers in biomedical research and enhance appreciation for scientific investigation, inquiry, and the acquisition of new knowledge, the center once again helped provide opportunities for veterinary students to do research at the Institute.

Twenty-four students participated in laboratory and field research and attended weekly professional development seminars, during which guest speakers addressed topics such as career opportunities in research, compliance issues in laboratory animal care, science writing, and the grant proposal process. They also participated in the Comparative & Experimental Medicine and Public Health Research Symposium. Near the end of the 10-week program, the students presented their research findings to their colleagues and to UTCVM faculty and staff. Since 2008, students in this program have co-published 63 peer-reviewed research articles.

The center fully funded 24 student stipends for the Summer Student Research Program. A grant from Morris Animal Foundation partially funded Dr. Stephen Kania's student, Kathryn Duncan. Dr. Kania, a center faculty member, coordinated the program, along with Dr. Linda Frank.

To maximize student participation, the program is open to both center and non-center faculty. During fiscal year 2016, five senior faculty and one junior faculty participated in the program. The center will continue to encourage participation of its faculty interested in mentoring DVM students.

KATHRYN BEARD

from Kingston, TN

3rd year | BS in Animal Science (Minor in Biology) at the University of Tennessee, Knoxville

MENTORS:

Dr. Kim Newkirk + Dr. Edward Ramsay

CAREER INTERESTS:

General veterinary practice and biology

“Enrofloxacin-associated retinal toxicity in exotic felids”

Enrofloxacin, a commonly used antibiotic in domestic cats, causes eye lesions. Many exotic animal veterinarians use enrofloxacin regularly in large cats but have not noticed eye issues or legions. Beard retrospectively studied large-cat eyes collected during postmortem exams to explore a possible correlation between thinner retinas and use of enrofloxacin in large cats.

AJ CALVIRD

from Ducktown, GA

2nd year | BS in Biology at the University of Georgia, Athens

MENTOR:

Dr. Richard Gerhold

CAREER INTERESTS:

Wildlife and pathology

“Parasitic fauna of commercial poultry litter and implications to wild turkeys”

Throughout the summer, Calvird analyzed the arthropods that are commonly found in commercial poultry litter, which is a mix of excrement, spilled feed, feathers, and other materials. The litter was then examined for possible transmittable avian parasites.

CAROLINE BENHAM

from Memphis, TN

2nd year | BS in Marine Ecology and Evolutionary Biology (Minor in Marine Biology) at Tulane University

MENTOR:

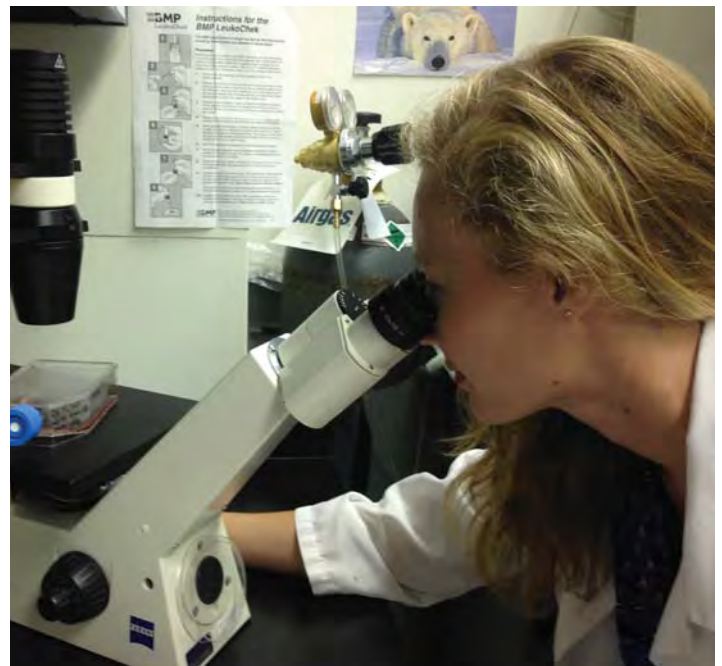
Dr. Marc Caldwell

CAREER INTERESTS:

Veterinary public health, food safety, zoonotic diseases in developing countries, and large animal practice

“Microenvironmental sampling techniques of the nasal cavity of cattle”

Benham was involved in a study of *M. haemolytica*. She took samples from calves intranasally and tracked the course of the disease through the body. She also inspected carcasses to determine significant pathology and reasons for carcass condemnation at slaughterhouses.



KENDALL CANNON

from Belvedere, CA

3rd year | BS in Psychology at Davidson College

MENTOR:

Dr. Jim Schumacher

CAREER INTEREST:

Equine sports medicine

"Efficacy of perineural injection of sarapin in the palmar digital nerve of the equine digit"

Sarapin, a chemical extract distilled from *Sarracenia purpurea* pitcher plants, has historically been used in human and veterinary medicine as a local anesthetic agent. Clinical studies that support Sarapin's efficacy, or lack thereof, are rare and limited to non-lame horses. Cannon's study evaluated the efficacy of the agent on horse forelimb palmar digital nerves using mepivacaine, a reputable local anesthetic.

SAMANTHA COMPTON

from Georgetown, KY

2nd year | BS in Business Administration at the University of Kentucky, Lexington

MENTORS:

Dr. David Bemis + Dr. Stephen Kania

CAREER INTERESTS:

Microbiology, surgery, radiology, neurology, and shelter medicine

"Evaluation of rapid tests for determination of pyroglutonyl arylamidase in Staphylococcus delphini"

By acquiring missing data for biochemical test reactions with *Staphylococcus delphini*, Compton hopes to aid in preliminary differentiation from *Staphylococcus aureus*. Isolates' identifications were confirmed using PCR and five different reagent tests.

HEATHER CARLIN

from Hendersonville, TN

3rd year | BS in Biology at the University of Kentucky

MENTOR:

Dr. Elizabeth Lennon

CAREER INTEREST:

Mixed animal private practice

"Protective role of the mast cell in inflammatory bowel disease"

Carlin researched the regulation of bone morphogenic proteins, which stimulate bone growth, by mast cells, a white blood cell type. The goal was to research inflammatory bowel disease in a mouse model to further future research into the disease.

MARTHA COOK

from Oak Ridge, TN

2nd year | BS in Mathematics (Minor in Psychology) at Sewanee: The University of the South

MENTOR:

Dr. Rebecca Trout-Fryxell

CAREER INTEREST:

Veterinary public health in developing countries

"Evaluating stable flies for insecticide resistance"

Stable flies were exposed to varying levels of insecticide, testing resistance. Each fly's DNA was then extracted to see if susceptibility to insecticide correlates with genes.

ALISON COWIE

from Adams, MA

2nd year | BA in British Literature/Creative Writing/
Military Science at James Madison University | BS in
Pre-Veterinary at Massachusetts
College of Liberal Arts

MENTORS:

Dr. Deb Miller + Dr. Brian Alford

CAREER INTERESTS:

Lab animal medicine and research

“Effect of parasitic infection on intersex in fish”

Fish populations are increasingly becoming intersexual (meaning having both types of sexual cells within a sexual organ, though not hermaphroditism), which may cause a cascade collapse within ecosystems. Intersex may be caused by a number of stressors, such as chemicals, physical stress, infection, disease, injury, or environmental changes. Cowie’s research was conducted to determine if a parasitic infection of gonadal tissue is directly related to the occurrence of intersex in wild-caught fish in East Tennessee.



RACHEL DICKSON

from Knoxville, TN

3rd year | BS in Chemical Engineering (Minor in
Chemistry) at the University of Tennessee, Knoxville

MENTOR:

Dr. Katie Tolbert

CAREER INTEREST:

Academia

*“Effect of probiotic on feline
Tritrichomonas foetus infection”*

Dickson’s study evaluated the effect of probiotics in treating an infection of felines caused by the intestinal parasite *Tritrichomonas foetus*. The infection may be curable through the use of probiotics.

KATHRYN DUNCAN

from Knoxville, TN

3rd year | BS in Animal Science at the University of
Tennessee, Knoxville

MENTOR:

Dr. Richard Gerhold

CAREER INTERESTS:

Lab animal medicine and academia

*“Host health impacts and host-parasite relationship of
gastrointestinal helminths in wild turkeys”*

To help researchers diagnose turkey tapeworms more efficiently, Duncan assisted in updating the baseline knowledge of tapeworms found in Tennessee wild turkeys. First, she identified tapeworms using classical standards and then targeted two tapeworm genes to add to GenBank, one of the largest freely accessible genetic databases.

LEANN FOWLER

from Johnson City, TN

3rd year | BS in Animal Science at the University of Tennessee, Knoxville

MENTOR:

Dr. Jose Castro

CAREER INTERESTS:

Equine sports medicine and academia

“Lasting effects of lidocaine and mepivacaine after a palmer digital nerve block using a computerized lameness locator system”

By using a lameness locator to calculate time values for regional nerve anesthesia, Fowler aimed to determine the objective longevity of carbocaine and lidocaine in a palmer digital nerve block on lame horses.

ALLISON GRAHAM

from Chicago, IL

3rd year | BS in Biology and Environmental Science at Rhodes College

MENTOR:

Dr. Katie Tolbert

CAREER INTEREST:

Veterinary dermatology

“Repeated famotidine administration results in a diminished effect on canine intragastric pH over time”
Famotidine can be administered to affect canine intragastric pH over time. Results revealed that famotidine is likely to be effective for symptom control or short-term therapy, but repeated daily administration is not viable as a long-term gastric acid control system.

ALYSSA HELMS

from Old Hickory, TN

3rd year | BS in Animal Science (Minor in Biology) at the University of Tennessee, Knoxville

MENTORS:

Dr. Elizabeth May + Dr. Stephen Kania

CAREER INTEREST:

Small animal medicine

“Genetics of the black coat color in schipperkes”
The schipperke is a small Belgian breed of dog, typically with a dark black coat. By DNA extraction, PCR, and sequencing on canine cheek swab samples, Helms aimed to link the genetics of the black coat color and Alopecia X, which typically affects Nordic breeds and toy or miniature poodles, causing the dogs to lose patches of fur.

RACHEL HERWICK

from Crestview, FL

2nd year | BS in Professional Biology (Minor in Chemistry) at the University of North Alabama

MENTORS:

Dr. Zenithson Ng + Dr. Julie Albright

CAREER INTEREST:

Small animal surgery

“Effect of animal-assisted intervention on preoperative anxiety and dose of sedation in children”
By examining the correlation between the effect of therapy dogs and sedation dosage in children, Herwick hypothesized that children who interacted with a therapy dog for 10 minutes prior to a necessary sedated procedure would require lower doses of sedation than children who play with an iPad for 10 minutes prior to a sedation procedure.



ANDREA KULHAWIK

from Lowell, MI

3rd year | BS in Zoology at Michigan State University

MENTORS:

Dr. Stephen Kania + Dr. Linda Frank

CAREER INTEREST:

Large animal medicine

“Detection of papillomavirus in greyhound corns”

Tissue samples of greyhounds, which are typically used as race dogs, were tested for papilloma virus in this study. The samples were tested to determine if the virus is a causative factor in paw pad skin lesions.

JACK LEE

from Danville, CA

2nd year | BS in Cellular and Molecular Biology (Minor in US History) at Vanderbilt University

MENTOR:

Dr. Darryl Millis

CAREER INTERESTS:

Small animal private practice

“Thermographic evaluation of cryotherapy duration of effect in dogs undergoing tibial plateau-leveling osteotomy”

Using medical infrared thermal imaging technology, Lee intended to quantify tissue temperatures after cryotherapy. The study evaluated the duration of cooling effects after a procedure that causes inflammation, such as surgery.

ALLISON MOONEY

from Bristol, TN

3rd year | BS in Biology at Virginia Tech

MENTOR:

Dr. Jacqueline Whittemore

CAREER INTEREST:

Small animal internal medicine

“Radial and coccygeal artery indirect Doppler systolic blood pressure measurements in privately-owned, conscious dogs”

Mooney’s summer study compared canine blood pressures taken at the radial and coccygeal arteries in conscious, privately-owned dogs.

BECCA NOEL

from Nashville, TN

3rd year | BS in Ecology and Evolutionary Biology at Tulane University | MS in Biomolecular Science from Lipscomb University

MENTOR:

Dr. Silke Hecht

CAREER INTERESTS:

Veterinary oncology or radiology

“Magnetic resonance imaging findings in dogs with spinal and paraspinal soft tissue sarcoma and histiocytic sarcoma”

Noel’s research was a retrospective study on MRI characteristics of spinal histiocytic and soft tissue sarcomas in dogs.



A L I S H A P O T T E R

from Charlotte, NC

2nd year | BS in Psychology, BA in Chemistry (Minor in Biology) at the University of North Carolina at Charlotte

MENTOR:

Dr. David Anderson

CAREER INTERESTS:

Large animal medicine, research, diagnostics, chiropractic care

“Biomaterials for biomedical application”

The work performed this summer culminated in a study of the various factors that contribute to small intestinal anastomosis procedures. In particular, they examined several stents and different methods of placing stents to potentially develop a biodegradable stent for use in large animals to reduce procedure complications.

B E T S Y P H I L L I P S

from Kissimmee, FL

2nd year | BS in Biology at the University of Central Florida | AA in Biology at Valencia College

MENTOR:

Dr. Jennifer Stokes

CAREER INTEREST:

Ophthalmology

“Thermographic evaluation of effect in dogs undergoing tibial plateau-leveling osteotomy”

Phillips looked at thermography images of the limbs of dogs that had undergone tibial plateau-leveling osteotomy. By examining the images before and after physical therapy, she sought to determine if thermography could localize by taking thermography images before and after physical therapy. Research was done to see if thermography could localize areas of inflammation in patients before doctors do physical exams. This has potential as a diagnostic tool in veterinary medicine as it is used in human medicine for the detection of breast cancer and other inflammatory diseases.

M O N I C A R A W S O N

from Memphis, TN

3rd year | BS in Biomedical Engineering (Minors in Biology and Chemistry) at the University of Memphis

MENTOR:

Dr. Madhu Dhar

CAREER INTEREST:

Translational medicine research

“Fat-derived porcine stem cell characterization”

Rawson characterized a new stem cell line from fat tissue of an adult pig. By running several assays, she was able to monitor their growth and development to later use the stem cells in cartilage defect research.

SARAH ROBERTS

from Camarillo, CA

3rd year | BS in Biological Sciences at California Polytechnical State University

MENTOR:

Dr. Cassie Lux

CAREER INTEREST:

Small animal veterinary medicine

"Effects of hyperbaric oxygen therapy on incisional and open wound healing in dogs"

Roberts participated in a retrospective study with the goal of identifying surgical wound reopening rates for colonic procedures. Then she researched the effects of hyperbaric oxygen therapy on incisional and open wound healing in dogs.

LESLIE SERRANO

from Drummonds, TN

2nd year | BS in Animal Science at the University of Tennessee at Martin

MENTOR:

Dr. Karen Tobias

CAREER INTERESTS:

Gross pathology, surgery, and mixed animal practice

"Evaluation of an ammonium meter for clinical use in dogs and cats"

This project examined the effects of different conditions on cooling blood specimens over a period of time to determine a suitable protocol for blood ammonia handling. Serrano also worked to determine a procedure for the use of a hand-held ammonia meter to be used in a different study.

KATIE WALLER

from Nashville, TN

2nd year | BS in Animal Science at Auburn University

MENTOR:

Dr. Brian Whitlock

CAREER INTERESTS:

Large animal medicine and ambulatory practice

"The effect of beta-hydroxybutyrate injection into the lateral cerebroventricles of ewes on plasma concentrations of luteinizing hormone"

Waller studied the effects of beta-hydroxybutyrate, a chemical compound that can be used by the brain as an energy source when blood glucose is low, on luteinizing hormone in ewes.



FIVE-YEAR BENCHMARK DATA (2012-2016)

Productivity among center faculty has been stable during the last 5-year period. From 2012 to 2016, center faculty published 233 articles in peer-reviewed journals and gave 241 presentations at national and international meetings.

Total research funding was up from \$2,429,602 in 2012 to \$4,654,148 in 2016 (Figs. 3 & 4). Figure 3 shows federal funding from 2012 to 2016.

Expenditures per faculty member averaged \$149,234 in FY2016. Over the past 5 years, the mean expenditure amount per faculty member has been \$157,815. The 5-year average return on the state's investment in the center is 4.3:1, the ratio of research expenditures to the state's appropriation. For comparison, benchmark data from 2012-2016 are summarized in Figures 3-5.

BENCHMARK SUMMARY (2012-2016)

Center faculty members have worked hard to maintain external funding during this difficult economic period and related constriction of research sponsorship from all quarters, in particular the National Institutes of Health (NIH).

Biomedical research support has stagnated in recent years, with the economic downturn and lack of an effective federal commitment to sustain or increase funding. Our center faculty has experienced this with increased competition for fewer dollars, resulting in a significant reduction in external funding over the past few years; this has been true for all universities.

We do have some cause for hope with several federal grants awarded to center faculty members during FY2016 and, in particular, our newer faculty members, which may signal renewed growth of external funding coming into our center. The UTCVM will continue to look for new

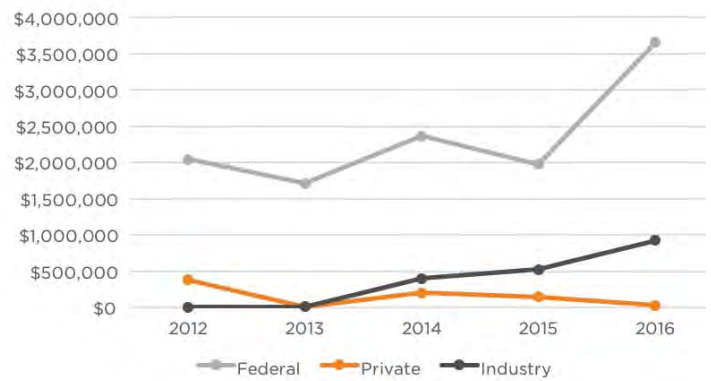


Fig. 3 Top Three External Funding Categories (FY 2012 - 2016)

ways to support faculty in obtaining the external sponsorship needed to grow discovery in the center's mission areas by enhancing opportunities for collaboration, focused investment in research equipment and facilities, and continued technical grant writing assistance.

FUTURE PLANS: LOOKING FORWARD

The Center has good reason for continued optimism as developments on a number of fronts promise opportunities for research growth including new faculty, administrative expertise and facilities, significant strengthening of research funding in regenerative medicine, broad development of relevant research planning across the Institute for Agriculture and in the specific area of antimicrobial resistance, a significant national concern affecting human health and food animal production management.

While federal and other research funding sources remain tight, our faculty continue to have success in securing support and, as noted in this report, extramural funding for Center faculty increased in 2016 with new and renewed NIH grants and a significant success by the regenerative medicine research team in securing well over \$5 million from the Department of Defense (DOD) for a proposal drafted in collaboration with investigators at University of Arkansas' Center for Integrative Nanotechnology Sciences. While the DOD has provided sporadic research funding

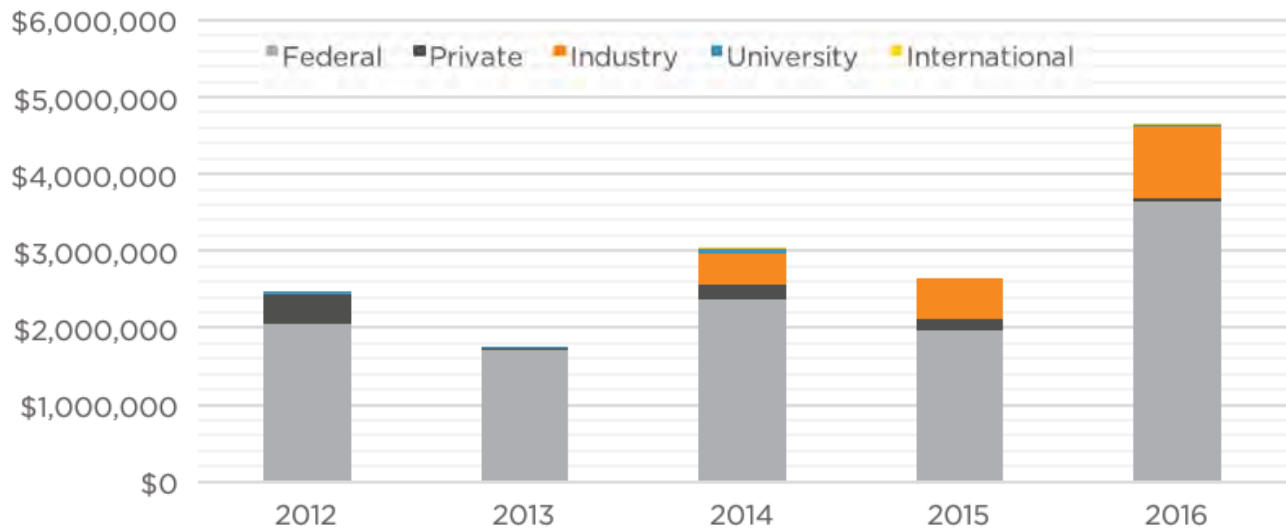


Fig. 4 External Funding by Source (FY 2012 – 2016)

for Center faculty in the past, the regenerative medicine team, led at UT by Dr David Anderson, have provided early evidence of establishing a program that may be of sustained interest to DOD with their encouragement for submission of additional new grant applications. In establishing this foothold, the team has demonstrated their potential to significantly grow their program into the future with strong federal backing.

Dr Steve Oliver, one of our original and most productive Center faculty members, retired this past year as Associate Dean for Research at UTIA, leaving behind an ongoing legacy of mastitis research and a long history helping to guide Center programs forward. While he will certainly be missed, AgResearch has found a replacement in Dr David White, who will join the CVM Research Committee in helping to administer Center programs. Dr White brings with him a background in veterinary infectious diseases and substantial federal administrative experience as the Chief Science Officer and

Research Director for the Office of Foods and Veterinary Medicine at the US Food and Drug Administration (FDA). He also has a significant record of research in antimicrobial resistance (AMR), which provides a substantial infusion of expertise and background knowledge for a group of faculty developing this area of investigation at UTIA with Center support. AMR has been identified as a national and international health threat with new attention from federal agencies including USDA and CDC. Center faculty continue to work in this topical area of critical research need, and as a group have attracted interest from CDC.

The Center also welcomes Dr Elizabeth (Liz) Lennon as a new assistant professor in Small Animal Clinical Sciences. Dr Lennon comes to UT from North Carolina State University with an NIH career award in intestinal inflammation and immunity that will complement interests of other UTIA faculty. She has established her research laboratory, with Center support, and is actively seeking additional federal and industry funding. Dr Lennon will be working closely with another Center faculty member, Dr

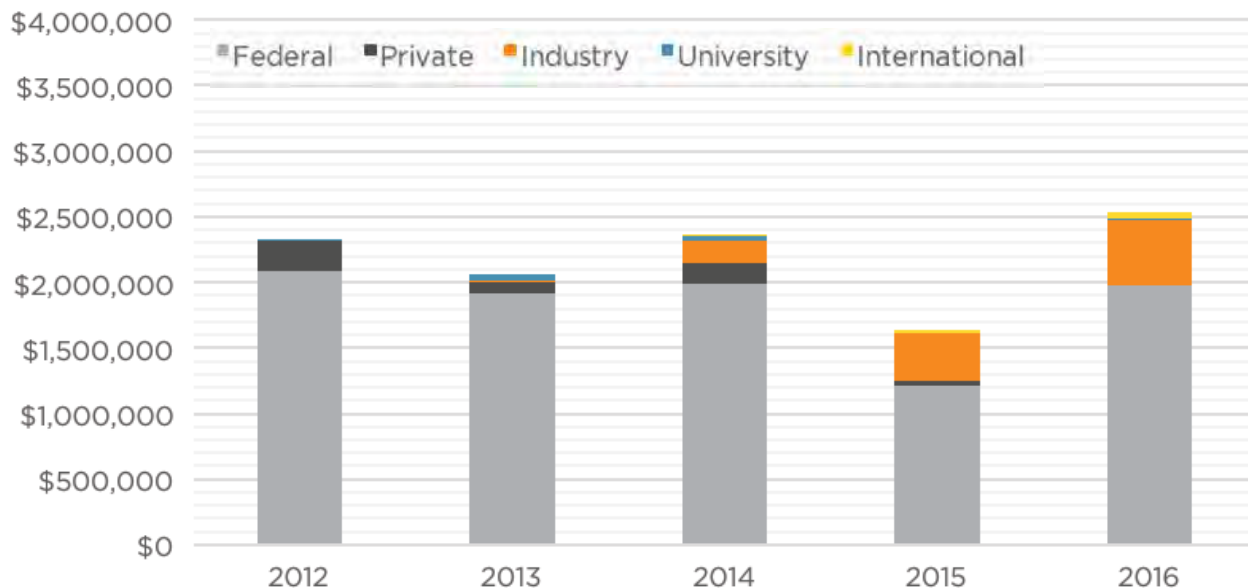


Fig. 5 Research Expenditures by Source (2012 – 2016)

Barry Rouse, taking advantage of his substantial expertise in immunology and infectious disease, international network of scientists, and skills in sustaining over 30 years of continuous RO1 grant support from the NIH. Additional activities and accomplishments that build for the future include successful installation of a specialized laboratory for the study of infectious diseases in the College of Veterinary Medicine, the only facility of its kind on the Knoxville campus and a resource that opens new avenues of federally funded research, potentially including AMR. Finally, UTIA has engaged in a ground-up exercise over the past year which has pulled together groups of investigators to establish priorities and build on research strengths for the coming years. Twenty-one proposals have been presented to date, a number of them involving Center faculty members and strongly aligned with Center goals. The Institute and Center are excited about the potential for one or more of these programs to lead to significant increases in extramural support and enhanced research activity in relevant areas of human health and livestock diseases.

FACULTY REPORTS

RAÚL **ALMEIDA** | A SHOT IN THE ARM

DAVID **ANDERSON** | GOT SOME NERVE

SEUNG JOON **BAEK** | TREAT + PREVENT: FIGHTING COLORECTAL CANCER

MARC **CALDWELL** | BREATHING EASIER

MARIA **CEKANOVA** | STEMMING PAIN

MEI-ZHEN **CUI** | THE HEART OF THE MATTER

MADHU **DHAR** | A JOINT EFFORT

STEPHEN **KANIA** | A DIFFERENT APPROACH TO PREVENTION

OUDESSA **KERRO DEGO** | STOPPING IT BEFORE IT STARTS

ELIZABETH **LENNON** | MAST CELLS + IBD: WHAT'S THE CONNECTION

TOMAS **MARTÍN-JIMENÉZ** | A WEIGHTY ISSUE

TRAVIS **MULLINIKS** | LATE BLOOMERS

BARRY **ROUSE** | REDUCING INFLAMMATION TO PREVENT BLINDNESS

BRYNN **VOY** | CHICK-CHILD CONNECTION

HWA-CHAIN ROBERT **WANG** | SHINING THE LIGHT ON TARGETED THERAPEUTICS

BRIAN **WHITLOCK** | PREVENTING FAILURE

XUEMIN **XU** | TARGETING ALS

RAÚL ALMEIDA

Research Associate Professor | Animal Science

MVD | University del Littoral (Argentina, DVM equivalent)

MS, PhD | Iowa State University

2 publications + 4 presentations in 2015



Characterization of novel surface immunodominant proteins from *Streptococcus uberis*

COLLABORATORS | Margaret E. Staton + Oudessa Kerro-Dego

PUBLICATIONS

Almeida RA, Kerro Dego O, Prado ME, Headrick SI, Lewis MJ, Siebert LJ, Pighetti GM, Oliver SP. "Protective effect of anti- SUAM antibodies on *Streptococcus uberis* mastitis." *Veterinary Research*. 2015;46:133.

Almeida RA, Kerro Dego O, Headrick SI, Lewis MJ, Oliver SP. "Role of *Streptococcus uberis* adhesion molecule in the pathogenesis of *Streptococcus uberis* mastitis." *Veterinary Microbiology*. 2015;179:332-335.

PRESENTATIONS

RA Almeida. "Epidemiology and pathogenesis of *Streptococcus uberis*." Proceedings of the 20th International Congress of ANEMBE (pp.185-188) in Burgos, Spain. 2015.

RA Almeida. "Experimental intra-mammary infection with *Escherichia coli*." Presented at the HIRPA Main Headquarters in Girona, Spain. 2015.

RA Almeida. "Pathogenesis of early infection events in bacterial pathogens." Post-graduate course in bacterial pathogenesis at the University of Littoral in Esperanza, Argentina. 2015.

RA Almeida. "Virulence factors and pathogenic strategies of bovine mastitis pathogens." Post-graduate course in bacterial pathogenesis at the University of Littoral in Esperanza, Argentina. 2015.

A SHOT IN THE ARM

Cows are being vaccinated with a surface protein as an alternative to antibiotic treatments for an infection referred to as mastitis. Mastitis leads to decreased milk quality, higher milk cost to customers, and pain for the cows themselves. Dr. Almeida's research shows increased titers of specific antibodies and less infected mammary quarters in vaccinated cows when compared to a placebo group.

Dr. Almeida's team is addressing the growing concern of preventative use of antibiotics, which led to the development of a vaccination as a more desirable alternative to control infections. With *Streptococcus uberis* becoming increasingly prevalent as an environmental mastitis pathogen and increasingly difficult to control, the team undertook the characterization study to define the ubiquity of *Streptococcus uberis* strains from diverse geographical locations.

This characterization study included defining protein structure, antigenic features, and expression under *in vivo* conditions on non-described proteins. Fifteen surface proteins were prepared from the bacteria and were determined as potential research candidates. The strongest candidates were selected based on serum collected from vaccinated and *Streptococcus uberis* convalescent cows.

DAVID ANDERSON

Professor | Large Animal Clinical Sciences

BS, DVM | North Carolina State University

MS | Kansas State University

10 publications + 6 presentations in 2015



Development of neuroregenerative scaffolds to support nerve cell proliferation: material design and manufacture and in vitro assessment

COLLABORATORS | Richard Steiner + Madhu Dhar
Alex Biris (University of Arkansas at Little Rock)

PUBLICATIONS

Alghazali KM, Nima ZA, Hamzah RN, Dhar MS, **Anderson DE**, Biris AS. "Bone tissue engineering: complex tunable structural and biological responses to injury, drug delivery, and cell based therapies." *Drug Metabolism Reviews*. 2015;47(4):431-454.

Anderson DE, Miesner MD. "Surgical management of orthopedic and musculoskeletal diseases of feedlot calves." *Veterinary Clinics of North America: Food Animal Practice*. 2015;31(3):425-440.

Coetzee JF, Mosher RA, Griffith GR, Gehring R, **Anderson DE**, KuKanic B, Miesner M. "Pharmacokinetics and tissue disposition of meloxicam in beef calves after repeated oral administration." *Journal of Veterinary Pharmacology and Therapeutics*. 2015;38(6):556-562.

Ferrer MS, Laflin S, **Anderson DE**, Miesner MD, Wilkerson MJ, George A, Miller LM, Larson R, Garcia Flores EO. "Prevalence of bovine sperm-bound antisperm antibodies and their association with semen quality." *Theriogenology*. 2015;84(1):94-100.

Ferrer MS, Schultz KM, **Anderson DE**. "Theriogenology question of the month. Twins in an alpaca." *Journal of the American Veterinary Medical Association*. 2015;247(8):889-892.

Hartnak AK, Niehaus AJ, Rousseau M, Pentecost RL, Miesner MD, **Anderson DE**. "Indications for and factors relating to outcome after rumenotomy or rumenostomy in cattle: 95 cases (1999-2011)." *Journal of the American Veterinary Medical Association*. 2015;247(6):659-664.

Higginbotham ML, McCaw DL, **Anderson DE**, Lattimer JC, Armbrust L, Andrews GA, McBride BD. "Treatment of a maxillary fibrosarcoma in an adult alpaca." *Journal of the American Veterinary Medical Association*. 2015;246(6):674-680.

Lakritz J, Linden D, **Anderson DE**, Specht TA. "Plasma concentrations of fenbendazole (FBZ) and oxfendazole in alpacas (*Lama pacos*) after single intravenous and oral dosing of FBZ." *Veterinary Medicine: Research and Reports*. 2015;6:71-81.

Miesner MD, **Anderson DE**. "Surgical management of common disorders of feedlot calves." *Veterinary Clinics of North America: Food Animal Practice*. 2015;31(3):407-424.

Rousseau M, **Anderson DE**, Rozell TG, Hand JM, Faris BR. "Comparison of polyglactin-910 and polidioxanone for closure of the linea alba following caudal ventral midline laparotomy in sheep." *Canadian Veterinary Journal*. 2015;56(9):959-962.

PRESENTATIONS

DE Anderson. “Bovine Surgery, Anesthesia and Pain Management.” Presented at the Pan Pacific Veterinary Conference in Brisbane, Australia. May 24-29, 2015.

DE Anderson. “Bone Tissue Regeneration.” Presented at the Sixth Nanotechnology for Health Care Conference in Morrilton, AR. December 2-4, 2015.

DE Anderson. “Bovine Surgery.” Presented at the Southwest Veterinary Symposium in Fort Worth, TX. September 24-27, 2015.

DE Anderson. “Bovine Surgery and Pain Management.” Presented at the Western Veterinary Conference in Las Vegas. NV. February 19, 2015.

DE Anderson. “Camelid First Aid Workshop.” Presented in Flat Rock, NC. June 6, 2015.

DE Anderson. “Camelid Health Management.” Presented at Double-O-Good Alpacas Celebrity Auction in Leesburg, VA. August 1, 2015.

GOT SOME NERVE

Carbon-based composite biomaterials and biocompatible polymers have shown beneficial regenerative characteristics for numerous tissues. Dr. Anderson’s group is focused on creating novel carbon-polymer biomaterials and assessing their potential to serve as scaffolds to stimulate nerve cell proliferation. High potential candidates may become suitable for use as a biomimetic peripheral nerve graft.

The goal of Dr. Anderson’s research was to create suitable biomaterials to support the adherence, proliferation, and persistence of neural cell and neuroprogenitor stem cells.

Future directions for Dr. Anderson’s research include an *in vivo* study using animal models and, ultimately, clinical trials.

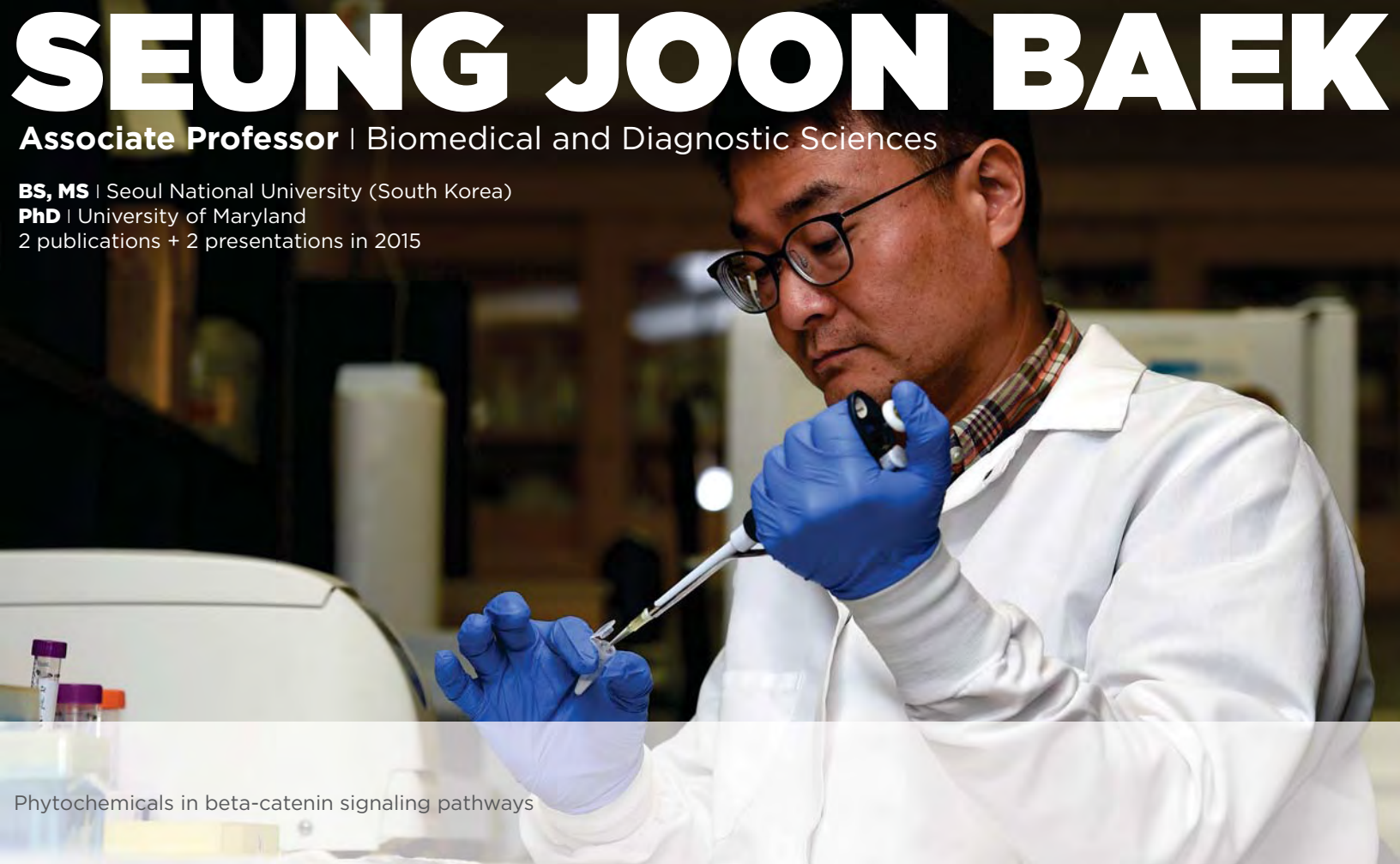
SEUNG JOON BAEK

Associate Professor | Biomedical and Diagnostic Sciences

BS, MS | Seoul National University (South Korea)

PhD | University of Maryland

2 publications + 2 presentations in 2015



Phytochemicals in beta-catenin signaling pathways

PUBLICATIONS

Cekanova M, Fernando RI, Siriwardhana N, Sukththankar M, De La Parra C, Woraratphoka J, Malone C, Ström A, **Baek SJ**, Wade PA, Saxton AM, Donnel RM, Pestell RG, Dharmawardhana S, Wimalasena J. "BCL-2 family protein, BAD is down-regulated in breast cancer and inhibits cancer cell invasion." *Experimental Cell Research*. 2015;331(1):1-10.

Wong J, Kim Y, Park Y, Lee SH, **Baek SJ**, Park Y. "Isomer specificity of conjugated linoleic acid on suppression of osteosarcomas." *Journal of National Sciences*. 2015;1(4):e67.

PRESENTATIONS

G Silva, M Marins, AL Fachin, **SJ Baek**. "Anti-tumorigenic activity of transchalcone in osteosarcoma." Presented at the AACR Annual Meeting in Philadelphia, PA. April 2015.

SJ Baek. "Subcellular Localization of Proteins Determines Their Biological Activity." Presented at the 8th Annual Protein and Peptide Conference in Nanjing, China. April 25-18, 2015.

TREAT + PREVENT: FIGHTING COLORECTAL CANCER

Dr. Seung Baek seeks to contribute to the development of strategies to reduce the incidence of colorectal cancer and improve its management. His studies focus on NAG-1, a protein that has been shown to play a role in the formation of cancer, known as oncogenesis.

Baek's group hypothesizes that NAG-1 controls anti-tumorigenesis and that its biological activity is dependent upon its location in a cell. Specifically, his latest project focuses on NAG-1's role in the nucleus and determining how NAG-1 is synthesized, modified, and regulated in tissues.


This work is particularly important because different laboratories have achieved contradictory results regarding the role of NAG-1 in oncogenesis. For example, NAG-1 sometimes appears to enhance cancer development and progression, but at other times, it appears to counteract the formation of tumors.

Although the death rate from colorectal cancer has steadily dropped since the 1980s, the American Cancer Society estimates there will be nearly 134,490 new colorectal cancer cases in the United States in 2016. Baek's ultimate goal is to contribute to the development of ways to prevent these new cases and treat existing ones.

MARC CALDWELL

Assistant Professor | Large Animal Clinical Sciences

MS, DVM, PhD | Auburn University
2 publications in 2015

A photograph of a man with short brown hair, wearing a white lab coat over a blue shirt, looking down at a piece of equipment in a laboratory. The background shows green metal railings and a wooden wall.

Effect of early, extended meloxicam therapy alone or in combination with ceftiofur on the inflammatory, behavioral, and performance outcomes of calves with bovine respiratory disease

COLLABORATORS | Peter Krawczel + Travis Mulliniks

PUBLICATIONS

Elkhenany H, Amelse L, Lafont A, Bourdo S, Caldwell M, Neilsen N, Dervishi E, Derek O, Biris A, Anderson D, Dhar M. "Graphene supports in vitro proliferation and osteogenic differentiation of goat adult mesenchymal stem cells: potential for bone tissue engineering." *Journal of Applied Toxicology*. 2015;35(4):367-374.

Woodrow JS, Caldwell M, Cox S, Hines M, Credille BC. "Comparative plasma pharmacokinetics of ceftiofur sodium and ceftiofur crystalline free acid in neonatal calves." *Journal of Veterinary Pharmacology and Therapeutics*. 2015;39(3):271-276.

BREATHING EASIER

Dr. Caldwell is working to reduce or abrogate the development of pathological inflammation associated with bovine respiratory disease (BRD). He hypothesizes that sustained meloxicam therapy alone or in combination with anti-microbial therapy will affect development of early inflammatory responses within animals, particularly those with BRD.

Bovine respiratory disease is a common cause of economic and production loss in the cattle industry and is a significant animal welfare issue. By monitoring calves with *Manheimia haemolytica* pneumonia, Dr. Caldwell plans to find a solution to aid in preventing loss.

Dr. Caldwell and his team have monitored clinical and behavioral changes, feed intake, and spatio-temporal relationships within calf herds.

MARIA CEKANOVA

Research Associate Professor | Small Animal Clinical Sciences

MS, RNDr, PhD | The University of Pavol Jozef Safarik (Slovakia)
6 publications + 1 presentation in 2015



Canine mesenchymal stem cells for treatment of musculoskeletal disorders as a model for human diseases

COLLABORATORS | Marti Drum, Darryl Millis, Jeffery Biskup, Joseph Bartges (Cornell University)

PUBLICATIONS

Bilheux H, **Cekanova M**, Vaas AA, Nichols TL, Bilheux JC, Donnell RL, Finochiarro V. "A novel approach to determine post mortem interval using neutron radiography." *Forensic Science International*. 2015;251:11-21.

Cekanova M, Fernando RI, Siriwardhana N, Sukthankar M, De La Parra C, Woraratphoka J, Malone C, Ström A, Baek SJ, Wade PA, Saxton AM, Donnell RM, Pestell RG, Dharmawardhana S, Wimalasena J. "BCL-2 family protein, BAD is down-regulated in breast cancer and inhibits cancer cell invasion." *Experimental Cell Research*. 2015;331(1):1-10.

Rathore K and **Cekanova M**. "Effects of environmental carcinogen benzo(a)pyrene on canine adipose-derived mesenchymal stem cells." *Research in Veterinary Science*. 2015;103:34-43.

Rathore K and **Cekanova M**. "A novel derivative of doxorubicin, AD198, inhibits canine transitional cell carcinoma and osteosarcoma cells in vitro." *Journal of Drug Design, Development and Therapy*. 2015;9:5323-5335.

Smolensky D, Rathore K, **Cekanova M**. "Sensitization to doxorubicin and its derivative AD198 chemotherapy by suppressing the PI3K/ADT1 signaling pathway in human bladder cancer cells." *BMC Cancer*. 2015;15:927.

Wimalasena J, Pestell RG, Fernando RI, **Cekanova M**, Samarakoon S. "Roles of BCL2 and BAD in Breast Cancer." *Journal of Clinical & Cellular Immunology*. 2015;6(5):352.

PRESENTATION

M Cekanova, Rathore K, Lee N, Vourn J, Bartges J, Callens A, Uddin J, Marnett L. "Monitoring the responses to radiation therapy in head and neck squamous cell carcinomas." Presented at Frontiers of Biomedical Imaging Sciences in Nashville, TN. May 12-15, 2015.

STEMMING PAIN

Stem cell therapies have enormous potential to improve and cure a range of acute and chronic diseases. Adult mesenchymal stem cells (MSC) are being intensively investigated because of their ability to differentiate into several cell lineages for treatment of musculoskeletal disorders. Dr. Cekanova aimed to evaluate the efficacy of multiple injections of canine autologous bone marrow in combination with platelet-rich plasma for the treatment of osteoarthritis (OA) in dogs.

Osteoarthritis is the most common cause of chronic pain in dogs. Drug therapies are available, but only treat symptoms and do not reverse cellular changes that occur in OA. Osteoarthritis also leads to a loss of biomechanical function, leading to restricted ability of dogs to walk and move.

Because osteoarthritis also affects humans, similarities in joint problems between the two species allows translational research to be conducted in dogs. Hopes are that this research will be able to be applied in clinical trials in the near future.

MEI-ZHEN CUI

Professor | Biomedical and Diagnostic Sciences

BS, MS | Jilin University (China)

PhD | Tokyo Institute of Technology (Japan)

3 publications + 5 presentations in 2015



Generation and characterization of smooth muscle cell-specific Cyr61 knockout mice

COLLABORATOR | Xuemin Xu

PUBLICATIONS

Cui MZ. "Potential therapeutics for myocardial ischemia-reperfusion injury. Focus on 'Induction of cardioprotection by small netrin-1 derived peptides'." *American Journal of Physiology - Cell Physiology*. 2015;309(2):C97-99.

Zeng L, Zhang F, Hu C, Xu DC, **Cui MZ**, Xu X. "Cellular FLICE-like inhibitory protein (c-FLIP) and PS1 - associated protein (PSAP) mediate presenilin 1-induced γ -secretase-dependent and -independent apoptosis, respectively." *Journal of Biological Chemistry*, 2015;290(30):18269-18280.

Zhang F, Hao F, An D, Zeng L, Wang Y, Xu X, **Cui MZ**. "Matricellular protein Cyr61 is a key mediator of platelet-derived growth factor-induced cell migration." *Journal of Biological Chemistry*. 2015;290(13):8232-8242.

PRESENTATIONS

C Hu, L Zend, TL Zhang, **MZ Cui**, X Xu. "Aph-1 is dispensable, while, NCT is differentially required for APP and Notch processing." Presented at the Society for Neuroscience 45th annual meeting in Chicago, IL. October 17, 2015.

MZ Cui. "The matricellular protein Cyr61 bridges lysophosphatidic acid/PDGF signaling pathways with the integrin signaling pathway, leading to cell migration." Presented at Penn State Hershey Medical Center in Hershey, PA. August 27, 2015.

MZ Cui. "Lysophosphatidic acid, growth factors and matricellular proteins in vascular smooth muscle cell migration." Presented at the 3rd Annual Meeting of the International Academy of Vascular Sciences: North American Section in Omaha, NE. September 10-12, 2015.

MZ Cui. "The matricellular protein Cyr61, a key mediator of lysolipid and PDGF-induced vascular smooth muscle cell migration and neointimal formation." Presented at the Rush University Medical Center in Chicago, IL. September 23, 2015.

MZ Cui. "De novo matricellular protein Cyr61 bridges LPA/GPCR pathway with the integrin pathway leading to cell migration." Presented at the University of Tennessee, Knoxville in Knoxville, TN. September 30, 2015.

THE HEART OF THE MATTER

Approximately 30–40% of atherosclerotic coronary arteries treated by angioplasty or bypass surgery become obstructed due to restenosis, an abnormal narrowing of an artery or valve after corrective surgery. This restenosis is primarily caused by a build up of neointimal smooth muscle cells (SMCs). It is still being determined what causes the build-up, but some data suggests SMC build-up is caused by platelet-derived growth factors (PDGF).

Smooth muscle cell migration is controlled by a protein named Cyr61. Dr. Cui hypothesized SMC-specific Cyr61 could play a key RLE for restenosis mediation. Dr. Cui's work this year characterized the effects of SMC-specific deficiencies, which may cause SMC build-up.

This preliminary study could determine the effect of a cell type-specific deficiency and reveal an innovative role of Cyr61 in PDGF-induced SMC migration.

MADHU DHAR

Research Associate Professor | Large Animal Clinical Sciences

BS, MS, PhD | University of Poona (India)
3 publications + 7 presentations in 2015



Xenogenic implantation of synovial fluid-derived mesenchymal stem cells in a rat model of subchondral defect

COLLABORATORS | Steve Adair + Mohammed Zayed

PRESENTATIONS

H Elkhenany, A Sherry, S Hecht, A Biris, R Abdelwahed, M Elkammar, D Anderson, **M Dhar**. "Graphene based scaffold for stem cell delivery in cortical bone defect: A preliminary study." Presented at Biomaterials Day 2015 in Nashville, TN. March 23, 2015.

H Elkhenany, A Sherry, S Hecht, S Bourdo, AS Biris, R Abdelwahed, M Elkammar, DE Anderson, **M Dhar**. "Bone healing formation using goat bone marrow and adipose derived stem cells in presence of graphene as a nanomaterial." Presented at the North American Veterinary Regenerative Medicine Association in Monterey Bay, CA. June 28-July 1, 2015.

M Dhar. "Animal models in cell-based therapies - importance of cells and biomaterials." Presented at the Biomaterials Day 2015 in Nashville, TN. March 23, 2015.

M Dhar. "Regenerative medicine: importance of cells and biomaterials." Presented at the 6th Nanotechnology for Healthcare Conference in Little Rock, AR. December 2-4, 2015.

M Dhar, H Elkhenany, L Amelse, N Neilsen, M Zayed, D Geiser, S Adair, J Schumacher, J Carter-Arnold. "Clinical outcomes in horses having musculoskeletal injuries treated using allogenic mesenchymal stem cells." Presented at the North American Veterinary Regenerative Medicine Association in Monterey Bay, CA. June 28-July 1, 2015.

M Zayed, C Caniglia, **M Dhar**. "Chondrogenesis: Pairwise comparison between bone marrow and synovial fluid-derived mesenchymal stem cells." Presented at the North American Veterinary Regenerative Medicine Association in Monterey Bay, CA. June 28-July 1, 2015.

M Zayed, C Caniglia, **M Dhar**. "Synovial fluid-derived mesenchymal stem cells as a cell source for cartilage tissue engineering." Presented at Biomaterials Day 2015 in Nashville, TN. March 23, 2015.

PUBLICATIONS

Alghazali KM, Nima ZA, Hamzah RN, **Dhar MS**, Anderson DE, Biris AS. "Bone tissue engineering: complex tunable structural and biological responses to injury, drug delivery, and cell based therapies." *Drug Metabolism Reviews*. 2015;47(4):431-454.

Dhar M, Amelse L, Neilsen N, Pelagie F, Carter-Arnold J. "Platelet-rich plasma enhances the cellular function of equine bone marrow-derived mesenchymal stem cells." *Journal of Stem Cell Research and Therapy*. 2015;5(4).

Elkhenany H, Amelse L, Lafont A, Bourdo S, Caldwell M, Neilsen N, Dervishi E, Derek O, Biris A, Anderson D, **Dhar M**. "Graphene supports in vitro proliferation and osteogenic differentiation of goat adult mesenchymal stem cells: potential for bone tissue engineering." *Journal of Applied Toxicology*. 2015;35(4):367-374.

A JOINT EFFORT

Articular cartilage injury following joint trauma is a major risk factor for the development of osteoarthritis. Early intervention prevents the progression of traumatic defects to advanced cartilage degeneration and osteoarthritis. Current treatments using non-steroidal anti-inflammatory medication can be associated with significant cardiovascular and gastric morbidity when used chronically.

Significant complications often occur with surgical treatment approaches, making the aim of Dr. Dhar's research to develop an evidence-based treatment method and an ability to restore mobility and quality of life. Transplantation of mesenchymal stem cells (MSC) is a promising strategy.

As a first step, Dr. Dhar's group established a consensus on the ideal source and dose of MSCs, *in vitro* precultivation, and differentiation. Dr. Dhar's laboratory isolated, expanded, and characterized equine MSCs *in vitro* from synovial fluid.

STEPHEN KANIA

Professor | Biomedical and Diagnostic Sciences

BS | Eastern Connecticut State University

MS | Washington State University

PhD | University of Florida

3 publications + 5 presentations in 2015



Identification of *Staphylococcus pseudintermedius* sortase inhibitors with therapeutic potential

COLLABORATORS | David Bemis + Jerome Baudry

PUBLICATIONS

Kawamura Y, Kuwabara S, **Kania SA**, Kato H, Hamagishi M, Fujiwara N, Sato T, Tomida J, Tanaka K, Bemis DA. "Porphyromonas pogonae sp. Nov., an anaerobic but low concentration oxygen-adapted coccobacillus isolated from lizards (*Pogona vitticeps*) or human clinical specimens, and amended description of the genus *Porphyromonas* Shah and Collins 1988." *Systematic and Applied Microbiology*. 2015;38(2):104-109.

Wilkes RP, **Kania SA**, Tsia YL, Lee PY, Chang HH, Ma LJ, Chang HF, Wang HT. "Rapid and sensitive detection of feline immunodeficiency virus using an insulated isothermal PCR-based assay with a point-of-need detection platform." *Journal of Veterinary Diagnostic Investigation*. 2015;27(4):510-515.

Witzel AL, Kirk CA, **Kania SA**, Bartges JW, Boson RC, Moyers T, Byrd H, Lauten S. "Relationship of adiponectin and its multimers to metabolic indices in cats during weight change." *Domestic Animal Endocrinology*. 2015;53:70-77.

PRESENTATIONS

DA Bemis, **SA Kania**, V Perreten. "Novel variants of *Staphylococcus intermedius*-like organisms isolated from black bears in the Great Smoky Mountains National Park, Tennessee, USA." Presented at the 4th American Society for Microbiology-European Society of Clinical Microbiology and Infectious Diseases (ASM-ESCMID) Conference on Methicillin-Resistant Staphylococci in Animals: Veterinary and Public Health Implications in Chicago, IL. November 2-5, 2015.

LA Frank and **SA Kania**. "Taqman qPCR technique for the diagnosis of dermatophilosis in horses." Presented at the North American Veterinary Dermatology Forum in Nashville, TN. April 2015.

M Balachandran, DA Bemis, V Perreten, **SA Kania**. "Protein A in *Staphylococcus pseudintermedius*." Presented at the 4th ASM-ESCMID Conference on Methicillin-Resistant Staphylococci in Animals: Veterinary and Public Health Implications in Chicago, IL. November 2-5, 2015.

M Riley, V Perreten, DA Bemis, **SA Kania**. "Discovering plasmids in MRSP using genome sequencing." Presented at the 4th ASM-ESCMID Conference on Methicillin-Resistant Staphylococci in Animals: Veterinary and Public Health Implications in Chicago, IL. November 2-5, 2015.

V Perreten, DA Bemis, **SA Kania**. "SCCmec IVG, A common element in MRSA and MRSP." Presented at the 4th ASM-ESCMID Conference on Methicillin-Resistant Staphylococci in Animals: Veterinary and Public Health Implications in Chicago, IL. November 2-5, 2015.

A DIFFERENT APPROACH TO PREVENTION

Multi-drug-resistant staphylococci are becoming a major concern for public health, especially with regard to companion animals, and livestock. Staphylococci are important pathogens in the aforementioned groups, with certain strains becoming resistant to antimicrobial drugs. Vaccine development has been a strained and difficult process.

Dr. Kania is investigating the effect of conservation of Protein A and the importance of the bacterial enzyme sortase in anchoring virulence factors to the surface of staphylococci. Staphylococci are potentially vulnerable to sortase inhibitors, but each species of *Staphylococcus* seems to have its own type of sortase, meaning that a single compound is unlikely to be effective against multiple staphylococci species.

Dr. Kania's future work includes *in vitro* testing within a biological milieu. This work could lead to adjusting screening parameters and/or the design and synthesis of new compounds.

OUDESSA KERRO DEGO

Assistant Professor | Animal Science

DVM | Addis Ababa University (Ethiopia)

MSc | Utrecht University (the Netherlands)

PhD | University of Saskatchewan (Canada)

2 publications + 2 presentations in 2015



Identification and characterization of virulence factors of *Staphylococcus aureus* isolates from cases of bovine mastitis

COLLABORATORS | Raúl Almeida + Doris Helen D'Souza

PUBLICATIONS

Almeida RA, Kerro Dego O, Prado ME, Headrick SI, Lewis MJ, Siebert LJ, Pighetti GM, Oliver SP. "Protective effect of anti- SUAM antibodies on *Streptococcus uberis* mastitis." *Veterinary Research*. 2015;46:133.

Almeida RA, Kerro Dego O, Headrick SI, Lewis MJ, Oliver SP. "Role of *Streptococcus uberis* adhesion molecule in the pathogenesis of *Streptococcus uberis* mastitis." *Veterinary Microbiology*. 2015;179:332-335.

PRESENTATIONS

Kerro Dego O, Almeida RA, Oliver SP. "Phenotypic and Genetic Characteristics of *Staphylococcus aureus* isolates from cases of bovine mastitis." Proceedings of Conference of Research Workers in Animal Diseases (p.8) in Chicago, IL. December 6-8, 2015.

Kerro Dego O, Almeida RA, Headrick SI, Oliver SP. "Vaccine against *Streptococcus uberis* mastitis: current and future directions." Proceedings of Comparative & Experimental Medicine and Public Health Research Symposium (p.15) in Knoxville, TN. May 18-19, 2015.

STOPPING IT BEFORE IT STARTS

S *taphylococcus aureus* affects the dairy industry and is a public health and food safety concern. Current control strategies are based on hygienic measures during milking and dry cow antibiotic therapy. Critical virulence factors responsible for *Staphylococcus aureus* mastitis are not well understood. It has been hypothesized that contact of *S. aureus* with mammary gland tissue initiates expression of critical factors required for colonization and forms a biofilm and other factors that allow bacteria to resist antibiotic treatments.

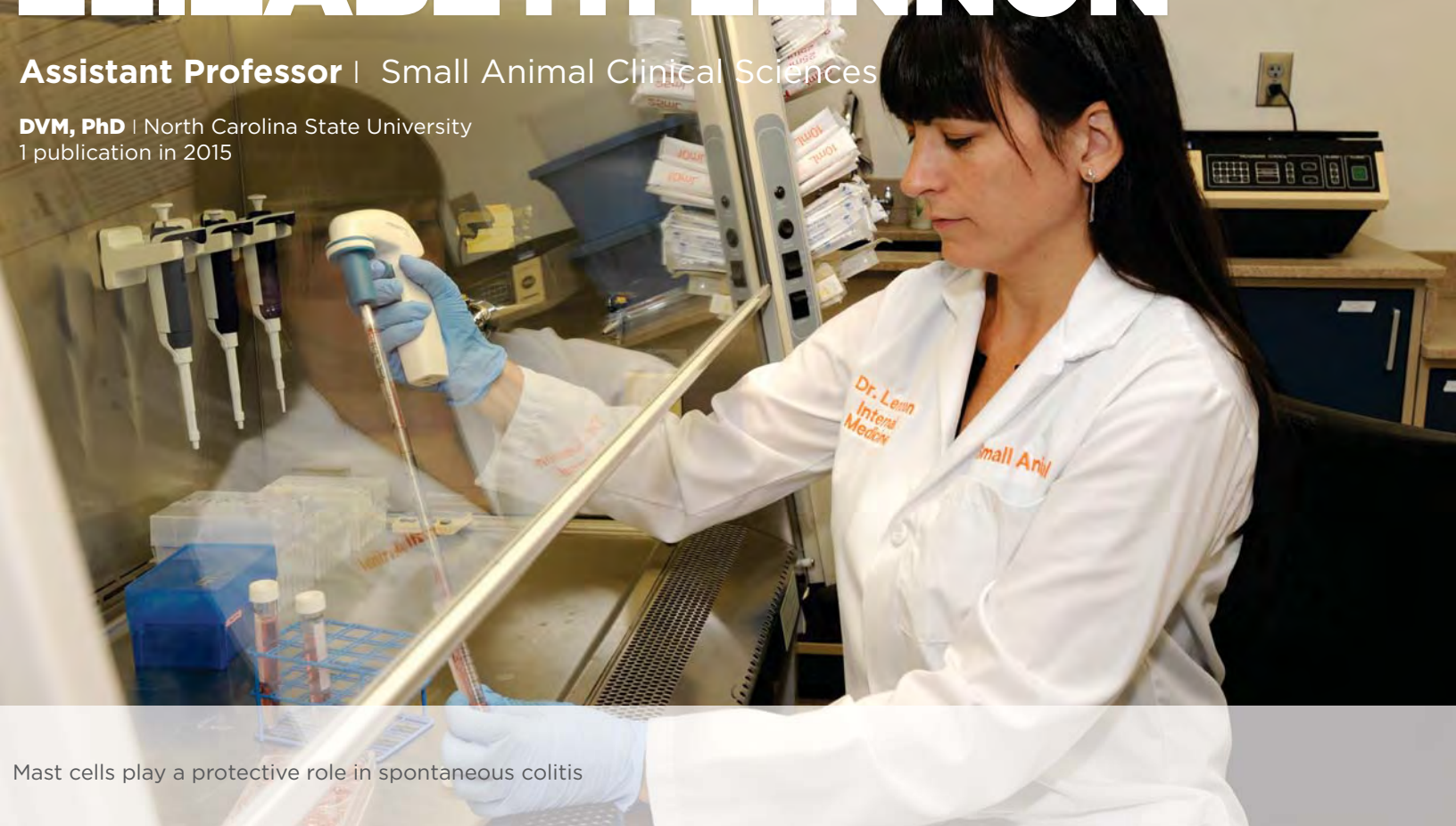
Dr. Kerro Dego aimed to identify factors expressed during early host-cell-bacterial interactions. His team tested 58 *staphylococci* strains from bovine mastitis for PXR and sixteen known virulence factors for production of biofilms, most of which carry major virulence genes.

Dr. Kerro Dego proposed to use predominant strains for further evaluation by RNA-sequencing and quantitative real-time PCR to identify virulence factors in early stages *in vitro*.

ELIZABETH LENNON

Assistant Professor | Small Animal Clinical Sciences

DVM, PhD | North Carolina State University
1 publication in 2015



Mast cells play a protective role in spontaneous colitis

PUBLICATION

Cooper RL, Drobatz KJ, **Lennon EM**, Hess RS. "Retrospective evaluation of risk factors and outcome predictors in cats with diabetic ketoacidosis (1997-2007): 93 cases." *Journal of Veterinary Emergency and Critical Care*. 2015 Mar-Apr;25(2):263-272.

MAST CELLS + IBD: WHAT'S THE CONNECTION

Inflammatory bowel disease (IBD) is a debilitating intestinal disease that currently affects up to 1.5 million people in the United States alone. The disease is increasing in prevalence and represents a heavy burden on the healthcare system, but no cure is available, and current lifelong treatment strategies carry significant side effects.

Mast cells (MCs) are known to play a significant role in IBD, but the precise nature of their role is not completely understood. It is believed that MCs contribute to intestinal health by regulating the intestinal barrier, clearing bacteria that may breach a compromised intestinal barrier, and influencing and orchestrating immune responses through interaction with other cell types. Dr. Lennon and her team have demonstrated that MCs play a novel protective role in acute colitis models.

Her studies aim to characterize the role of MCs in spontaneous colitis. Further investigation of the mechanism of the anti-inflammatory role of the MC may elucidate novel therapies for IBD.

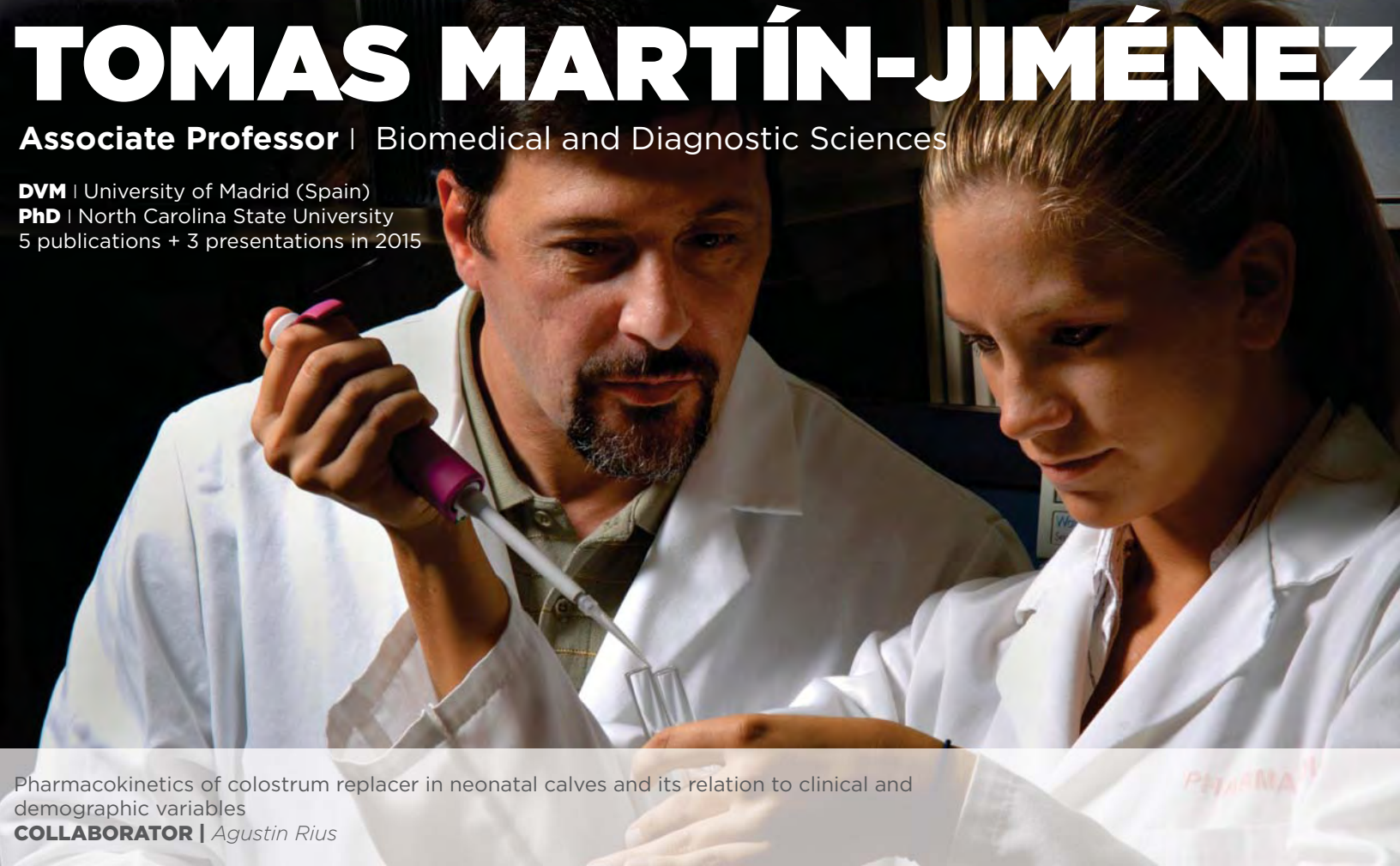
TOMAS MARTÍN-JIMÉNEZ

Associate Professor | Biomedical and Diagnostic Sciences

DVM | University of Madrid (Spain)

PhD | North Carolina State University

5 publications + 3 presentations in 2015



Pharmacokinetics of colostrum replacer in neonatal calves and its relation to clinical and demographic variables

COLLABORATOR | *Agustin Rius*

PUBLICATIONS

Baine K, Jones MP, Cox S, **Martín-Jiménez T.** “Pharmacokinetics of intravenous and oral gabapentin in Hispaniolan Amazon parrots (*Amazona ventralis*).” *Journal of Avian Medicine and Surgery.* 2015;29(3):165-173.

Boonstra JL, Barbosa L, Van Bonn WG, Johnson SP, Gulland FM, Cox SK, **Martín-Jiménez T.** “Pharmacokinetics of tramadol hydrochloride and its metabolite O-desmethyltramadol following a single, orally administered dose in California sea lions (*Zalophus californianus*).” *Journal of Zoo and Wildlife Medicine.* 2015;46(3):476-481.

Martín-Jiménez T. “Chapter 1: Pharmacokinetics: Absorption and Distribution.” In *Veterinary Pharmacology.* Basic Concepts and Therapeutic Applications. Botana L, ed. Panamericana Editions. 2015.

Martín-Jiménez T. “Chapter 2: Pharmacokinetics: Metabolism and Elimination.” In *Veterinary Pharmacology.* Basic Concepts and Therapeutic Applications. Botana L, ed. Panamericana Editions. 2015.

Martín-Jiménez T. “Chapter 3: Pharmacokinetics: Quantitative Integration.” In *Veterinary Pharmacology.* Basic Concepts and Therapeutic Applications. Botana L, ed. Panamericana Editions. 2015.

PRESENTATIONS

Boonstra JL, Cox SK, **Martín-Jiménez T.** “Pharmacokinetics of meloxicam after intramuscular and oral administration of a single dose to American flamingos (*Phoenicopterus ruber*).” Presented at the 2015 International Association for Aquatic Animal Medicine Conference in Chicago, IL. April 6-10, 2015.

Martín-Jiménez T, Aly S, Pithua P, Garcia A, Chigerwe M, Haines D, Williams D. “Pharmacokinetics of immunoglobulin G in calves fed a colostrum replacer.” Presented at the 2015 American Academy of Veterinary Pharmacology and Therapeutics Biannual Conference in Fort Collins, CO. May 17-20, 2015.

Peter B, **Martín-Jiménez T,** Risser J, Galina L. “Pharmacokinetics of translactational delivery of the analgesic meloxicam.” Presented at the 2015 American Association of Swine Veterinarians Annual Meeting in Orlando, FL. February 28 – March 3, 2015.

A WEIGHTY ISSUE

Failure of passive transfer (FPT) of immunity in dairy herds puts calves at a higher risk for septicemia, navel infections, respiratory and gastrointestinal infections, and other illnesses before weaning. Over time, FPT can lead to high morbidity and mortality among preweaned calves and brings about important economic, public health, and animal welfare issues.

To address these issues, Dr. Martín-Jiménez and his team have studied a correlation between variable concentrations of passively transferred immunoglobulin G (IgG) and body weight related to apparent inefficiency of intestinal absorption of nutrients. IgG immunity is obtained in neonatal calves from colostrum within their first hours of life. A lack of colostrum could lead to issues in calf vitality and developmental health.

Failure of passive transfer is important to dairy production. Dr. Martín-Jiménez and his team hope to quantify this process to better predict individual calf requirements.

TRAVIS MULLINIKS

Assistant Professor | Animal Science

BS | Oklahoma State

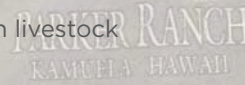
MS, PhD | New Mexico State University

3 publications + 6 presentations in 2015



Identifying the role of beta-hydroxybutyrate in regulating reproduction, stress, and metabolism in livestock

COLLABORATORS | Brynn Voy + Brian Whitlock



PUBLICATIONS

Babero RP, Malheiros EB, Araujo TLR, Berchielli TT, Ruggieri AC, Nave RLG, **Mulliniks JT**, Reis RA. "Influence of herbage allowance and supplementation levels on growing steers grazing Marandu palisade grass pastures." *Animal Feed Science and Technology*. 2015;209:110-118.

Mulliniks JT, Ruis AF, Edwards MA, Edwards SR, Hobbs JD, Nave RLG. "Improving efficiency of production in pasture- and range-based beef and dairy systems." *Journal of Animal Science*. 2015;93:2609-2615.

Petersen MK, Mueller CJ, **Mulliniks JT**, Waterman RC, Roberts AJ, Rinella MJ. "Sources of variability in livestock water quality over 5 years in Northern Great Plains." *Journal of Animal Science*. 2015;93:1792-1801.

PRESENTATIONS

BH Voy, **JT Mulliniks**, B Whitlock, S Howard, S Edwards, J Davitt, M Stanton, S Das. "Influence of beta-hydroxybutyrate on gene expression of hypothalamus and pituitary tissues in castrated male lambs." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

JT Mulliniks. "Matching cow type with environment." Presented at the UT Plateau Research and Education Center Steak and Potatoes Field Day in Crossville, TN. 2015.

JT Mulliniks. "Ration Balancing." Presented at the Cumberland County Cattlemen's in Crossville, TN. 2015.

JT Mulliniks. "Using GrowSafe Feeding Technology in AgResearch." Presented at the UT Plateau Research and Education Center Steak and Potatoes Field Day in Crossville, TN. 2015.

JT Mulliniks, BH Voy, B Whitlock, S Howard, S Edwards. "Injection of beta-hydroxybutyrate in the lateral ventricle suppresses luteinizing hormone release in castrated male lambs." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

MN Sawalhah, AF Cibils, A Maladi, H Cao, DM VanLeeuwen, JL Holechek, CM Balck-Rubio, RL Wesley, RL Endecott, **JT Mulliniks**, MK Petersen. "Assessment of foraging behavior of beef cows on rangeland: analysis of four years of GPS data." Proceedings of the 25th International Meeting on Beef and Milk Production in Hot Climates in Ensenada, Baja California, Mexico.

LATE BLOOMERS

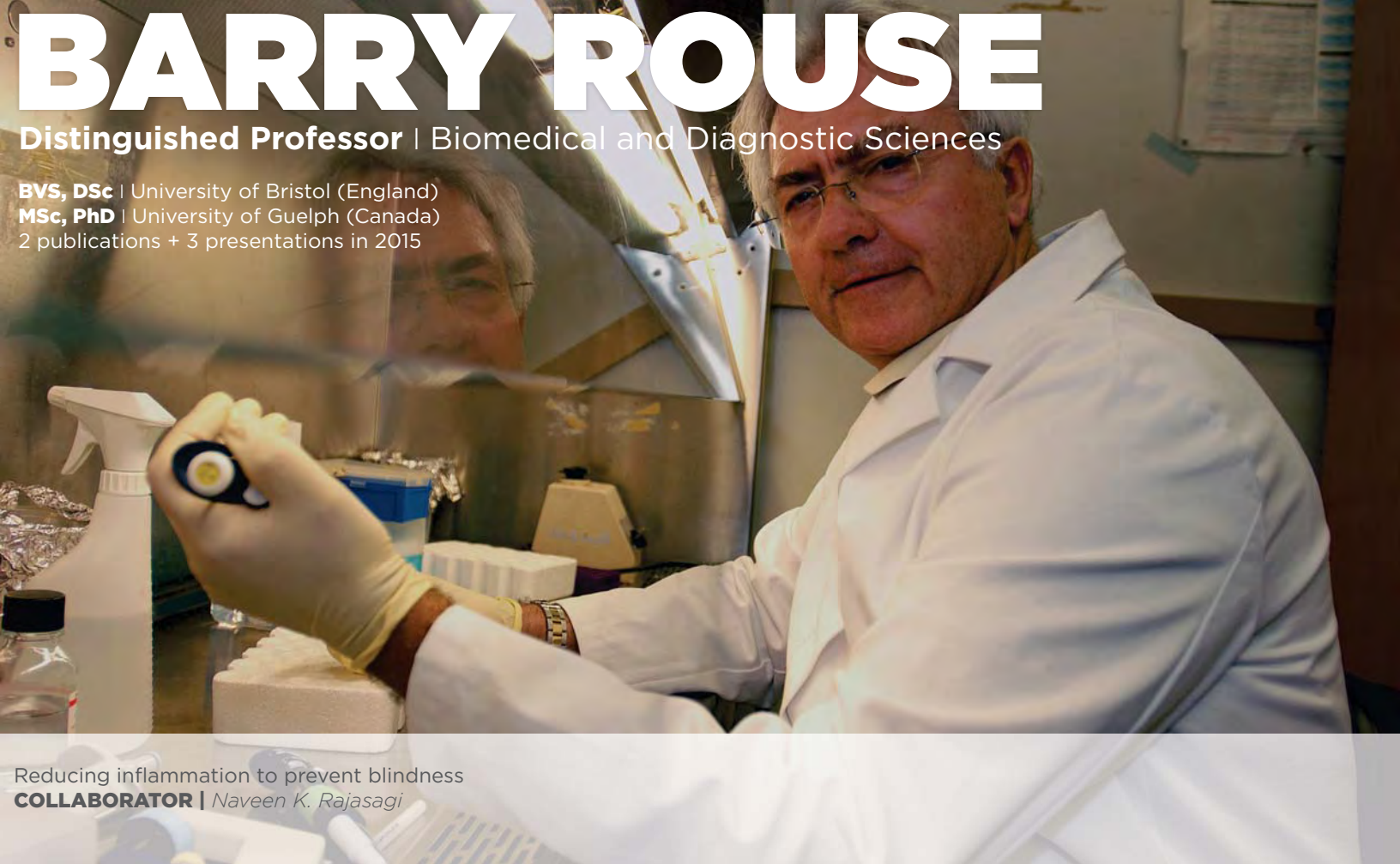
No objective tools exist to predict timing of a cow's conception before breeding is initiated each year in a cattle herd. However, if cows could be classified as potential late breeders, then they would receive different management to stimulate earlier breeding, which would have positive outcomes, including heavier calf weight the next year and an improved potential for a cow to stay productive and experience an extended productive lifetime.

In several mammalian species, reproductive functions are known to be impaired during periods of nutrient imbalances. Dr. Mulliniks is studying the metabolic dysfunctions from nutrient imbalances manifested by elevated beta-hydroxybutyrate, a potential driver for reproductive incompetence in livestock. Dr. Mulliniks hopes to produce preliminary data to use in studies involving assessment of ketone status prior to breeding.

BARRY ROUSE

Distinguished Professor | Biomedical and Diagnostic Sciences

BVS, DSc | University of Bristol (England)
MSc, PhD | University of Guelph (Canada)
2 publications + 3 presentations in 2015



Reducing inflammation to prevent blindness
COLLABORATOR | Naveen K. Rajasagi

PUBLICATIONS

Gimenez F, Mulik S, Veiga-Parga T, Bhela S, **Rouse BT**. "Robo 4 counteracts angiogenesis in herpetic stromal keratitis." *PLoS One*. 2015;10(12):e0141925.

Bhela S, Mulik S, Gimenez F, Reddy PB, Richardson RL, Varanasi SK, Jaggi U, Xu J, Lu PY, **Rouse BT**. "Role of miR-155 in the pathogenesis of herpetic stromal keratitis." *American Journal of Pathology*. 2015;185(4):1073-1084.

PRESENTATIONS

B Rouse. "Bill Narayan Memorial Lecture" Presented at the 21st Annual SNIP Conference in Miami, FL. April 22-25, 2015.

B Rouse. "Bill Narayan Lectureship" Presented at the International Society of NeuroVirology in San Diego, CA. June 2-6, 2015.

B Rouse. "Immunity or tissue damage to viruses - Can we Exploit what we know?" Presented at the Univeristy of Pittsburgh in Pittsburgh, PA. January 21, 2015.

REDUCING INFLAMMATION TO PREVENT BLINDNESS

Herpes simplex virus-1 (HSV-1) can infect the cornea, causing herpes viral keratitis, which is a major cause of blindness worldwide. Longterm treatment with the drug fingolimod is highly effective in controlling herpetic keratitis lesions, but this effect is lost upon discontinuation of the treatment. Dr. Rouse's research team has found that upon discontinuation of fingolimod, a rebound effect exists that sometimes results in more severe lesions than those seen in untreated animals.

His next task is figuring out why this rebound effect occurs. So far, Dr. Rouse's group has determined that the cause seems to stem from the infiltration of the cornea with Th17 effector cells. Such T cells are capable of inducing an inflammatory response in the cornea to help the body defend itself against things that appear foreign and harmful. In this instance, however, the immune response is unwanted because it leads to the inflammation that can ultimately cause blindness.

Dr. Rouse's results have shown that this relapse of chronic inflammation might be preventable using a combination therapy of fingolimod and a drug that will neutralize the generation and later infiltration of Th17 cells. The right combination of drug therapies could shorten the necessary treatment time, saving patients money and reducing the risk of long-term side effects.

BRYNN VOY

Associate Professor | Animal Science

BS, PhD | University of Tennessee, Knoxville
1 publication + 7 presentations in 2015



Developing a dual purpose model: Can dietary fatty acids developmentally program reduced adipose tissue in broiler chicks?

PUBLICATION

Dodson MV, Allen RE, Du M, Bergen WG, Velleman SG, Poulos SP, Fernyhough-Culver M, Wheeler MB, Duckett SK, Young MR, **Voy BH**, Jiang Z, Hausman GJ. "Evolution of meat animal growth research during the past 50 years: Adipose and muscle stem cells." *Journal of Animal Science*. 2015;93(2):457-481.

PRESENTATIONS

A Wells, B Barrington, DW Threadgill, S Campagna, **BH Voy**. "Investigating tissue level gene-by-diet interactions with metabolomics." Presented at Experimental Biology (EB) 2015 in Boston, MA. March 28-April 1, 2015.

BH Voy, JT Mulliniks, B Whitlock, S Howard, S Edwards, J Davitt, M Stanton, S Das. "Influence of beta-hydroxybutyrate on gene expression of hypothalamus and pituitary tissues in castrated male lambs." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

BH Voy. "Adipose gene expression: uncovering mechanisms of fatness and leanness in domestic broiler chicks." Presented at Auburn University Genomics Lecture Seriece in Auburn, AL. November 6, 2015.

JT Mulliniks, **BH Voy**, B Whitlock, S Howard, S Edwards. "Injection of beta-hydroxybutyrate in the lateral ventricle suppresses luteinizing hormone release in castrated male lambs." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

R Beckford, TE Torchon, S Das, **BH Voy**. "Lipolysis upregulates fatty acid oxidation and suppresses adipogenesis in young broiler chicks." Presented at Poultry Science in Louisville, KY. July 27-30, 2015.

TE Tochon, S Das, **BH Voy**. "Dietary flax oil enriches adipose tissue phospholipids in log chain n-3 PUFA and reduces adiposity." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

TE Tochon, S Das, **BH Voy**. "Enriching the diet in n-3 polyunsaturated fatty acids reduces adiposity and adipocyte size in a broiler chick model for childhood obesity." Presented at EB 2015 in Boston, MA. March 28-April 1, 2015.

CHICK-CHILD CONNECTION

Childhood obesity has been on the rise and is a growing health concern not only in the United States, but also worldwide. Nationally, the childhood obesity rate is around 17 percent for children under the age of 18. Broiler chicks are a novel model for studying the development of childhood obesity, since broiler chicks rapidly deposit excess fat relative to other chickens, prior to sexual maturity. At the same time, similarities in lipid metabolism between this avian species and humans create an opportunity to better understand this health concern.

New means to reduce fat deposition in juveniles is important for both the broiler chicken industry and for human health. Genetic selection for rapid growth in commercial broilers produces efficiency in meat production, but at the same time inadvertently doubles the deposition of adipose tissue. Excess fat contributes to many issues in the industry, wasting feed, increasing cost to growers, and reducing fertility and immunocompetence.

Dr. Voy's experiments will be used to produce data for industry proposals to various companies developing novel dietary plant-based oils with unique fatty acid profiles.

HWA-CHAIN ROBERT WANG


Professor | Biomedical and Diagnostic Sciences

BVM | National Chung-Hsing University (Taiwan, DVM equivalent)

MS | Auburn University

PhD | University of Virginia

2 publications + 13 presentations in 2015



In vivo-labeled orthotopic urinary bladder tumor animal model for targeted therapeutics

COLLABORATORS | Robert Donnell, Agricola Odoi, + Steven Ripp

PRESENTATIONS

E Heal, **HC Wang**, L Zhao. "Effects of chronic exposure to benzo[a]pyrene, a lipophilic mammary carcinogen, on stromal fibroblasts: Role in breast carcinogenesis." Proceedings of Comparative and Experimental Medicine and Public Health Research Symposium in Knoxville, TN. May 18-19, 2015.

LA Pluchino and **HC Wang**. "Reactive oxygen species-mediated breast cell carcinogenesis enhanced by multiple carcinogens and intervened by dietary ergosterol and mimosine." Proceedings of Comparative and Experimental Medicine and Public Health Research Symposium in Knoxville, TN. May 18-19, 2015.

HC Wang. "Environmental-chemical carcinogenesis of breast cells and intervention." Presented at the Department of Public Health in Knoxville, TN. March 5, 2015.

HC Wang. "New progresses on oncogenic cell signaling." Presented at the Guangdong Ocean University in Zhanjiang City, China. April 20, 2015.

HC Wang. "Preparation and submission for SCI cited paper." Presented at the Guangdong Ocean University in Zhanjiang City, China. April 20, 2015.

HC Wang. "Carcinogenesis and prevention as well as targeted cancer therapeutics." Presented at the Guangdong Ocean University in Zhanjiang City, China. April 21, 2015.

HC Wang. "Teaching oncogenetic cell signaling and facilitating application-based learning exercise." Presented at the Guangdong Ocean University in Zhanjiang City, China. April 22, 2015.

HC Wang. "Carcinogenesis, targeted prevention and therapeutics." Presented at the National Chung Cheng University in Chia-Yi, Taiwan. June 15, 2015.

HC Wang. "Carcinogenesis, targeted prevention and therapeutics." Presented at the China Medical and Pharmaceutical University in Taichung City, Taiwan. June 16, 2015.

HC Wang. "Targeted intervention of breast cell carcinogenesis model." Presented at the NIMBioS Investigative Workshop - Many-cell System Modeling in Knoxville, TN. July 19-21, 2015.

HC Wang. "Graduate education in the US." Presented at the Xinjiang Agricultural University in Urumqi City, China. November 27, 2015.

HC Wang. "Cellular carcinogenesis and intervention." Presented at the Nanjing Agricultural University in Nanjing City, China. December 4, 2015.

HC Wang. "Graduate education in the US." Presented at the Nanjing Agricultural University in Nanjing City, China. December 4, 2015.

PUBLICATIONS

Pluchino L, Lui A, Wang HC. "Reactive oxygen species-mediated breast cell carcinogenesis enhanced by multiple carcinogens and intervened by dietary ergosterol and mimosine." *Free Radical Biology and Medicine*. 2015;80:12-26.

Zhu JD, Meng W, Wang XL, Wang HC. "Broad-spectrum antiviral agents." *Frontiers in Microbiology*. 2015;5:517.

SHINING THE LIGHT ON TARGETED THERAPEUTICS

Urinary bladder cancer (UBC) is the fifth most common cancer in the United States. Approximately 74,000 new cases have been estimated for 2015. Dr. Wang's focus is to validate anticancer regimen effectiveness.


After implanting bacterial luciferase gene cassette (h-Lux)-expressing cancer cells into the bladders of immune-deficient mice, Dr. Wang treated tumor-bearing mice with anticancer agents and monitored them in real time by bioluminescent imaging to determine the progression and regression of UBC and metastatic tumors.

These studies are expected to establish an advanced, orthotopic UBC animal model for validating the efficacy of anticancer regimens development, regression, and recurrence to control UBC.

BRIAN WHITLOCK

Associate Professor | Large Animal Clinical Sciences

MS | Michigan State University
DVM, PhD | Auburn University
1 publication in 2015

A close-up photograph of a male veterinarian wearing a light blue surgical cap, a matching face mask, and blue scrubs. He is wearing white gloves and is focused on a surgical procedure, using a pair of metal forceps. The background is a warm, yellowish-orange light, suggesting an operating room environment.

The Expression of Kiss1 and Kiss1R in Bovine Placenta
COLLABORATOR | *Lisa Amelse*

PUBLICATION

Pratt SL, Stowe HM, **Whitlock BK**, Stickland L, Miller M, Calcaterra SM, Dimmick MD, Aiken GE, Schrick FN, Long NM, Duckett SK, Andrae JG. "Bulls grazing Kentucky 31 tall fescue exhibit impaired growth, semen quality, and decreased semen freezing potential." *Theriogenology*. 2015;88(3):401-414.

PREVENTING FAILURE

Kisspeptin and its receptor, Kiss1R, are highly expressed in placenta, with expression levels changing throughout placental development. Both under- and over-expression can lead to problematic pregnancies in humans. However, this has not been shown to be the case in rodents, indicating that the impact of defects of kisspeptin expression may be species specific.

The genetic profile of bovine placenta is more similar to that of humans than to that of rodents, suggesting that the bovine may be a better model for defects in placental development. Additionally, understanding potential problems in the development of bovine placenta and the ability of a cow to maintain a pregnancy have a potential economic impact for cattle producers.

The results of this project will enable Dr. Whitlock and his team to generate preliminary data, which will be used in the submission of an external grant to the USDA in an attempt to develop a method of detecting placental failure in bovines.

XUEMIN XU

Professor | Biomedical and Diagnostic Sciences

MS, PhD | Tokyo Institute of Technology (Japan)
2 publications + 2 presentations in 2015



PSAP, a novel therapeutic target in amyotrophic lateral sclerosis (ALS)
COLLABORATOR | Donald M. McGavin

PUBLICATIONS

Zeng L, Zhang F, Hu C, Xu DC, Cui MZ, **Xu X**. "Cellular FLICE-like inhibitory protein (c-FLIP) and PS1 - associated protein (PSAP) mediate presenilin 1-induced γ -secretase-dependent and -independent apoptosis, respectively." *Journal of Biological Chemistry*, 2015;290(30):18269-18280.

Zhang F, Hao F, An D, Zeng L, Wang Y, **Xu X**, Cui MZ. "Matricellular protein Cyr61 is a key mediator of platelet-derived growth factor-induced cell migration." *Journal of Biological Chemistry*. 2015;290(13):8232-8242.

PRESENTATIONS

C Hu, L Zeng, TL Zhang, MZ Cui, **X Xu**. "Aph-1 is dispensable, while, NCT is differentially required for APP and Notch processing." Presented at the Society for Neuroscience 45th annual meeting in Chicago, IL. October 17, 2015.

L Zeng, F Zhang, C Hu, DC Hu, MZ Cui, **X Xu**. "Cellular FLICE-like Inhibitory Protein (c-FLIP) and PS1 - associated Protein (PSAP) Mediate Presenilin 1-induced γ -Secretase-dependent and -independent Apoptosis, Respectively." Presented at the Society for Neuroscience 45th annual meeting in Chicago, IL. October 17, 2015.

TARGETING ALS

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease primarily affecting the upper and lower motor neurons of the central nervous system. Mutations in the Cu/Zn superoxide dismutase (SOD1) gene account for the motor neuron loss in the majority of inherited forms of ALS; however, the underlying molecular mechanism remains unknown.

Dr. Xu studied a variety of gene mutations based on molecular mechanisms to study if deletions of genes (like PSAP) from SOD1 would have any effect on ALS. The team studied the mechanism that underlies the neurodegeneration caused by mutations of SOD1 in ALS in hopes of better understanding the causes of the disease.

The study will help determine the pathological role of the gene PSAP in mediating SOD1-induced neurodegeneration in ALS, which may lead to the identification of new therapeutic targets for treatment and prevention of ALS.

INVESTIGATOR	PROJECT TITLE	FUNDING AGENCY	PROJECT PERIOD	2016 RECEIPTS	2016 EXPENDITURES
Almeida, Raul	<i>Southeast Quality Milk Initiative: Implementing science-based recommendations in the field to control mastitis & improve milk quality in the Southeast</i>	USDA Agriculture and Food Research Initiative	2/1/13–1/31/17	\$0	\$430,030
	<i>Streptococcus uberis surface proteins as vaccine candidates for the control of Streptococcus uberis mastitis in dairy cows</i>	Private industry	12/17/13–8/11/17	\$571,239	\$308,957
Anderson, David	<i>Prostaglandin E2 (PGE2) testing</i>	Boehringer Ingelheim Vetmedica	3/1/16–2/28/17	\$100,000	\$0
	<i>Multiscale technology for rapid, enhanced bone regeneration</i>	US Department of Defense	9/30/15–9/29/18	\$2,659,522	\$108,552
	<i>Pilot study: Mitigation of pain in cattle associated with soft tissue surgery</i>	Boehringer Ingelheim Vetmedica	3/24/14–3/23/16	\$0	\$16,265
Caldwell, Marc	<i>Leukocyte profile evaluation in calves with bovine respiratory disease</i>	Confidential Industry	3/31/16–3/30/17	\$16,972	\$2,281
	<i>Efferent lymph duct cannulation for mucosal immune response modeling of the oronasal cavity in cattle following oral or intranasal vaccination</i>	Merck Animal Health	10/19/14–12/31/15	\$0	\$38,518
	<i>The development of microenvironmental sampling techniques of the nasal cavity of cattle and experimental nasal colonization of Mannheimia haemolytica in cattle</i>	USDA National Institute of Food and Agriculture	10/1/14–9/30/16	\$18,571	\$1,670
	<i>A real-time location system to enhance dairy health research and herd management</i>	USDA National Institute of Food and Agriculture	10/1/13–9/30/15	\$26,895	\$26,895
Cekanova, Maria	<i>Detection of COX-2-expressed cancers by Fluorocoxib A</i>	National Institutes of Health	8/11/14–7/31/17	\$0	\$100,555
	<i>Grading of canine mast cell tumors from biopsy samples</i>	AB Science	8/1/14–6/30/16	\$142,368	\$116,326
Cui, Mei-Zhen	<i>Novel mechanism mediating LPA-induced smooth muscle cell and vascular responses</i>	National Institutes of Health	6/15/11-5/31/17	\$0	\$155,766
Dhar, Madhu	<i>Egyptian government graduate student sponsorship</i>	Egyptian Cultural & Educational Bureau	10/1/13–9/30/15	\$0	\$1,661
	<i>Egyptian government graduate student sponsorship</i>	Egyptian Cultural & Educational Bureau	6/30/14–6/25/16	\$0	\$9,951
	<i>Transduction of hematopoietic stem cells to stimulate RNA interference for treatment of feline infectious peritonitis</i>	Winn Feline Foundation	1/22/14–6/30/15	\$0	
Kania, Stephen	<i>2015 Meril Veterinary Scholars Research Program</i>	Meril Limited	3/26/15–8/31/15	\$0	\$2,510
	<i>UTCEM graduate student sponsorship</i>	Egyptian Cultural & Educational Bureau	7/29/15–7/28/19	\$8,600	\$21,297
	<i>UTCEM graduate student sponsorship</i>	Egyptian Cultural & Educational Bureau	7/29/15–7/28/19	\$8,600	\$21,750
	<i>Immune modulation using small interfering RNA for treatment of feline infectious peritonitis</i>	Winn Feline Foundation	4/14/15–5/1/17	\$11,000	\$0
	<i>The Natural Terrestrial Vegetation of Tennessee project/ecological site</i>	USDA Natural Resources Conservation Service	9/24/14–9/30/16	\$25,000	\$13,075
	<i>Host health impacts and host-parasite relationship of gastrointestinal helminths in wild turkeys</i>	Morris Animal Foundation	5/5/16–8/15/16	\$5,000	\$3,299
	<i>Development of a live animal serological ELISA assay for detection and surveillance of Parelaphostrongylus tenuis in cervids</i>	Oklahoma State University Foundation	12/1/15–11/30/16	\$15,000	\$0
	<i>Development of a live animal serological ELISA assay for detection and surveillance of Parelaphostrongylus tenuis in cervids</i>	Tufts University	3/15/16–3/14/17	\$24,685	\$4,091
	<i>Immune response to parasite vaccine</i>	East Tennessee Clinical Research	4/1/16–6/30/18	\$74,030	\$2,631
Elizabeth Lennon	<i>Characterization of the novel protective role of the mast cell in colitis</i>	National Institutes of Health	12/1/15–5/31/19	\$126,900	\$78,713

INVESTIGATOR	PROJECT TITLE	FUNDING AGENCY	PROJECT PERIOD	2016 RECEIPTS	2016 EXPENDITURES
Mulliniks, Travis	<i>Demonstrating cost-effective, low-input grazing management systems using stockpiled native forages</i>	USDA Natural Resources Conservation Service	9/24/14–10/31/17	\$66,059	\$192,284
	<i>Effect of biochar on forage digestibility, methan production, and methanogens</i>	Proton Power, Inc	12/7/15–8/31/16	\$23,982	\$14,441
	<i>Nutritive value and forage accumulation of alfalfa and alfalfa-mixtures as influenced by forage management</i>	USDA National Institute of Food and Agriculture	9/1/14–8/31/17	\$68,587	\$42,975
Rouse, Barry	<i>Mechanisms of herpetic keratitis</i>	National Institutes of Health	1/1/13–12/31/16	\$475,464	\$428,786
	<i>T-Regulatory cells in HSV immunity and immunopathology</i>	National Institutes of Health	2/1/11–1/31/17	\$0	\$258,281
Wang, Hwa-Chain Robert	<i>Intervention of Ras-ERK-activated cancers</i>	National Institutes of Health	9/1/14–8/31/16	\$185,674	\$135,031
	<i>International Multi-Task Cooperative and Exchange Program</i>	Association of American Veterinary Medical Colleges	12/1/06–12/31/17	\$0	\$389
	<i>GABA-BR-mediated prevention of pancreatic cancer</i>	National Institutes of Health	9/28/09–8/31/15	\$0	\$0
TOTALS				\$ 4,654,148	\$ 2,536,980

ACTUAL, PROPOSED, AND REQUESTED BUDGET

THE UNIVERSITY OF TENNESSEE COLLEGE OF VETERINARY MEDICINE
CENTER OF EXCELLENCE IN LIVESTOCK DISEASES AND HUMAN HEALTH

	FY 2015-16 Actual			FY 2016-17 Proposed			FY 2017-18 Requested		
	Matching	Appropriations	Total	Matching	Appropriations	Total	Matching	Appropriations	Total
Expenditures	179826	359651	539477	592107	1184215	1776322	264306	528611	792917
Salaries									
Faculty				10157	20315	30472	4534	9068	13602
Other Professional	18044	36088	54133	13600	27200	40800	6071	12142	18212
Clerical/ Supporting	27015	54031	81046	1694	3388	5082	756	1512	2269
Assistantships	6111	12222	18333						
Total Salaries	51170	102341	153511	25451	50903	76354	11361	22722	34083
Longevity	933	1867	2800						
Fringe Benefits	7157	14315	21472	19069	38139	57208	8512	17024	25537
Total Personnel	59261	118523	177784	44521	89042	133562	19873	39746	59620
Non-Personnel									
Travel	13892	27784	41676						
Software	922	1843	2765						
Books & Journals									
Other Supplies	54083	108166	162249	172166	344331	516497	76852	153703	230555
Equipment	19277	38553	57830	60000	120000	180000	26783	53566	80349
Maintenance	920	1839	2759						
Scholarships	6667	13334	20001	72572	145143	217715	32395	64789	97184
Consultants									
Renovation				200333	400667	601000	89425	178850	268275
Other Expenses	3126	6251	9377	9303	18607	27910	4153	8306	12459
Printing, Publications, Postage	2595	5190	7785	5546	11092	16638	2476	4951	7427
Contract Special Services	17434	34867	52301	27667	55333	83000	12350	24700	37050
Professional Services & Memberships	1650	3301	4951						
Total Non-Personnel	120564	241129	361693	547587	1095173	1642760	244432	488865	733297
GRAND TOTAL	179826	359651	539477	592107	1184215	1776322	264306	528611	792917
Revenue									
New State Appropriation		500321	500321		492226	492226		516839	516839
Carryover State Appropriation		563089	563089		703759	703759		11772	11772
New Matching Funds	250161		250161	246114		246114	258420		258420
Carryover from Previous Matching Funds	281544		281544	351879		351879	5886		5886
Total Revenue	531705	1063410	1595115	597993	1195985	1793978	264306	528611	792917