



CENTER OF EXCELLENCE

in

Livestock Diseases & Human Health

2019 Annual Report



THIS REPORT IS PRODUCED BY

THE UNIVERSITY OF TENNESSEE
College of Veterinary Medicine

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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 arboreturns. Technologies developed by UTIA's researchers benefit producers and consumers alike.

The Herbert College of Agriculture 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.

ADMINISTRATION

Dr. Michael McEntee

Associate Dean for Research

Dr. James P. Thompson

Dean, College of Veterinary Medicine

Dr. Tim Cross

*Senior Vice President/Senior Vice Chancellor, University of Tennessee
Institute of Agriculture*

Our Mission

1. To promote interdisciplinary activities designed to improve the quality of human life through better animal health
2. To expand livestock disease research capabilities
3. To identify and characterize animal diseases that are similar to human disease
4. To develop new strategies for the diagnosis, treatment, and prevention of disease.

Letter from the Dean

We are pleased to present the 2019 annual report for the Center of Excellence in Livestock Disease and Human Health.

Within this report, you will see highlights of 11 faculty research projects funded by the center in fiscal year 2019. These faculty members have made significant advancements in infectious diseases and host defenses, tissue regeneration, genetics, and carcinogenesis. Center faculty also made significant advancements in the prevention and treatment of infectious and non-infectious livestock diseases that affect agricultural productivity.

The 2019 return on investment, as the ratio of research expenditures to the state appropriation for the center was 3.2:1. Benchmark data can be found on pages 24-25 and include fiscal years 2015-2019.

Center faculty continue to garner national and international recognition for their research and scholarship. During the 2018 calendar year, center faculty published 46 peer-reviewed articles and gave 42 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. James P. 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. The details of current center faculty research are provided in the Faculty Reports section (pp. 28-38).

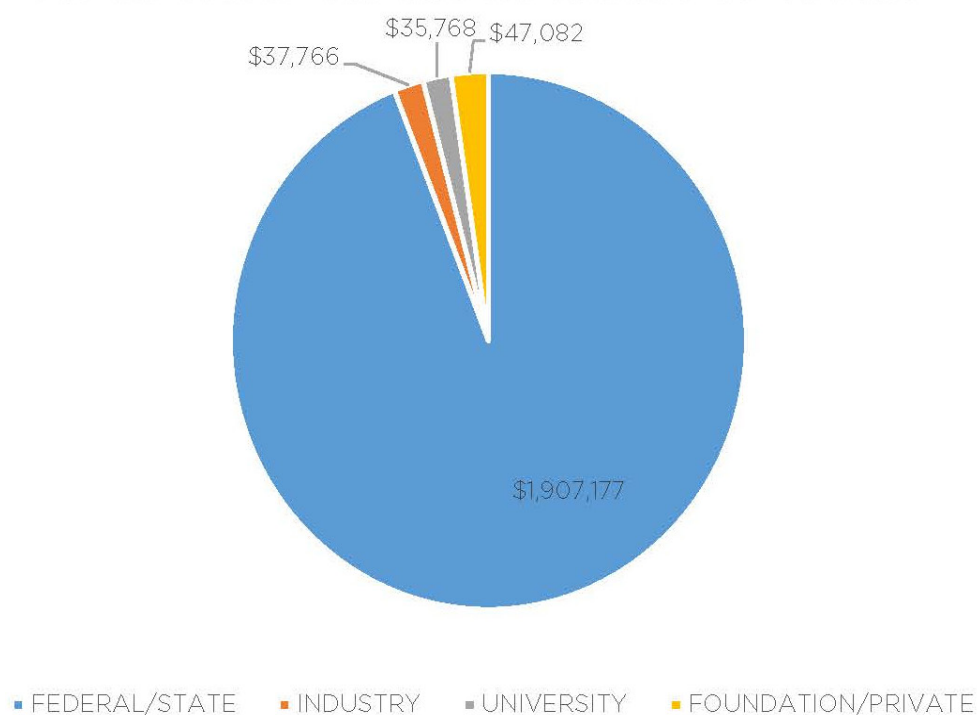
During the 2018 calendar year, the 12 center faculty averaged 3.8 peer-reviewed publications (46 total) and 3.5 presentations (42 total) at prestigious national and international meetings.

The publications of the 2018 center faculty have been cited by others an average of 10.17 times. These numbers tell us that scientists worldwide have positively evaluated center faculty work and used it to stimulate, validate, and/or support their own work in similar fields. Therefore, citations are indicators of the quality of faculty work.

Particularly noteworthy articles in 2018 were by Drs. Anderson and Dhar, Kania and Bemis, Gerhold, and Whitlock. Drs. Anderson and Dhar published “Polyurethane/nano-hydroxyapatite composite films as osteogenic platforms” in the *Journal of Biomaterials Science: Polymer Edition*. This publication highlighted the novel work Drs. Anderson and Dhar are doing in the field of regenerative medicine. Drs. Kania and Bemis published “Expression and Function of Protein A in *Staphylococcus pseudintermedius*” in the journal *Virulence*. In this publication, Drs. Kania and Bemis continued their work in understanding *Staphylococcus pseudintermedius* in order to create a vaccine for canines. In addition, Dr. Gerhold published “Human impact on the diversity and virulence of the ubiquitous zoonotic parasite *Toxoplasma gondii*” in the *Proceedings of the National Academy of Sciences*, where he emphasized how humans have helped spread the zoonotic virus, *T. gondii*. Finally, Dr. Whitlock published “Factors associated with seroprevalence of *Anaplasma marginale* in Kentucky cattle” in *Veterinary Parasitology: Regional Studies and Reports*. His research was instrumental to the Kentucky cattle industry. See Publications and Presentations (pp. 40-45) for more details. Furthermore, Dr. Anderson and his research team have also produced intellectual property and were awarded a new provisional patent in 2018: Biodegradable intraluminal small intestinal anastomotic guide, serial number: 62/697,475.

The return on the state’s investment in the center was 3.2:1, 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 spent \$3.20 in external funding. External funding totaled \$2,027,793 this year, while expenditures for the year were \$1,654,883. The funding includes a multi-year award for Dr. Naveen Rajasagi, totaling \$448,710, to facilitate his work on the herpes virus. Dr. Dhar earned an award to finance her work on bone regeneration, totaling \$427,018. Dr. Gerhold also received an award for \$913,542 from the Tennessee Wildlife Resources Agency to study the Tennessee elk population. Finally, Dr. Kania’s work towards a *Staphylococcus pseudintermedius* vaccine earned him a \$47,082 grant from the American Kennel Club Canine Health Foundation. See Research Funded Externally and Research Expenditures on page 12 for the fiscal year 2019 data summary.

FIG 1. FY 2019 EXTERNAL FUNDING BY SOURCE



Benchmark	2019 (12 Faculty)	2018 (11 Faculty)
	N ¹	N ²
Publications	46	43
Peer-Reviewed Articles	46	41
Books/Chapters/Other	0	2
Presentations	42	32
International	7	1
National	28	21
State or Local	7	10
Research Monies		
External Funding	\$2,027,793	\$1,907,070
Research Expenditures	\$1,654,883	\$1,647,768
Return on Investment	3.2:1	3.3:1

¹ Publications and presentations based on the 2018 calendar year; research monies based on the 2019 fiscal year.

² Publications and presentations based on the 2018 calendar year; research monies based on the 2019 fiscal year.

PROGRAM REPORT

Introduction

Since 1984, the center has developed successful programs that affect the understanding, treatment, and prevention of livestock and human diseases. These programs predominately focus on molecular and cellular approaches to research in infectious diseases and host defenses, tissue responses to insult and regeneration, genetics, and carcinogenesis.

The center has developed investigative strengths along innovative, sophisticated, and contemporary lines in two general areas:

- 1) Animal Models and Comparative Medicine, and*
- 2) Mechanisms of Disease, Pathogenesis, and Immunity*

These two areas are highly interrelated, and the center plays a critical and unique role in developing these focused areas of strength in both the University of Tennessee College of Veterinary Medicine (UTCVM) and the Institute of Agriculture. These areas also encompass the “One Health” concept, wherein the interrelated disciplines of animal, human, and environmental health are combined for the betterment of all three.

Personnel



Dr. Michael McEntee has served as the director of the center since 2012.

Ms. Kim Rutherford oversees submissions of faculty proposals for funds.



Dr. Stephen Kania chaired the Research Advisory Committee responsible for selecting the 2019 funded proposals.

Ms. Amanda Hand produces the annual report.



Funding and Expenditures

Research Funded Externally, Fiscal Year 2019

Investigator	Federal/State	Industry	University	Foundation/ Private	TOTAL
Anderson, David			\$35,768		\$35,768
Caldwell, Marc		\$15,138			\$15,138
Dhar, Madhu	\$427,018				\$427,018
Gerhold, Richard	\$913,542	\$22,628			\$936,170
Kania, Stephen				\$47,082	\$47,082
Lennon, Elizabeth	\$117,907				\$117,907
Rajasagi, Naveen	\$448,710				\$448,710
TOTALS	\$1,907,177	\$37,766	\$35,768	\$47,082	\$2,027,793

Research Expenditures, Fiscal Year 2019

Investigator	Federal/ State	Industry	International	University	Foundation/ Private	TOTAL
Anderson, David	\$948,899					\$948,899
Bemis, David					\$8,856	\$8,856
Caldwell, Marc	\$5,632	\$13,293				\$18,871
Dhar, Madhu	\$84,124					\$84,124
Gerhold, Richard	\$22,818	\$20,479	\$21,742	\$14,541		\$79,580
Graves, Meggan	\$12,312					\$12,312
Kania, Stephen			\$21,742		\$18,353	\$40,095
Odoi, Agricola				\$4,660		\$4,660
Rajasagi, Naveen	\$407,293					\$407,293
Whitlock, Brian				\$50,193		\$50,193
TOTALS	\$1,481,078	\$33,772	\$43,484	\$69,394	\$27,209	\$1,654,883

Allocation of Funding

The Center of Excellence in Livestock Diseases and Human Health supports investigators and promotes research through a variety of mechanisms. Although it is not a primary source of research funding, the center facilitates established investigators' efforts to maintain and expand their research programs, promotes new investigators' potential to develop competitive research programs, and fosters new collaborative ventures.

Center faculty consist of senior and junior members. Senior members, who are featured in Faculty Reports (pp. 28-38), have research interests in line with center objectives and a history of securing external funding using center funds. Junior members are those who have received seed money, bridge funding, or are new faculty who have received start-up funds. Junior members are expected to actively pursue and eventually secure external funding.

Start-Up Funds

The center provided \$41,333 in start-up funds for 6 junior faculty members to secure additional funding in 2019. Their research areas are described below:



Alejandro Esteller-Vico
Biomedical & Diagnostic
Sciences
\$9,000



Connie Fazio
Small Animal
Clinical Sciences
\$5,000



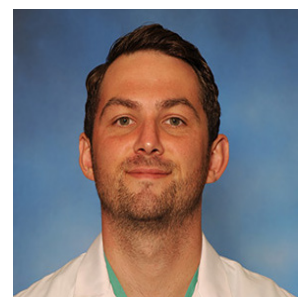
Adrien Hespel
Small Animal Clinical
Sciences
\$5,000



Andrea Lear
Large Animal Clinical
Sciences
\$12,333



Pierre-Yves Mulon
Large Animal Clinical
Sciences
\$5,000



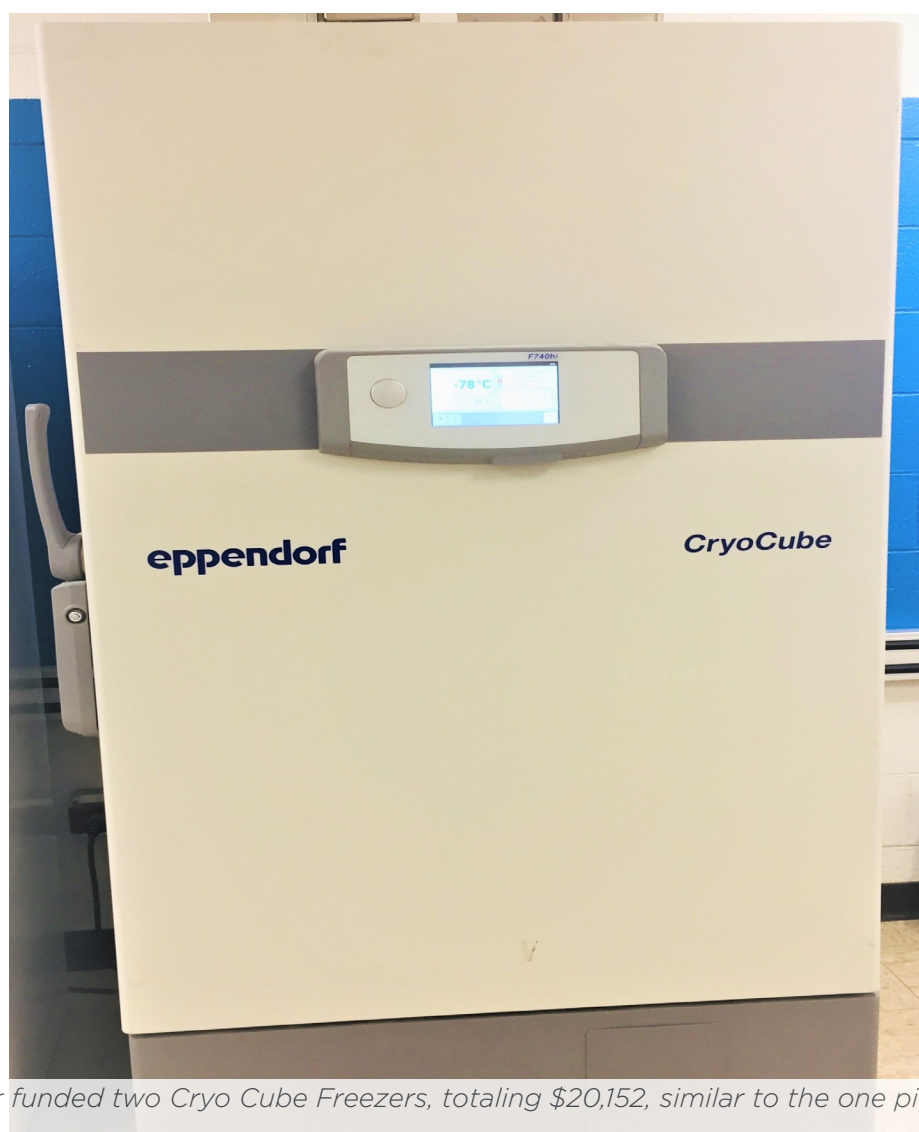
Kyle Snowden
Small Animal Clinical
Sciences
\$5,000

Infrastructure and Supplies

The center promotes the research infrastructure of both the UTCVM and the Institute of Agriculture through the purchase and maintenance of essential research equipment. The Research Advisory Committee reviews requests based on three criteria: justification of need, current availability of equipment, and number of investigators who may benefit.

Equipment

In fiscal year 2019, the center contributed \$127,550 towards research infrastructure maintenance, repair and improvement for laboratories, equipment, and animal facilities. For example, a **High Performance Liquid Chromatography (HPLC) replacement unit** (\$94,986) was purchased for the Biological and Diagnostic Sciences Department. This machine is



The center funded two Cryo Cube Freezers, totaling \$20,152, similar to the one pictured here.

capable of taking any sample that can be dissolved in liquid and identify compounds as meticulously as parts per trillion! Moreover, an **BioRad PCR Unit** (\$8,500) was purchased for Dr. Lear, located in the Large Animal Clinical Sciences. A CMI1 camera (\$5,700) was purchased for Dr. Dhar. Finally, two **Cryo Cube Freezers** (\$20,152) were purchased. These freezers are able to store samples in temperatures as low as -86 degrees Celsius. Furthermore, each freezer can house over 40,000 containers, allowing our researchers ample space to securely hold and freeze their samples.

Supplemental Funding

Drs. **Barry Rouse and Marcy Souza** were provided \$31,000 in supplemental research funding to develop preliminary data to advance their programs in infectious disease immunology and food safety.

Travel

This year, the center sponsored \$5,505 towards the travel expenses of several faculty and students to attend conferences and present their research both nationally and internationally. For example, \$1,442 were spent for **Drs. Andrea Lear and Chika Okafor** to attend a meeting in Chicago, IL in December 2018. Dr. Lear received center start-up funds this year as a junior faculty member, and Dr. Okafor has received center funds in the past. Moreover, Dr. Okafor received \$487 in center travel funding to attend an international meeting in Chiang Mai, Thailand in November of 2018.

In addition, **Dr. Naveen Rajasagi**, a 2019 center award recipient, received \$255 of center travel funds to attend a meeting in Bethesda, MD in May of this year. Moreover, **Drs. Stephen Kania and Linda Frank** received \$1,985 to attend a conference in College Station, TX in August of 2018. Dr. Kania is also a 2019 center award recipient. Drs. Kania and Frank included three students, **Nicole Corder, Nicole Szafranski, and Kellie Wood**, on the trip. The center also provided travel for other veterinary students. Both **Katherine Hedges and Jane Woodrow** attended a conference in Phoenix, AZ in June of this year, and veterinary student **Calvin Kidd** received \$800 to attend an international conference in Quebec, Canada.

UT CVM Research Day

The center was a major sponsor of the University of Tennessee College of Veterinary Medicine Research Day (formerly known as the Comparative and Experimental Medicine and Public Health Research Symposium). This year, twenty-seven CEM students and DVM students gave oral presentations. The research day was designed to share research results via a 12-minute presentation, with 3-minutes for questions from the audience. Four faculty members also gave 25-minute talks about their current research endeavors, with 5-minutes for questions from the audience. The faculty members who presented their research are as follows: Dr. Cheryl Greenacre, Dr. Tena Ursini, Dr. Urshulaa Dholakia, and Dr. Naveen Rajasagi. The student presenters were scored based on their performance, and the award winners are highlighted below.

2019 UTCVM Research Day Awards

Presentation Award Winners

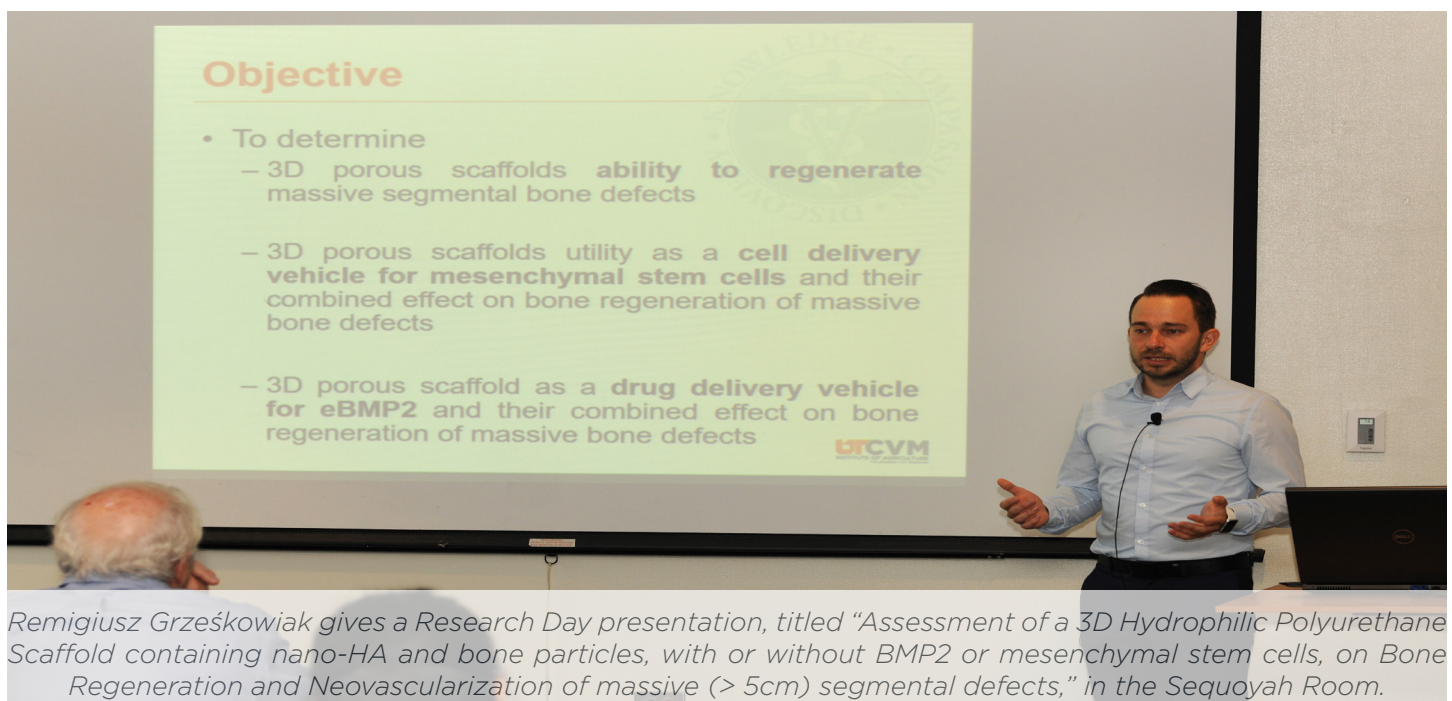
Graduate Student Category

1st Place – Remigiusz Grześkowiak, Comparative & Experimental Medicine

“Assessment of a 3D Hydrophilic Polyurethane Scaffold containing nano-HA and bone particles, with or without BMP2 or mesenchymal stem cells, on Bone Regeneration and Neovascularization of massive (> 5cm) segmental defects”

Mentor: Dr. David Anderson

Travel award of \$500.00



Remigiusz Grześkowiak gives a Research Day presentation, titled “Assessment of a 3D Hydrophilic Polyurethane Scaffold containing nano-HA and bone particles, with or without BMP2 or mesenchymal stem cells, on Bone Regeneration and Neovascularization of massive (> 5cm) segmental defects,” in the Sequoyah Room.

2nd Place – Alisha Pedersen, Comparative & Experimental Medicine

“Next generation, rapidly degradable anastomotic guide for enhanced surgical technique for end-to-end small intestinal anastomosis”

Mentor: Dr. David Anderson

Travel award of \$300.00

3rd Place – Laura Horton, Comparative & Experimental Medicine

“Assessment of Turtle and Leech (Hirudinea) Parasite-host Assemblage Variation in Middle Tennessee Wetlands across a Disturbance Gradient”

Mentor: Dr. Richard Gerhold

Travel award of \$200.00

Veterinary Student Category

1st Place – Rachael Wolters, Class of 2020

“Patterns of Antimicrobial resistance among Streptococcus canis isolates from dogs presented to the Onderstepoort Veterinary Academic Hospital, South Africa”

Mentor: Dr. Agricola Odoi

Travel award of \$500.00

2nd Place – Samantha Kuschke, Class of 2021

“Effects of Incubation Temperature on Intestinal Length in Leatherback Sea Turtle (Dermochelys Coriacea) Hatchlings from Boca Raton, Florida”

Mentor: Dr. Deb Miller

Travel award of \$300.00

3rd Place – Laura Freeman, Class of 2021

“Comparison of acute load to failure testing of goat femoral neck fractures, ex vivo, repaired using 4.0-mm solid, cannulated, or enhanced cannulated cancellous bone screws”

Mentors: Drs. Pierre-Yves Mulon and David Anderson

Travel award of \$200.00

Phi Zeta Award for Excellence in Animal Health Research

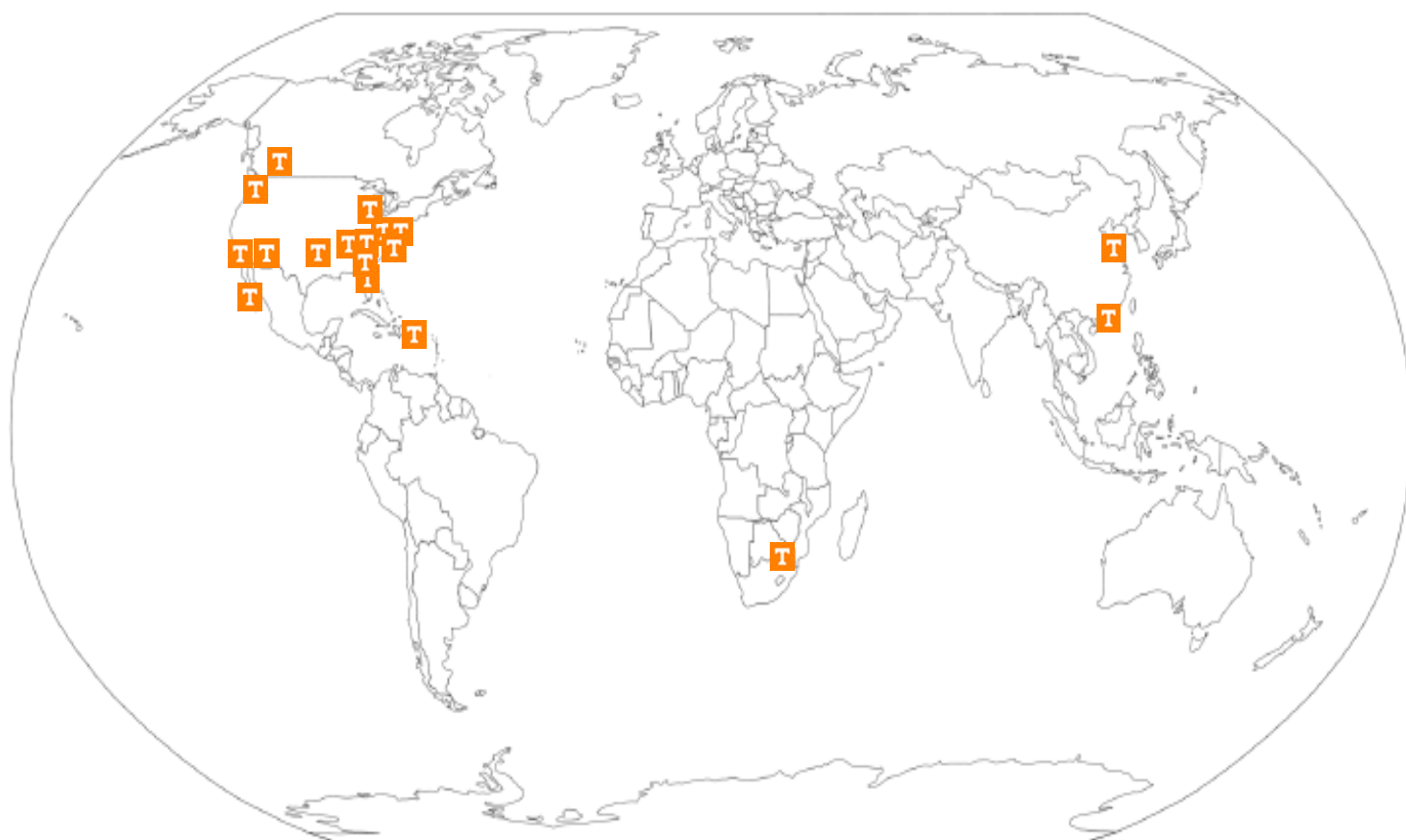
Megan Wright, UTCVM Class of 2022

“Clinical trial to test efficacy of COWP in lowering GIN egg numbers in adult alpacas”

Mentors: Drs. Andrea Lear, John Schaefer, and Ricardo Videla

Cash award of \$250.00

Dissemination of Research



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 2018 calendar year can be found in the Publications and Presentations section (pp. 39-45).

Through scientific conferences, Center of Excellence faculty share their research with a worldwide audience. The map above highlights where center faculty research was presented in 2018.

Popular Press and 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, biweekly spot on the local NBC affiliate WBIR Channel 10's "Live at Five at Four" news show. The college also manages a Facebook page, a VolVet Connect alumni e-newsletter, and a quarterly referring DVM newsletter. As of October 2019, the Facebook page had 12,589 "likes" from individuals. Page administrators post clinical and research information for users. There is also an alumni Facebook page with 1,369 "likes," a farm and equine hospital page with 1,749 "likes," and the Equine Performance and Rehabilitation Center has a page with 1,127 "likes". VolVet Connect contains items of note aimed at DVM alumni, including UTCVM research news, continuing education, network opportunities, and a Comparative and Experimental Medicine graduate student's research focus is presented. UTCVM is also on Twitter (4,300 followers), has a YouTube channel with 649 subscribers, and has a Pinterest presence with 913 monthly viewers. The Instagram account has 1,812 followers.

VolVet Vision is a yearly magazine that explores the research, teaching, and outreach services of UTCVM. This year, the magazine featured a story about King Charles I, lovingly known as Charlie. Charlie is an alpaca, who suffered from a severe pulmonic stenosis, or narrowing of the heart valve. Although a common procedure in dogs, Dr. Pierre-Yves Mulon and his team performed a balloon valvuloplasty to widen his heart valve, the first ever performed on an alpaca.



Charlie prepares for a balloon valvuloplasty surgery after suffering from severe pulmonic stenosis.

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 UTCVM. Twenty-two 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 UTCVM Research Day. Near the end of the 10-week program, the students presented their research findings to their colleagues and to UTCVM faculty and staff.

The center fully funded 20 student stipends for the Summer Student Research Program. A grant from Boehringer Ingelheim funded two students (Arin Wildmann and Eliza Burbank). Dr. Stephen 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 2019, three senior center faculty and three junior members participated in the program. The center will continue to encourage the participation of its faculty interested in mentoring DVM students.



Summer Students get a “behind-the-scenes” tour of the Knoxville Zoo.

Summer Student Research Program

Michelle Buitrago

Brentwood, TN • 2nd year

BS in Biology from Purdue University

Faculty Mentor: Aude Castel

Summer Project: Efficacy of NOCITA (bupivacaine liposome injectable suspension) for post-operative analgesia

Career Interests: She wants to become a DVM board certified in Neurology and Neurosurgery

Eliza Burbank

Nashville, TN • 1st year

BA in Internal Relations from American University

Faculty Mentor: Richard Gerhold & Debra Miller

Summer Project: Health Survey of South Carolinian Coyotes

Career Interests: She wants to work in wildlife and zoo medicine, focusing on conservation.

Rachel Clark

Tampa, FL • 2nd year

BS in Biology from Southern Adventist University

Faculty Mentor: David Anderson

Summer Project: Elution characteristics of vancomycin loaded polyurethane based scaffolds and evaluation of bioactivity

Career Interests: She wants to pursue a career in small animal medicine and exotics.

Desmond Coates

Memphis, TN • 2nd year

BS in Animal Science from the University of Tennessee

Faculty Mentors: Pierre-Yves Mulon

Summer Project: Simultaneous implantation of titanium dental implants in a graphene-polyurethane bone regeneration scaffold

Career Interests: He wants to pursue a PhD

and work as a small animal veterinarian.

Tania Dawant

Nashville, TN • 1st year

BS in Engineering Science and Biological Science from Vanderbilt University

Faculty Mentors: Richard Gerhold

Summer Project: Determining the prevalence of *Toxoplasma gondii* in a Population of Watergowl

Career Interests: She would like to pursue a career interest in wildlife and conservation research.

Michelle Espy

Tullahoma, TN • 1st year

BS in Animal Science from the University of Tennessee

Faculty Mentor: Stephen Kania

Summer Project: Effects of Behavior and Sociality on Physiological Impairment in Chimpanzees

Career Interests: She has an interest in zoo, exotic, and mixed animal medicine and theriogenology.

Laura Freeman

Nashville, TN • 1st year

BS in Animal Science from the University of Connecticut

Faculty Mentor: David Anderson

Summer Project: Comparison of resistance to bending in solid, cannulated, and enhanced cannulated cancellous screws in the repair of femoral neck fractures

Career Interests: She intends to pursue an internship with the goal of becoming an ophthalmologist.

Kristina Kravchencko

Knoxville, TN • 2nd year

BS in Animal Science from the University of

Summer Student Research Program

Tennessee

Faculty Mentors: David Anderson

Summer Project: Elution Characteristics of BMP2 from Impregnated 3D Tissue Regeneration Scaffolds

Career Interests: She would like to pursue a career in either food production medicine, public health, or the military.

Samantha Kuschke

Randolph, NJ • 1st year

BS in Biology from Purdue University

Faculty Mentor: Deb Miller

Summer Project: Effects of incubation temperature on intestinal length in leatherback sea turtle (*dermochelys coriacea*) hatchlings from Boca Raton, Florida

Career Interests: She is interested in Zoo Medicine, Wildlife Medicine, and/or Research and Conservation.

Madelyn Moore

Johnson City, TN • 2nd year

BS in Animal and Veterinary Science from Clemson University

Faculty Mentor: Riley Thompson

Summer Project: Post Thaw Assessment of Dama Gazelle and Onager Spermatozoa

Career Interests: She wants to pursue a surgical specialty.

Laura Morse

Knoxville, TN • 2nd year

BS in Animal Science from the University of Tennessee

Faculty Mentor: Zenithson Ng

Summer Project: Effect of the veterinary visit on heart rate variability in dogs

Career Interests: She wants to work in mixed animal veterinary medicine.

Sabrina Pruitt

Hampshire, TN • 2nd year

BS in Animal Science from the University of Tennessee at Martin

Faculty Mentor: Jennifer Weisent

Summer Project: Seroprevalence of Tick-borne pathogens in free-roaming cats

Career Interests: She wants to pursue a mixed animal practice and shelter medicine.

Sierra Slautterback

Camarillo, CA • 1st year

BS in Animal Science from the University of Tennessee

Faculty Mentor: Richard Gerhold

Summer Project: Fecal parasites and ELISA testing on wild turkeys in East Tennessee

Career Interests: She wants to become a poultry veterinarian and work in the poultry industry.

Sayge Smith

Knoxville, TN • 2nd year

BS in Animal Science from the University of Tennessee

Faculty Mentor: Cheryl Greenacre

Summer Project: Investigating the epidemiology of the zoonotic pathogen, *Toxoplasma gondii*, in alternatively raised poultry

Career Interests: She wants to pursue an avian and exotics medical practice.

Austin Turner

McDonough, GA • 1st year

BS in Organismal Biology from Auburn University

Faculty Mentor: Meggan Graves

Summer Project: Pharmacodynamics of Transdermal Flunixin in Goats Following Castration

Career Interests: He plans to practice food animal medicine.

Continued

Jamilea Van Hemel

Coral Springs, FL • 1st year

BS in Animal Science from the University of Florida

Faculty Mentor: Karen McCormick

Summer Project: Evaluation of the accuracy of morphometric measurements when utilized to assess body weight of horses with extreme body condition scores

Career Interests: She wants to pursue a career in mixed animal general practice.

Dené Vann

Gates, NC • 1st year

BS in Animal Science from North Carolina State University

Faculty Mentor: Rebecca Trout Fryxell

Summer Project: They're Here! Discovery of the Asian Longhorned Tick in Tennessee and Why This Tick is Important

Career Interests: She plans to pursue a PhD with a focus transmission of disease between wildlife and farm animals, public health, and food safety.

Arin Wildmann

Memphis, TN • 1st year

BS in Biology from the University of Memphis

Faculty Mentor: Debra Miller

Summer Project: Estimating the encystment rate of *Batrachochytrium* salamandrivorans zoospores in the skin of Eastern Newts

Career Interests: She is interested in a career in wildlife health, zoo medicine, and research.

Kassandra Willoughby

Yucaipa, CA • 2nd year

BS in Biology from Augusta University

Faculty Mentor: David Anderson

Summer Project: Osteoinduction in non-orthotopic sites in rats

Career Interests: She wants to pursue a

career in lab animal medicine.

Sarah Wingo

Nashville, TN • 2nd year

Completed coursework at the University of Tennessee

Faculty Mentor: Steven Adair

Summer Project: Effect of Nano-based 3D Scaffold on Equine Splint-Bone Healing

Career Interests: She would like to become a large animal ambulatory veterinarian.

Megan Wright

White House, TN • 2nd year

BS in Animal Science from the University of Tennessee

Faculty Mentor: Andi Lear

Summer Project: Clinical Trial to Test Efficacy of COWP In Lowering GIN Egg Numbers In Adult Alpacas

Career Interests: She wants to pursue a career in large animal medicine.

Norah Young

Canfield, OH • 2nd year

BS in Pre-Veterinarian Studies at Otterbein University

Faculty Mentor: Tena Ursini

Summer Project: Measurement of muscle activation induced by therapeutic exercise in horses

Career Interests: She wants to build an equine general practice or work in equine surgery.

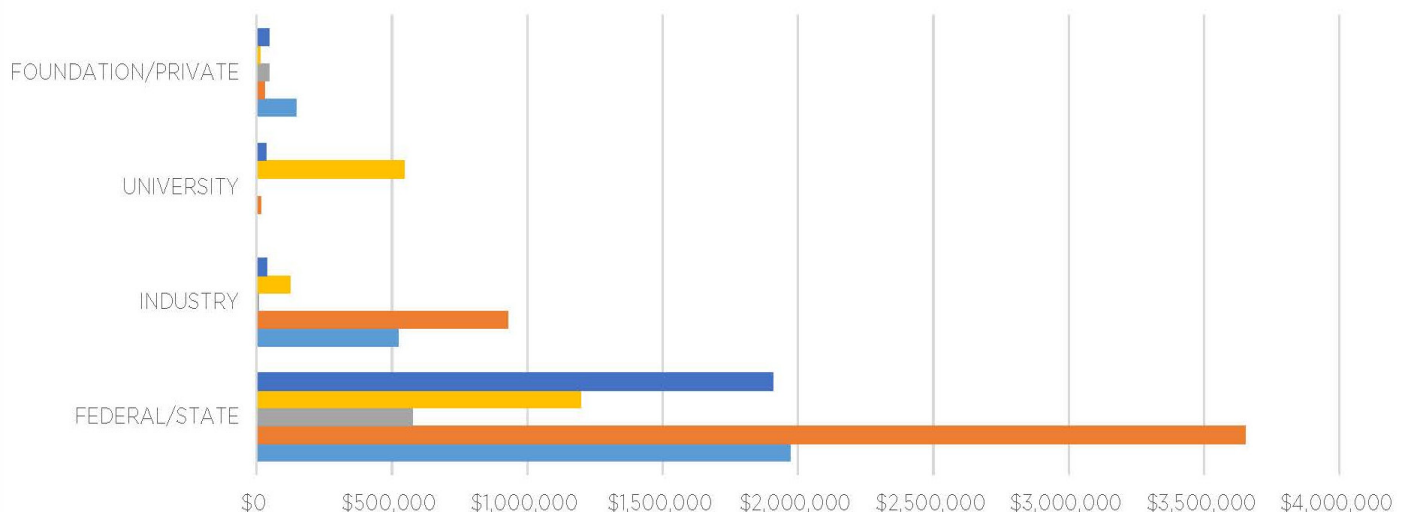
Five-Year Benchmark Data (2015-2019)

Productivity among center faculty has been stable during the last 5-year period. From 2015-2019, center faculty have published 253 articles in peer-reviewed journals and gave 204 presentations at national and international meetings.

Total research funding was down from \$2,643,146 in 2015 to \$1,922,576 in 2019 (see Figure 2). Figure 3 shows the four top grossing external funding categories—federal, industry, university funding, and foundation and private organizations—from 2015-2019.

Expenditures per faculty member averaged \$136,907 in fiscal year 2019. Over the past 5 years, the mean expenditure amount per faculty member has been \$145,158. The 5-year average return on the state's investment in the center is 3.6, the ratio of external funding to the state's appropriation. For comparison, benchmark data from 2015-2019 are summarized in Figure 2.

FIG 2. EXTERNAL FUNDING BY SOURCE (FY 2015-2019)

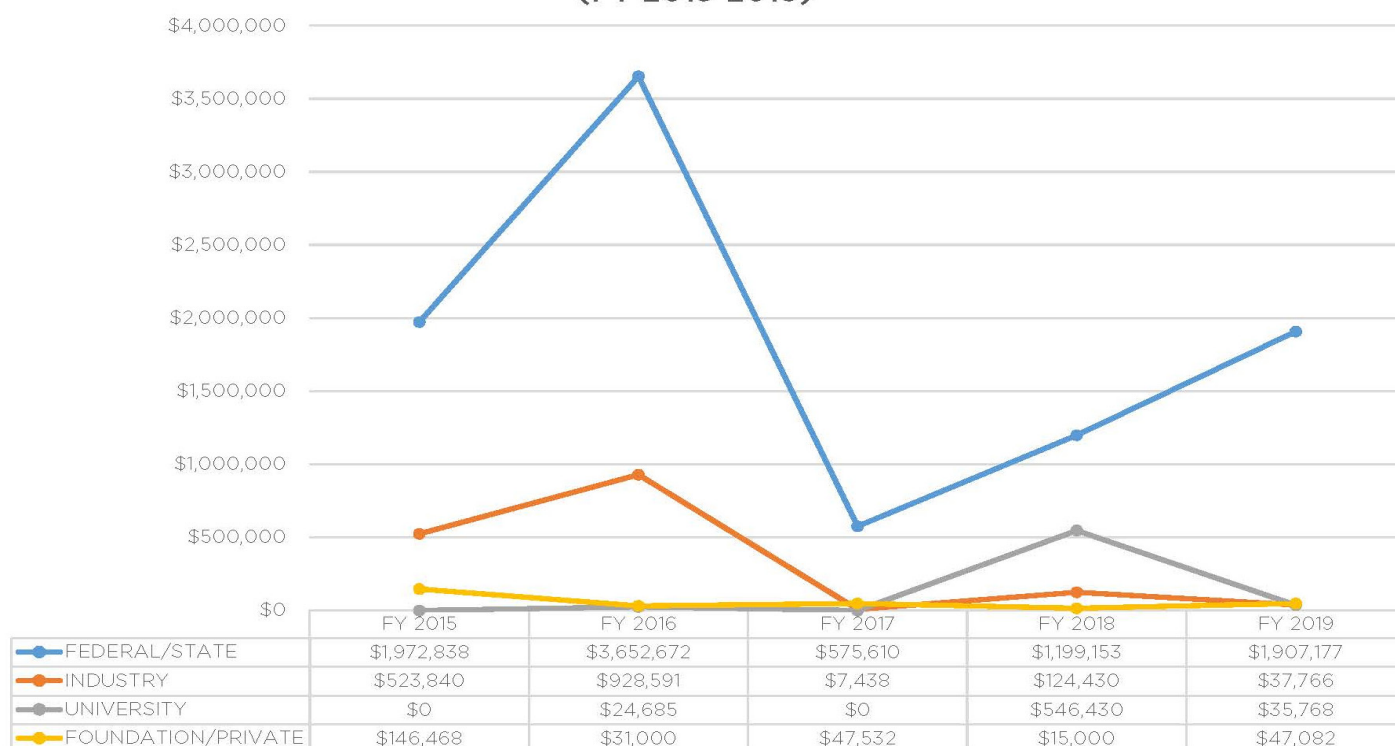


Benchmark Summary (2015-2019)

Center faculty members have worked hard to maintain external funding as biomedical research support has stagnated in recent years. The 2009 economic downturn had a significant impact on federal sponsorship as available funds were directed elsewhere over this period. Our center faculty members have experienced this drop in available funds, which has been further exacerbated by increased competition for fewer dollars; this has been true for all universities.

We do have some cause for hope as the government now appears to be more willing to redirect funds to the National Institutes of Health (NIH) and other federal sponsors of university researchers. Importantly, the NIH has also revised some of their funding models in the last few years to help ensure a greater proportion of their dollars fund more junior investigators. The UTCVM and UTIA will continue to look for new ways to support faculty in obtaining the external sponsorships needed to advance discoveries in the center's mission areas by enhancing opportunities for collaboration, focused investment in research equipment and facilities, and continued technical grant writing assistance.

**FIG 3. TOP GROSSING EXTERNAL FUNDING CATEGORIES
(FY 2015-2019)**



Future Plans: Looking Forward

The Center of Excellence in Livestock Diseases and Human Health (COE) will continue to cultivate research programs in 2020 through investments in facilities, equipment and faculty operating support.

Efforts and investments to grow research in the University of Tennessee Institute of Agriculture (UTIA) and College of Veterinary Medicine (CVM) will continue into 2020. This includes ongoing searches designed to attract faculty with established research credentials that will sustain federal funding in the areas of infectious disease, host responses to infectious disease and other stressors, and cattle genomics. Building on infectious disease and genomic research that addresses animal production and human health directly aligns with a robust new multidisciplinary initiative on the UTIA/UTK campus to develop an overarching area of research around “one health”, which recognizes that human, animal, plant and environmental health are inextricably linked and can no longer be considered independently. Our established Center of Excellence is an important contributor to this effort in supporting studies involving animal and/or human health, often as they relate to the environment. Studies conducted by our Center faculty provide a foundation for this nascent one health program and, as such, will further leverage Center support for additional research growth across UT as we face increasingly serious problems in zoonotic infectious diseases, sustainability of food production, water, antimicrobial resistance, climate change, etc.

UTIA and CVM recently entered into an agreement with Hanover Research, a grantsmanship consulting firm, to provide grant development services to UTIA faculty. This additional, new resource is expected to increase the success rate of extramurally funded grant proposals, critical in this hypercompetitive environment. Hanover grant consultants, many with substantial track records of grantsmanship themselves, will strengthen grant proposals targeting federal agencies as well as private and non-profit foundations. Their reviews will provide key insights into targeted sponsor priorities and recommendations for grant proposal improvement. This support, provided at no cost to participating faculty or their departments, will be primarily directed towards larger (\$1M plus) and more complex, multidisciplinary grant applications expected to effectively complement the campus one health initiative. In addition, Hanover will be presenting a day-long grantsmanship workshop in 2020 open to all UTIA faculty.

With new faculty and establishment of new programs of research and infrastructural support the future of impactful research here on the UT Knoxville campus is quite bright.

FACULTY RESEARCH SUMMARIES

Dr. David Anderson

PROFESSOR AND DEPARTMENT HEAD
LARGE ANIMAL CLINICAL SCIENCES

About Dr. Anderson

MS | Kansas State
University

DVM | North Carolina
State University

Supported by:
Karen Gilhousen
Fund, Crouch D.
Biomedical Research
Seed Program, Site
Savor Inc., TEVRO, &
The Department of
Defense

Collaborators: Drs.
Pierre-Yves Mulon,
Sherry Cox, & Alex
Biris

Publications: 7 in
2018

Presentations: 5 in
2018



Beating Post-Surgery Infections to the Punch

After undergoing surgery, bacterial infections, including osteomyelitis and sepsis, often occur, which impede the healing process. Specifically, osteomyelitis and sepsis surrounding the compromised bone and tissue are often hard to reach and treat due to poor blood flow, compromised tissue, and an impaired immune system response. Although there are medical advances to help with infections post-surgery, there has yet to be a device to help address infections at the local level, which would help curtail bacterial infections, like osteomyelitis and sepsis. Dr. Anderson, in a collaboration with Mark Smeltzer at the University of Arkansas Medical Science Center and Lt. Col. John Decker, is examining the use of polymers implanted during surgery as a drug delivery system to treat local infections during recovery. Moreover, the polymer device that Dr. Anderson uses will not only deliver antimicrobial drugs, but also aid in tissue regeneration. After determining the length of drug uptake and the porosity of the polymer, Dr. Anderson intends to use his findings to submit a grant with the Department of Defense.

Dr. Marc Caldwell

ASSISTANT PROFESSOR
LARGE ANIMAL CLINICAL SCIENCES



Rooting Out Antimicrobial Resistance

Due to high susceptibility to disease, it is a common practice among cattle health professionals to administer antimicrobial agents prior to or during the marketing of weaned calves, oftentimes before the animals have even shown signs of respiratory illness. In fact, an estimated twenty-five percent of beef cattle entering the feedlot have received antimicrobial therapy to combat respiratory infections. However, those respiratory infections, bovine respiratory disease (BVD) being one, tend to also lead to antimicrobial resistance when overused. Dr. Caldwell and his team are examining a specific antimicrobial drug, Ceftiofur, in order to determine the pharmacokinetics of the drug, as well as to determine its clinical effectiveness against bacterial infections in the bovine respiratory tract. He believes that the drug's duration will result in an increase in antimicrobial resistance in calves. Dr. Caldwell intends to use his preliminary research to submit a grant to the National Institute of Food and Agriculture, Agriculture and Food Research Initiative.

About Dr. Caldwell

MS | Auburn
University

DVM, PhD | Auburn
University

Supported by:
BioMerieux Inc.

Collaborator: Dr.
Sherry Cox

Publications: 2 in
2018

Presentations: 1 in
2018

Dr. Madhu Dhar

RESEARCH ASSOCIATE PROFESSOR
LARGE ANIMAL CLINICAL SCIENCES

About Dr. Dhar

MS | University of
Poona (India)

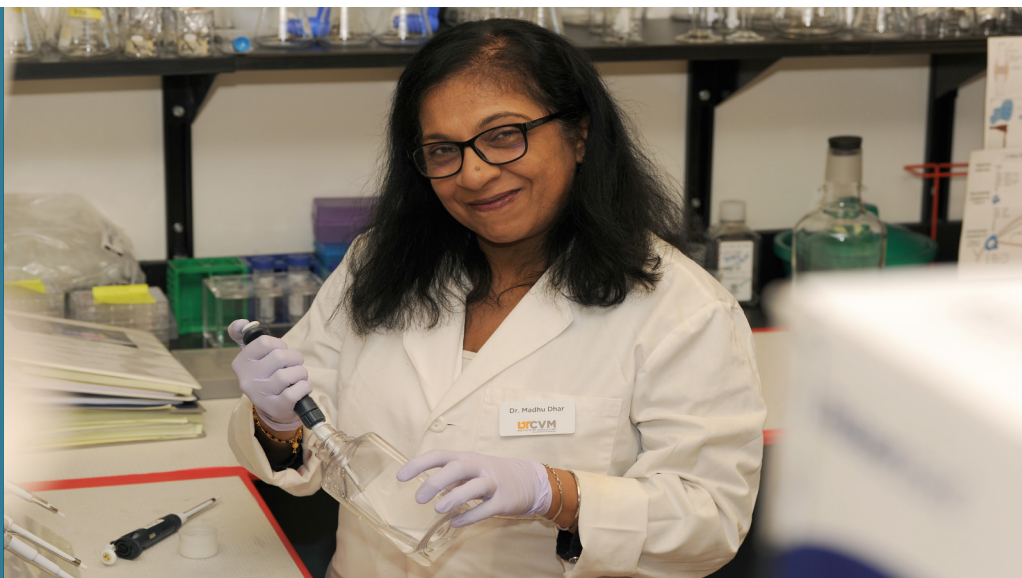
PhD | University of
Poona (India)

Sponsored by:
National Institutes of
Health & Department
of the Army

Collaborators: Dr.
David Anderson &
Austin Bow

Publications: 3 in
2018

Presentations: 2 in
2018

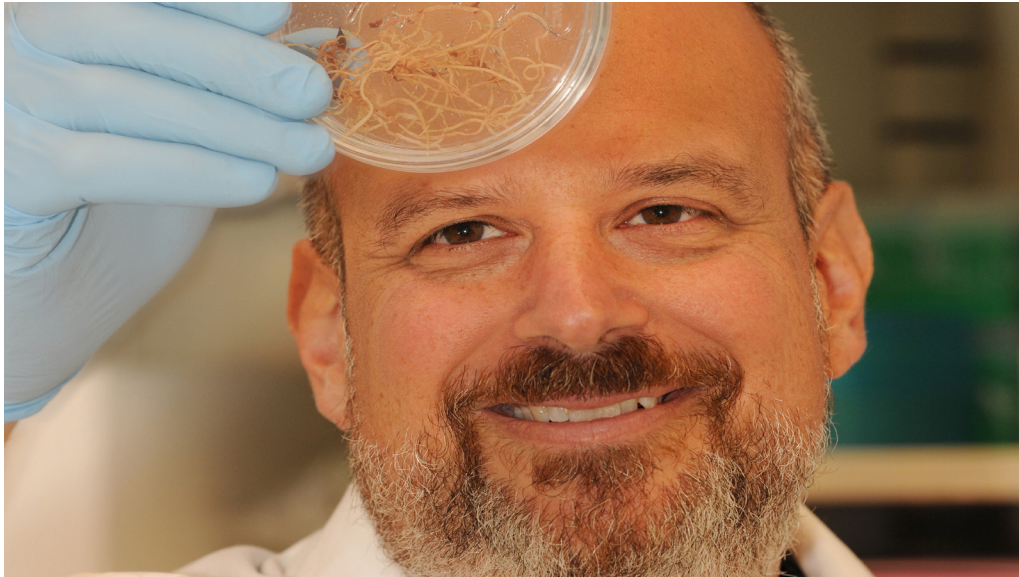


Working the MSCs to the Bone

As the population in the United States begins to age, the amount of bone injuries will undoubtedly increase. Geriatric patients are at higher risk for bone fractures due to the brittle nature of aging bones. Moreover, post-menopausal women are at an even higher risk of bone fractures, as hormone deficiencies cause decreased bone mineral density, decreased bone marrow cell differentiation, and decreased osteoprogenitor cell populations. Therefore, there is a significant need for bone tissue engineering capable of restoring bone function after a fracture. Dr. Dhar has collaborated with the Nanotechnology Center at the University of Arkansas, Little Rock to produce a porous nanocomposite scaffold to use as a delivery system for mesenchymal stem cells (MSCs). MSCs are made from fat-derived human stem cells, and they help accelerate bone healing and repair. The scaffold adheres to the bone, and as it dissolves, it unleashes the MSCs into the fractured bone. Dr. Dhar and her team intends to experiment with the scaffold model on osteoporotic rats. Her research will provide an opportunity to submit a grant to the National Institutes of Health, National Institute of Aging.

Dr. Richard Gerhold

ASSISTANT PROFESSOR
BIOMEDICAL AND DIAGNOSTIC SCIENCES



Exploring *T. Gondii* in Free-Range Poultry

There has been a dramatic increase in alternatively raising poultry, including free-range poultry and organically raised poultry. Although these new methods are becoming more mainstream, there is little information about the transmission of zoonotic pathogens by infected free-range poultry, especially birds intended for human consumption. Toxoplasmosis, which is caused by *Toxoplasma gondii*, was named the third most important food borne illness in the United States by the CDC. Pregnant women who contract *T. gondii* can result in stillbirths and abortions. Therefore, it is essential that information about this pathogen be gained. Due to their free-range environment, poultry are more likely to acquire *T. gondii* oocysts while foraging for food. Previous studies uncovered a *T. gondii* prevalence in 20% of wild turkeys. Dr. Gerhold and his team are researching alternatively raised turkeys to uncover the prevalence of *T. gondii* in order to determine the likelihood these birds could transmit the pathogen to humans. His research will ultimately provide information to help control *T. gondii* infections in alternatively raised poultry. Dr. Gerhold hopes to submit a grant to either the USDA's National Institute of Food and Agriculture or the CDC.

About Dr. Gerhold

DVM | Purdue
University

MS | University of
Georgia

PhD | University of
Georgia

Supported by:
Tennessee Wildlife
Resources Agency

Collaborators: Drs.
Cheryl Greenacre &
Chunlei Su

Publications: 8 in
2018

Presentations: 10 in
2018

Dr. Meggan Graves

CLINICAL ASSISTANT PROFESSOR
LARGE ANIMAL CLINICAL SCIENCES

About Dr. Graves

BS | Tennessee
Technological
University

DVM | University of
Tennessee

Supported by:
Faculty First OIT

Collaborators: Drs.
Sherry Cox, Peter
Krawczel, & Andrea
Lear

Publications: 1 in
2018



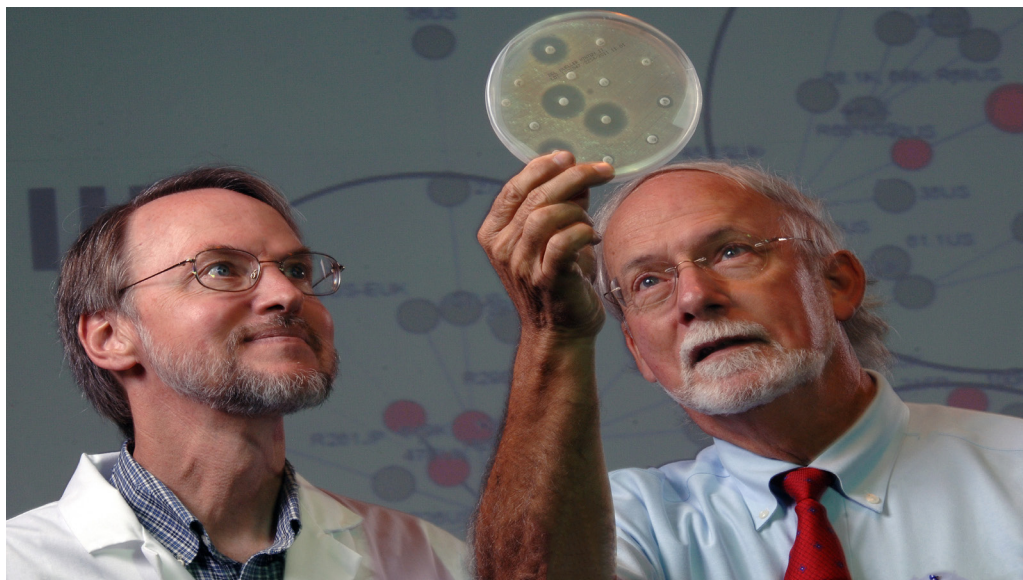
NSAIDs Numbing the Pain of Castration

No one wants to see an animal in pain. Therefore, non-steroid anti-inflammatory drug (NSAID) use is becoming more popular in veterinary medicine because of the low cost and convenience. A particular NSAID, flunixin meglumine (FM), is the only approved medicine to treat pain in cattle. It is most often used to treat fevers caused by bovine respiratory disease or endotoxic mastitis. However, there is no research to determine whether FM is safe for other farm animal species, like goats. Dr. Graves and her team are trying to determine the pharmacokinetics of FM in goats undergoing castration. Because castration can cause painful discomfort and acute inflammation, it is an ideal opportunity to test the effectiveness of FM on goats. Dr. Graves intends to use the results from this study to publish in a peer-reviewed journal; present at a veterinary, ethology, and producer meeting; and lead to sustainable funding from extramural sources.

Drs. Stephen Kania and David Bemis

PROFESSORS

BIOMEDICAL AND DIAGNOSTIC SCIENCES



Preventing Canine Pyoderma

Staphylococcus pseudintermedius, or *S. pseudintermedius*, is the primary cause of canine pyoderma, a painful skin infection in dogs. *S. pseudintermedius* can also cause other infections, including urinary tract, wound, and surgical site infections. Because of the increase of antimicrobial resistance among bacteria, it is important to create a vaccine to help combat the detrimental effects of *S. pseudintermedius*. Drs. Kania and Bemis have begun to develop a vaccine for the bacteria, locating three potential strains that can be genetically altered to create a vaccine. They intend to use gene editing through Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) technology to modify each strain's genetic sequence, specifically the adenosine synthase gene. Drs. Kania and Bemis have already secured outside funding from UTRF for a vaccine trial, as well as developed a provisional patent. They hope to convert the provisional patent into a utility patent with the success of the vaccine's clinical trial. They have also submitted an NIH R03 grant proposal, which is currently under review.

About Dr. Kania

MS | Washington State University

PhD | University of Florida

Supported by:
Boehringer Ingelheim
Vetmedica, AKC
Canine Health
Foundation, &
University of
Tennessee Research
Foundation

Publications: 6 in
2018

Presentations: 1 in
2018

About Dr. Bemis:

PhD | Cornell University

Publications: 3 in 2018

Dr. Elizabeth Lennon

ASSISTANT PROFESSOR
SMALL ANIMAL CLINICAL SCIENCES

About Dr. Lennon

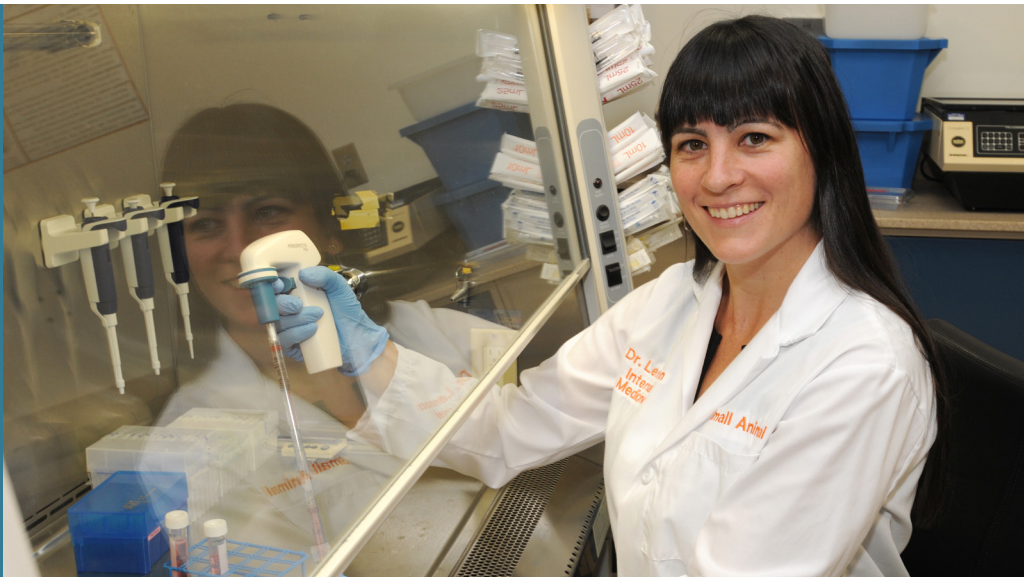
DVM | North
Carolina State
University

PhD | North Carolina
State University

Supported by:
National Institutes of
Health & Morris
Animal Foundation

Collaborators: Drs.
Emily Gould & Katie
Tolbert

Publications: 3 in
2018



Annihilating Mast Cell Tumors With Acid Suppressants

Mast cell tumors and mastocytosis are two of the most common tumors in dogs, cats, and humans. In dogs, mast cell tumors usually appear under the skin; however, these tumors often appear in the gastrointestinal tract in cats. Mastocytosis occurs in humans and consists of mast cells that populate under the skin and/or internal organs. Although acid suppressants have not been approved to treat mastocytosis in humans, they are commonly prescribed to treat mast cell neoplasms in small animal patients. Mast cells require an acid pH to maintain their structure. Therefore, proton pump inhibitors, or acid suppressants, may negatively affect mast cell growth. PPIs may also affect tumor angiogenesis and chemotherapy resistance. Dr. Lennon and her team are examining the use of proton pump inhibitors to reduce the size of mast cell tumors in dogs. She is the first to attempt to combat mast cell tumors with proton pump inhibitors. If clinical trials on dogs are successful, Dr. Lennon's work can easily translate to human trials. Data collected from this study will be used to write a NIH grant.

Dr. Agricola Odoi

PROFESSOR
BIOMEDICAL AND DIAGNOSTIC SCIENCES



Predicting Prediabetes

Diabetes is one of the leading causes of physical disabilities and death in the United States. More importantly, prediabetes, or individuals with elevated A1c levels, increases the risk of Type 2 diabetes. Both prediabetes and diabetes increase the risk of heart disease, stroke, nerve damage, kidney failure, and eye problems. However, for prediabetic patients, a change in lifestyle choices can reduce the likelihood of Type 2 diabetes by 40-70%. This remarkable statistic demonstrates the need for early diagnosis of prediabetes in order for patients to make the necessary lifestyle changes to prevent Type 2 diabetes. Dr. Odoi has partnered with Shamarial Roberson from the Florida Department of Health to target specific geographic regions that are “hotspots” for both prediabetes and diabetes. Using Geographic Information Systems (GIS) and spatial epidemiology, Dr. Odoi is targeting at risk groups in various regions of Florida to provide the necessary care to help prevent further disease and death. He hopes to use his findings to apply for a grant from the American Diabetes Association, the American Heart Association, or the National Institutes of Health.

About Dr. Odoi

DVM | Makerere
University (Uganda)

MS | University of
Nairobi (Kenya)

PhD | University of
Guelph (Canada)

Supported by: Smith
International Center,
UTIA

Collaborators:
Shamarial Roberson

Publications: 6 in
2018

Presentations: 10 in
2018

Dr. Naveen Rajasagi

RESEARCH ASSISTANT PROFESSOR
BIOMEDICAL AND DIAGNOSTIC SCIENCES

About Dr. Rajasagi

MS | Acharya N. G.
Ranga Agricultural
University (India)

PhD | Louisiana
State University

Supported by:
National Institutes of
Health

Collaborator: Dr.
Barry T. Rouse

Publications: 2 in
2018

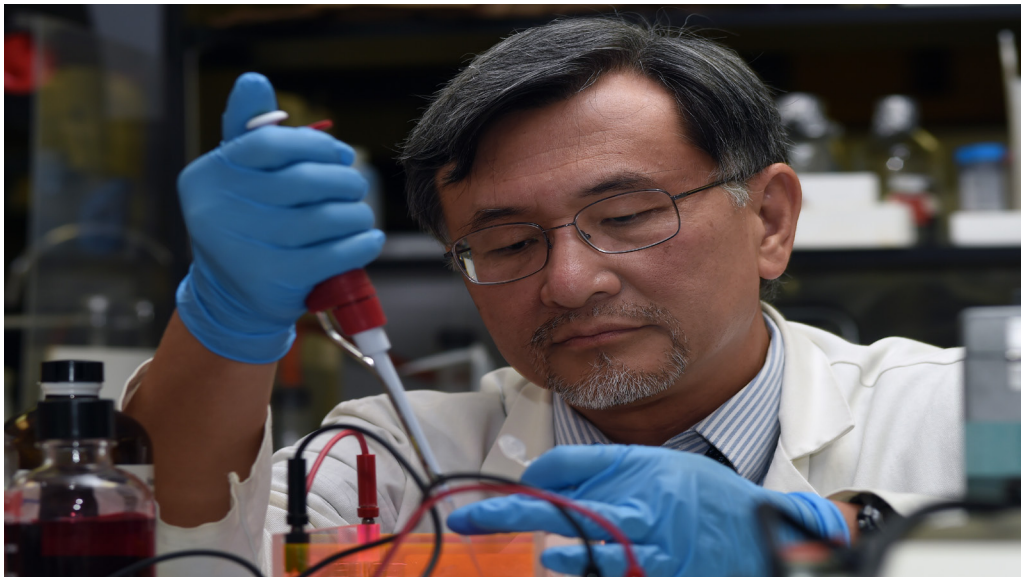


Eying a Cure for Herpes-Induced Ocular Lesions

In the United States, more than 50% of adults have experienced infection from the herpes simplex virus 1. Although many infected individuals do not have symptoms, others experience lesions in the skin, eye, and, in rare cases, the brain, which can be life threatening. The tiny lesions in the eye caused by a herpes simplex virus type 1 infection creates chronic tissue damage. Although there are drug treatments available, many of these medicines have unfavorable side effects. Therefore, it is important that these lesions, and the damage caused by them, be controlled using less harmful treatment regimens. Through the incorporation of a mouse model, Dr. Rajasagi and his team have discovered that regulatory T cells help ameliorate the effects of these lesions. However, he is unsure how to increase regulatory T cells to reach a desired level to treat lesions caused by herpes simplex virus type 1. Moreover, regulatory T cells may be able to help with tissue repair. After conducting his research, Dr. Rajasagi intends to use his findings to submit a R21 grant to the National Institutes of Health. This grant will focus on the roles of amphiregulin in herpes simplex virus type 1 ocular lesions.

Dr. Hwa-Chain Robert Wang

PROFESSOR
BIOMEDICAL AND DIAGNOSTIC SCIENCES



Beating Breast Cancer

In North America and Europe, breast cancer is the second leading cancer death among women. In the United States, 1 out of 8 women will develop breast cancer within their lifetime. Triple-negative breast cancer comprises 15-20% of breast cancer cases. Initially, triple-negative breast cancer responds well to conventional treatments; however, the long-term prognosis is poor due to cancer recurrence and metastasis. Additionally, targeted treatments often encourage other cells to “rescue” the cancer cells, creating drug resistance and cancer recurrence. Knowing this, Dr. Wang developed a triple-combination anticancer treatment to combat cancer cell growth and “rescuing” cells, while also limiting treatment toxicity. Dr. Wang utilizes FDA-approved agents, gemcitabine, romidepsin, and cisplatin (Gem+Rom+Cis), to inhibit cancer growth and prevent recurrence in mice. Moreover, Dr. Wang is able to assess toxicity by examining the treatment’s effects on bone marrow, liver, and kidneys in mice. Because Gem+Rom+Cis is already FDA approved, these experimental results can easily be translated into clinical trials. The results of these experiments will be used to obtain a grant through the NIH or the Department of Defense Breast Cancer Research Program to begin the work of transitioning into clinical trials.

About Dr. Wang

DVM | National
Chung-Hsing
University (Taiwan)

MS | Auburn
University

PhD | University of
Virginia

Supported by:

Collaborators: Drs.
Robert Donnell and
Agricola Odoi

Publications: 2 in
2018

Presentations: 4 in
2018

Dr. Brian Whitlock

ASSOCIATE PROFESSOR
LARGE ANIMAL CLINICAL SCIENCES

About Dr. Whitlock

MS | Michigan State
University

DVM | Auburn
University

PhD | Auburn
University

Supported by:

Collaborator: Lisa
Amelse

Publications: 4 in
2018

Presentations: 9 in
2018



Kissing the Stress Out of Infertility

It is essential that food animals maintain their fertility not only to protect farmers from economic losses, but also to prevent food insecurity. However, several environmental and physiological stressors, such as heat, inflammation, and a negative energy balance on the hypothalamic pituitary gonadal axis, can inhibit fertility in these animals. Kisspeptin (Kp) and its receptor, Kiss1R, are necessary for reproduction in fish, birds, and mammals. Kp is found in the hypothalamus of rats and other mammals and produced by two distinct nuclei: anteroventricular periventricular (AVPV) and arcuate (ARC). By determining which stressors affect each nuclei, it can help define which stressors are influencing reproduction. Moreover, it can provide potentially effective treatments to reinstate reproduction in cattle. Dr. Whitlock and his team seek to understand how Kp is affected by these external environmental stressors in order to increase cattle reproduction. He intends to utilize the findings in this study to submit a grant to the United States Department of Agriculture (USDA) and complete several peer-reviewed journal publications.

PUBLICATIONS AND PRESENTATIONS

David Anderson

PUBLICATIONS

- Snowden R, Anderson D, Ursini T, Mulon PY. Femoral head ostectomy as a treatment for craniodorsal coxo-femoral luxation in a Shorthorn cow. *Vet Rec Case Rep* 2018;7: e000778.
- Fetrow J, Royster E, Morin D, Molgaard D, Wingert D, Yost J, Overton M, Apley M, Godden D, Cramer G, Sorge U, Scheifers J, Goldsmith T, Chebel R, Anderson D, Hanzlicek G, Dwyer KA, Dwyer L. Development and Implementation of a National Center of Excellence in Dairy Production Medicine Education for Veterinary Students. *JVME*, accepted 2018.
- Jackson BK, Bow AJ, Kannarpady G, Biris AS, Anderson DE, Dhar M, Bourdo. SE. Polyurethane/nano-hydroxyapatite composite films as osteogenic platforms. *J Biomater Sci Polym Ed.* 2018;2:1-18.
- van Amstel SR, Anderson DE, Videla R. Modified abaxial approach for resection of the distal sesamoid bone and distal interphalangeal joint while preserving the digital flexor tendons of three Angus bulls with septic arthritis. *J Am Vet Med Assoc.* 2018;252:873-881.
- Whitehead CE, Anderson DE, Saville WJA. Retrospective analysis of 185 occurrences of clinical neurological signs in 181 South American Camelids. *J Vet Sci Anim Husb.* 2018;6:1-12.
- Anderson DE, DiCarlo C, Whitlock BK. Sudden death following dystocia and peritoneal contamination with a polyethylene polymer-based obstetrical lubricant in an alpaca. *Vet Rec Case Rep.* 2018;6:e000597.
- Newman KD, Anderson DE, Samii VF, Weisbrode SE, Adair HS. Preliminary Investigation of the Interaction of Misoprostol and Phenylbutazone on Bone Response to Injury in Horses. *J Vet Sci Anim Husb.* 2018;6:404.

PRESENTATIONS

- Anderson DE. Surgical management of fractures in Camelids (4 topic seminars). Presented at: European College of Veterinary Surgeons Annual Conference; July 5-8, 2018; Athens, Greece.
- Rifkin R, Grzeskowiak R, Mulon PY, Adair HS, Biris AS, Dhar M, Anderson DE. Biometric Assessment of Ambulation in Healthy Goats. Presented at: American College of Veterinary Surgeons Annual Symposium; October 2018; Phoenix, AZ.
- Anderson DE. Fracture repair (1 hour) and Pain Management (1 hour). Presented at: Food Animal Veterinarians Conference; January 27, 2018; Murfreesboro, TN.
- Warrington GL, Hall PT, Anderson DE, Rifkin R, Greenacre CB, Crouch DL. Isometric torque during electrical stimulation of muscles crossing the ankle in a rabbit model of tenotomy. Presented at: Biomedical Engineering Society Annual Meeting; October 16-19, 2018; Philadelphia, PA.
- Mulon PY, Zarzosa M, Harper DP, Anderson DE. Mechanical evaluation of cannulated orthopedic screws reinforced with orthopedic cement and/or 316L SS pins, to enhance resistance to bending. Presented at: American College of Veterinary Surgeons Annual Symposium; October 2018; Phoenix, AZ.

David Bemis

PUBLICATIONS

- Townsell M, Legendre AM, Bemis DA, Behrend E, Phillips S. Long-Term Treatment and Survival in Three Apparently Immunocompetent Dogs with Disseminated Fungal Infection Caused by *Phialosimplex caninus*. *J Am Anim Hosp Assoc.* 2018;54:e54602.
- Kennedy RC, Fling RR, Robeson MS, Saxton AM, Schneider LG, Darcy JL, Bemis DA, Zhao L, Chen J. Temporal dynamics of gut microbiota in triclocarban-exposed weaned rats. *Environ Sci Pollut Res.* 2018;25:14743-14751.
- Huse HK, Miller SA, Chandrasekaran S, Hindler JA, Lawhon SD, Bemis DA, Westblade LF, Humphries RM. Evaluation of Oxacillin and Cefoxitin Disk Diffusion and MIC Breakpoints Established by the Clinical and Laboratory Standards Institute for Detection of *mecA*-Mediated Oxacillin Resistance in *Staphylococcus schleiferi*. *J Clin Microbiol.* 2018;56:e01653-17.

Marc Caldwell

PUBLICATIONS

- Collins SL, Caldwell M, Whitlock, BK. Comparison of head trauma induced by penetrating and non-penetrating captive bolt in horned goats. *AJVR*. 2018;78:151-157.
- Hixson CL, Krawczel PD, Caldwell M, Miller-Cushon EK. Behavioral changes in group-housed dairy calves infected with *Mannheimia haemolytica*. *J Dairy Sci*. 2018;6:S0022-0302.

PRESENTATIONS

- Caldwell M.** Extended Meloxicam Therapy Improves Behavioral and Performance Parameters of Beef Calves Infected with *Mannheimia haemolytica*. Invited speaker at: ACVIM Forum. 2018; Seattle, WA.

Madhu Dhar

PUBLICATIONS

- Jackson BK, Bow AJ, Kannarpady G, Biris AS, Anderson DE, Dhar M, Bourdo SE. Polyurethane/nano-hydroxyapatite composite films as osteogenic platforms. *J Biomater Sci Polym Ed*. 2018;29:1426-1443.
- Zayed M, Newby S, Misk N, Donnell R, Dhar M. Xenogenic implantation of equine synovial fluid-derived mesenchymal stem cells leads to articular cartilage regeneration. *Stem Cells Int*. 2018;1073705.
- Zayed M, Adair S, Ursini T, Schumacher J, Misk N, Dhar M. Concepts and challenges in the use of mesenchymal stem cells as a treatment for cartilage damage in the horse. *Res Vet Sci*. 2018;118:317-323.

PRESENTATIONS

- Dhar M, Ursini T. Large Animal Regenerative Medicine. Presented at: Henton Veterinary Conference; Dec 4-7, 2018; Knoxville, TN.
- Dhar M. Biologic Therapies for Sports Conditions. Presented at: 10th International Association of Veterinary Rehabilitation and Physical Therapy Symposium; July 30-Aug 2, 2018; Knoxville, TN.

Richard Gerhold

PUBLICATIONS

- Grunenwald C, Butler E, Wunschmann A, Armien A, Carstensen M, Hildebrand E, Moon R, Gerhold RW. Emergence of the arterial worm *Elaeophora schneideri* in moose (*Alces alces*) and tabanid fly vectors in northeastern Minnesota, USA. *Parasite Vector*. 2018;11:507.
- Grunenwald C, Sidor I, Mickley R, Dwyer C, Gerhold RW. *Tetratrichomonas* and *Trichomonas* spp.-associated disease in free ranging Common Eiders (*Somateria mollissima*) from Wellfleet Bay, MA and description of ITS1 region genotypes. *Avian Dis*. 2018;62:117-123.
- Spriggs M, Gerhold RW, Wilkes R, Keenlance P, Sanders R, Witt J, Miller D. Serosurvey, hematology, and causes of mortality of free ranging American martens (*Martes Americana*) in Michigan. *J Zoo Wildl Med*. 2018;49:371-389.
- Jiang T, Shwab K, Martin R, Gerhold RW, Rosentha B, Dubey JP, Su C. A partition of *Toxoplasma gondii* genotypes across spatial gradients and among host species, and decreased parasite diversity towards areas of human settlement in North America. *Int J Parasitol*. 2018;48:611-619.
- Gerhold RW, Kurth K, Claibourne A, Chapman A, Hickling G. *Baylisascaris* in TN wildlife. *J Wildl Dis*. 2018;54:874-876.
- Dudek B, Kochert M, Barnes J, Bloom P, Papp J, Gerhold RW, Purple K, Jacobson K, Preston C, Vennum C,

- Watson J, Heath J. Prevalence and risk factors for *Trichomonas gallinae* and trichomonosis in Golden eagles nestlings in western North America. *J Wildl Dis.* 2018;54:755-764.
- Shwab K, Saraf P, Zhu X, Zhou D, McFerrin B, Ajzenberg D, Schares G, Hammond-Aryee K, Helden P, Higgins S, Gerhold RW, Rosenthal B, Zhao X, Dubey J, Su C. Human impact on the diversity and virulence of the ubiquitous zoonotic parasite *Toxoplasma gondii*. *Proc Natl Acad Sci.* 2018;115:E6956-E6963.

PRESENTATIONS

- Gerhold R. Update on Blackhead disease and investigation of blackhead transmission from poultry litter. Presented at: Northeast Gamebird Meeting; September 2018; Cape May, NJ.
- Gerhold R. Cats and heartworms. Presented at: Central Veterinary Conferences; May 2018; Virginia Beach, VA.
- Gerhold R. Slow kill vs melarsomine for heartworm treatment of dogs. Presented at: Central Veterinary Conferences; August 2018; Kansas City, MO.
- Gerhold R. Update on tick-borne diseases. Presented at: Central Veterinary Conferences; December 2018; San Diego, CA.
- Gerhold R, Applegate R. Transmission of *Histomonas meleagridis* from chicken litter to wild turkeys. Presented at: International Wildlife Disease Association; August 2018; St. Augustine, FL.
- Gerhold R, Calvrid A, Dozier A, Applegate R. Investigating the mechanism of *Histomonas meleagridis* (blackhead disease) transmission from commercial poultry to wild turkeys in middle Tennessee. Presented at: Tennessee Chapter of The Wildlife Society; March 2018; Spencer, TN.
- Johnson V, Buehler D, Harper C, Gerhold R, Applegate R. Nest and brood ecology of eastern wild turkeys in southern middle Tennessee. Presented at: Tennessee Chapter of The Wildlife Society; March 2018; Spencer, TN.
- Purple K, Girard Y, Rogers K, Gerhold R. Investigating the molecular epidemiology and transmission potential of *Trichomonas* spp. from hunter killed columbiformes in California. Presented at: Molecular Parasitology and Vector Biology Symposium April 2018; Athens GA.
- Dell B, Purple K, Gerhold R. Retrospective investigation of translocated elk in Tennessee and examination of canid definitive hosts for *Echinococcus granulosus*. Presented at: Molecular Parasitology and Vector Biology Symposium; April 2018; Athens GA.
- Gerhold R. Diseases of back yard poultry. Presented at: Henton Annual Conference; December 2018; Knoxville, TN.

Meggan Graves

PUBLICATIONS

- Graves MT, Ivey JL. Ulcerative stomatitis associated with ingestion of broomsedge hay in a horse. *Vet Rec Case Rep.* 2018;6:e000660.

Stephen Kania

PUBLICATIONS

- Balachandran M, Bemis DA, Kania SA. Expression and Function of Protein A in *Staphylococcus pseudintermedius*. *Virulence.* 2018;9:390-401.
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Elizabeth Lennon

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Agricola Odoi

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Naveen Rajasagi

PUBLICATIONS

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Hwa-Chain Robert Wang

PUBLICATIONS

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Wang HCR. Innovation and Creativity; Building a Research Team for Fundable Projects; Writing a Scientific Manuscript; Rationalized therapeutic regimens for breast and urinary bladder cancers. Invited speaker at: Guangdong Ocean University; May 3-9, 2018; Zhanjiang City, China.

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Brian Whitlock

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- Okafor CC, Collins SL, Daniel JA, Harvey B, Coetzee JF, Whitlock BK. Factors associated with seroprevalence of bovine anaplasmosis in Texas. *Vet Parasitol: Reg Stud Rep.* 2018;14:32-40.
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- Brown WE, Garcia M, Mamedova LK, Zenobi MG, Staples CR, Whitlock BK, Daniel JA, Bradford BJ. Alpha-1-acid glycoprotein is negatively associated with dry matter intake in postpartum dairy cows. Presented at: 35th ADSA Discover Conference; October 2018; Itasca, IL.
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- Amelse LL, Mulliniks T, Daniel JA, Whitlock BK. Beta-hydroxybutyrate enhances kisspeptin-stimulated expression of gonadotropin releasing hormone in GT1-7 cells. Presented at: ADSA; June 2018.
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- Whitlock BK, Gregg BA, Parker PA, Waller MK, Garcia M, Bradford BJ, Daniel JA. The effects of central administration of a leptin receptor antagonist on endotoxin-induced hypophagia and fever in sheep. Presented at: ADSA; June 2018.
- Gregg BA, Parker PA, Waller MK, Garcia M, Bradford BJ, Daniel JA, Whitlock BK. Central administration of an acute phase protein, α -1-acid-glycoprotein, increases rectal temperature in sheep. Presented at: ADSA; June 2018.

Research Funded Externally

Investigator	Project Title	Funding Agency	Project Period	2019 Receipts	2019 Expenditures
David Anderson	Multiscale technology for rapid, enhanced bone regeneration	Department of Defense	9/30/15-9/29/18	\$769,762	\$948,899
David Bemis	Clinical Trial of Virulence Factor Vaccine for Staphylococcus pseudintermedius Canine Pyoderma	UT Research Foundation	1/2/18-2-6/19	\$0	8,856
Marc Caldwell	Supporting Early Career Veterinarians in Rural Practice in Tennessee	USDA-NIFA	9/1/17-8/31/21	\$14,600	\$5,632
	Validation of VIDAS® Anti-Müllerian Hormone Assay in Cattle	BioMerieux Inc.	6/4/18 - 6/3/19	\$7,569	\$12,933
	Validation of a Commercial Lateral Flow ELISA for the Detection of Bovine Cardiac Troponin I	Expedite Animal Health	5/1/19 - 7/31/19	\$8,141	\$306
Madhu Dhar	Bone regeneration: mesenchymal stem cells and graphene biomimetic nanomaterials	HHS-NIH-National Inst. Of Health	9/1/18-8/31/21	\$82,505	\$84,124
Richard Gerhold	ECEB Egyptian Scholarship Ammar-Gerhold	Egyptian Cultural & Education	7/29/15-7/28/19	\$21,742	\$21,742
	Research Agreement on developing a Serological Test for P. tenuis infection	Tufts College University	3/15/19-12/31/18	\$14,958	\$14,541
	Wild Turkey Harvest, Hunter Satisfaction, and Population Dynamics in Tennessee	Tennessee Wildlife Resources Agency	8/1/16-7/31/22	\$25,425	\$22,818
	Effect of dose of percent coverage of the coccidia vaccine Advent	Huvepharma	6/5/18-6/4/19	\$22,628	\$20,479
Meggan Graves	Transdermal Flunixin Pharmacokinetics and Pain Control Following Castration in Goats"	USDA NIFA	7/1/18-6/30/19	\$0	\$12,312

Investigator	Project Title	Funding Agency	Project Period	2019 Receipts	2019 Expenditures
Stephen Kania	ECEB Egyptian Scholarship Abouelkhari-Kania	Egyptian Cultural & Education	7/29/15-7/28/19	\$21,721	\$21,742
	Immune response to parasite vaccine	East Tennessee Clinical Research	5/25/16-8/30/18	\$16,982	\$8,931
	Clinical Trial of Virulence Factor Vaccine for Staphylococcus pseudintermedius Canine Pyoderma	UT Research Foundation	1/2/18-2-6/19	\$0	\$8,856
	Molecular epidemiology of methicillin-resistant Staphylococcus pseudintermedius in the United States	American Kennel Club	5/1/19-7/30/20	\$9,416	\$566
Agricola Odoi	Strengthening Agricultural Production and Regional Trade Among Women Smallholder Farmers in Tanzania	Mississippi State University	9/4/17-7/31/19	\$4,433	\$4,660
Naveen Rjasagi	Mechanisms of Herpetic Keratitis	NIH	9/30/84-12/31/20	\$336,632	\$347,007
	Impact of metabolic regulation on viral neuro-virulence	NIH	2/1/19-1/31/21	\$66,698	\$60,286
Brian Whitlock	Is orosomucoid a mechanistic link between inflammation and impaired intake during the transition period?	Kansas State University (KSU)	3/13/17-11/4/19	\$51,669	\$50,193
TOTALS				\$1,474,881	\$1,654,883

Actual, Proposed, and Requested Budget

	FY 2018-19 Actual			FY 2019-20 Proposed		
	Matching	Appropri.	Total	Matching	Appropri.	Total
Expenditures	\$167,155	\$334,311	\$501,466	\$823,380	\$1,646,759	\$2,470,139
Salaries						
Faculty	\$2,641	\$5,281	\$7,922	\$5,281.33	\$10,562.67	\$15,844
Other Professional	\$1,202	\$2,403	\$3,605	\$5,333.33	\$10,666.67	\$16,000
Clerical/ Supporting	\$22,657	\$45,314	\$67,971	\$77,748.67	\$155,497.33	\$233,246
Assistantships	\$4,100	\$8,199	\$12,299	\$7,198.00	\$14,396.00	\$21,594
Total Salaries	\$30,599	\$61,198	\$91,797	\$95,561	\$191,123	\$286,684
Longevity	\$99	\$198	\$297			
Fringe Benefits	\$4,191	\$8,383	\$12,574	\$19,096.67	\$38,193.33	\$57,290
Total Personnel	\$34,889	\$69,779	\$104,668	\$114,658	\$229,316	\$343,974
Non-Personnel						
Travel	\$2,538	\$5,077	\$7,615	\$6,247.00	\$12,494.00	\$18,741
Software	\$589	\$1,178	\$1,767			\$0
Books & Journals			\$0			\$0
Other Supplies	\$24,621	\$49,243	\$73,864	\$213,761.33	\$427,522.67	\$641,284
Equipment	\$43,113	\$86,226	\$129,339	\$264,946.67	\$529,893.33	\$794,840
Maintenance	\$12,801	\$25,601	\$38,402	\$1,400.00	\$2,800.00	\$4,200
Scholarships			\$0			\$0
Consultants			\$0			\$0
Renovation			\$0	\$166,666.67	\$333,333.33	\$500,000
Other (Specify): Rentals/ Entertainment	\$449	\$899	\$1,348			\$0
Printing/Publications/ Postage	\$2,226	\$4,453	\$6,679	\$10,666.67	\$21,333.33	\$32,000
Professional Services/ Memberships	\$1,203	\$2,407	\$3,610	\$5,333.33	\$10,666.67	\$16,000
Contract & Special Services	\$44,518	\$89,036	\$133,554	\$39,700.00	\$79,400.00	\$119,100
Computer Services	\$207	\$413	\$620			\$0
Total Non-Personnel	\$132,266	\$264,532	\$396,798	\$708,722	\$1,417,443	\$2,126,165
GRAND TOTAL	\$167,155	\$334,311	\$501,466	\$823,380	\$1,646,759	\$2,470,139
Revenue						
New State Appropriation		\$516,404	\$516,404		\$523,631	\$523,631
Carryover State Appropriation		\$971,052	\$971,052		\$1,153,145	\$1,153,145
New Matching Funds	\$258,202		\$258,202	\$261,815		\$261,815
Carryover from Previous Matching Funds	\$485,526		\$485,526	\$576,573		\$576,573
TOTAL REVENUE	\$743,728	\$1,487,456	\$2,231,184	\$838,388	\$1,676,776	\$2,515,164

	FY 2020-21 Requested		
	Matching	Appropri.	Total
Expenditures	\$289,914	\$579,829	\$869,743
Salaries			
Faculty	\$1,859.67	\$3,719.33	\$5,579
Other Professional	\$1,878.00	\$3,756.00	\$5,634
Clerical/ Supporting	\$25,756.67	\$51,513.33	\$77,270
Assistantships	\$2,534.33	\$5,068.67	\$7,603
Total Salaries	\$32,029	\$64,057	\$96,086
Longevity			
Fringe Benefits	\$6,724.00	\$13,448.00	\$20,172
Total Personnel	\$38,753	\$77,505	\$116,258
Non-Personnel			
Travel	\$2,199.67	\$4,399.33	\$6,599
Software			\$0
Books & Journals			\$0
Other Supplies	\$75,266.00	\$150,532.00	\$225,798
Equipment	\$93,288.33	\$186,576.67	\$279,865
Maintenance	\$2,112.00	\$4,224.00	\$6,336
Scholarships			\$0
Consultants			\$0
Renovation	\$58,683.67	\$117,367.33	\$176,051
Other (Specify): Rentals/ Entertainment			\$0
Printing/Publications/ Postage	\$3,755.67	\$7,511.33	\$11,267
Professional Services/ Memberships	\$1,878.00	\$3,756.00	\$5,634
Contract & Special Services	\$13,978.33	\$27,956.67	\$41,935
Computer Services			\$0
Total Non-Personnel	\$251,162	\$502,323	\$753,485
GRAND TOTAL	\$289,914	\$579,829	\$869,743
Revenue			
New State Appropriation		\$549,812	\$549,812
Carryover State Appropriation		\$30,017	\$30,017
New Matching Funds	\$274,906		\$274,906
Carryover from Previous Matching Funds	\$15,008		\$15,008
TOTAL REVENUE	\$289,914	\$579,829	\$869,743



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