



Center of Excellence
in Livestock Diseases and Human Health

2015 Annual Report

Real. Life. Solutions.

UTIA INSTITUTE OF
AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Table of Contents

1	Letter from the Dean	2
2	Our Mission	3
	Administration	3
3	Summary of Accomplishments	4
4	Program Report	6
	Introduction	6
	Personnel	6
	Funding & Expenditures	7
	Allocation of Funding	8
	Bridge Funds	8
	Start-Up Funds	9
	Infrastructure & Supplies	10
	CEMPH Research Symposium	13
	Dissemination of Research	14
	Summer Student Research Program	17
	Five-Year Benchmark Data	23
	Benchmark Summary (2011–2015)	24
	Future Plans	25
5	Faculty Reports	26
	Sara Allstadt	27
	Raúl Almeida	28
	Seung Baek	29
	Marc Caldwell	30
	Claire Cannon	31
	Maria Cekanova	32
	Madhu Dhar	33
	Shigetoshi Eda	34
	Stephen Kania & David Bemis	35
	Barry Rouse	36
	Rebecca Trout Fryxell	37
	Hwa-Chain Robert Wang	38
	Ximin Zeng	39
6	Publications & Presentations	40
7	Research Funded Externally	48

This report is produced by the University of Tennessee, College of Veterinary Medicine, Office of the Associate Dean for Research, 2407 River Dr, Rm A102, Knoxville, TN 37996-4550; 865-974-0227

https://vetmed.tennessee.edu/research/Pages/Center_of_Excelsence.aspx

Editing

Misty R. Bailey
Elizabeth Carter

Photography

Greg Hirshoren
Phil Snow

Graphic Design

Misty R. Bailey
Elizabeth Carter

Writing

Misty R. Bailey
Elizabeth Carter
Sandra Harbison
Dr. Michael McEntee
Center faculty

Special Thanks

Kimberly Campbell
Emily Dyke
Catheryn Hance
Heather Means
Kim Rutherford
Melissa Walker
Kathy Yates



1 Letter from the Dean

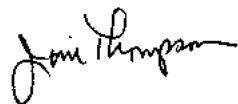
We are pleased to present the 2015 annual report for the Center of Excellence in Livestock Diseases and Human Health.

Within this report, you will see highlights of 13 faculty research projects funded by the center in fiscal year 2015. These faculty have made significant advancements in cancer biology, molecular pathophysiology, host defense, and disease transmission. Center faculty also made significant advancements in the prevention and treatment of infectious and non-infectious livestock diseases that affect agricultural productivity.

The 2015 return on investment, as the ratio of research expenditures to the state appropriation for the center, was 3.2:1. Benchmark data are also included for fiscal years 2011–2015.

Center faculty continue to garner national and international recognition for their research and scholarship. During calendar year 2014, center faculty published 43 peer-reviewed articles and gave 34 presentations at regional, national, and international meetings.

Despite increased fiscal challenges faced by our center faculty, we are extremely 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

2 Our Mission

- Promote interdisciplinary activities designed to improve the quality of human life through better animal health
- Expand livestock disease research capabilities in the College of Veterinary Medicine (UTCVM) and the Institute of Agriculture
- Identify and characterize animal diseases that are similar to human diseases
- Develop new strategies for the diagnosis, treatment, and prevention of disease

Administration

Associate Dean for Research

Dr. Michael McEntee

Dean, College of Veterinary Medicine

Dr. Jim Thompson

Chancellor, Institute of Agriculture

Dr. Larry Arrington

The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, gender identity, age, physical or mental disability, or covered veteran status.

Pub. # E180103-00-002-16

3 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 (p. 27–39).

During the 2014 calendar year, the 14 center faculty averaged three peer-reviewed publications (43 total) and two presentations at prestigious national and international meetings (27 total).

Benchmark	2015 (14 faculty)	2014 (15 faculty)
	<i>n</i> *	<i>n</i> †
Publications	83	114
Peer-reviewed articles	43	51
Books/chapters/other	1	0
Abstracts or posters	39	63
Presentations	34	102
International	19	21
National	8	42
State or local	7	39
Research monies		
External funding	\$2,643,146	\$3,042,651
Research expenditures	\$1,632,146	\$2,360,916
Return on investment	3.2:1	4.5:1

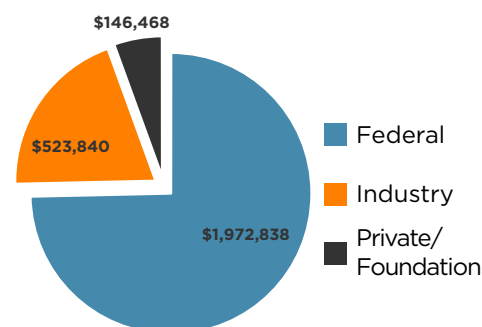


Fig. 1. FY 15 external funding by source.

*Publication and presentation numbers based on 2014 calendar year; research monies based on 2015 fiscal year.

†Publication and presentation numbers based on 2013 calendar year; research monies based on 2014 fiscal year.

Figure 2 shows the number of times the publications of 2015 center faculty have been cited by others over the last five calendar years. These numbers tell us that scientists worldwide have evaluated center faculty work positively 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. On average, each publication of these 14 center faculty has been cited 15.65 times.

The average h-index for 2015 faculty is 18.1 (last 20 years). The h-index is a metric to measure productivity and citation impact of the publications of a scientist. The index is based on the set of the investigator's most cited papers and the number of citations that the investigator has received in other publications. Therefore, an h-index of 18.1 means that center faculty, on average, have at least 18 publications that have been cited at least 18 times each.

Particularly noteworthy articles in 2014 were by Drs. Seung Baek and Shigetoshi Eda. Dr. Baek published articles in the journals *Cancer Letters* and *Free Radical Biology and Medicine*. Dr. Eda's work was published in *Biosensors and Bioelectronics*. These journals all have an impact factor above 5.5. 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. See Publications and Presentations (pp. 40–47) for more details.

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 returned \$3.20 in external funding. External funding totaled \$2,643,146 this year, while expenditures for the year were \$1,632,146. The funding includes new, multi-year awards for Drs. Sara Allstadt, Marc Caldwell, Maria Cekanova, Barry Rouse, and Hwa-Chain Robert Wang, totaling \$1,066,905, and new 1-year awards for Drs. David Bemis, Caldwell, Cekanova, and Stephen Kania, totaling \$501,150. See "Research Funded Externally" and "Research Expenditures" on p. 7 for the fiscal year 2015 data summary.

External Funding:
\$2,643,146
New Grants:
\$1,568,055

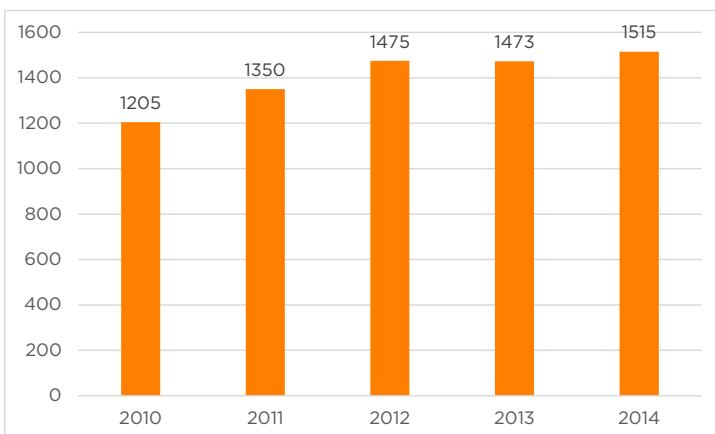


Fig 2. Number of times publications by 2015 center faculty were cited by others from calendar year 2010 to 2014 (Source: Web of Science; all publications since 1997).

4 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, toxicology, host defense, molecular 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 director of the center since October 1, 2012. Dr. Reza Seddighi chaired the Research Advisory Committee responsible for selecting 2015 funded proposals. Ms. Kim Rutherford oversees submissions of faculty proposals for funds, and Ms. Misty Bailey produces the annual report.



Clockwise from top left: Seddighi, Rutherford, Bailey



Center director, Dr. Michael McEntee

Funding & Expenditures

Research Funded* Externally FY 2015

Investigator	Federal	Industry	Foundation/ Private	Total
Allstadt, Sara			\$126,468	\$126,468
Almeida, Raul	\$541,000	\$49,585		\$590,585
Bemis, David		\$15,000		\$15,000
Caldwell, Marc	\$45,466	\$206,271		\$251,737
Cekanova, Maria	\$414,939	\$247,984		\$662,923
Kania, Stephen		\$5,000		\$5,000
Rouse, Barry	\$817,114			\$817,114
Trout Fryxell, Rebecca			\$20,000	\$20,000
Wang, Hwa-Chain Robert	\$154,319			\$154,319
Totals	\$1,972,838	\$523,840	\$146,468	\$2,643,146

*Represents FY 2015 receipts for active grants.

Research Expenditures FY 2015

Investigator	Federal	Industry	Foundation/ Private	International	Total
Allstadt, Sara			\$703		\$703
Almeida, Raul	\$232,732	\$189,995			\$422,727
Baek, Seung			\$5,304		\$5,304
Bemis, David		\$4,734			\$4,734
Caldwell, Marc	\$26,895	\$5,086			\$31,981
Cekanova, Maria	\$93,114	\$144,082	\$4,820		\$242,016
Dhar, Madhu		\$20,325	\$11,372	\$14,227	\$45,924
Eda, Shigetoshi		\$2,785			\$2,785
Kania, Stephen		\$4,490	\$4,358		\$8,848
Rouse, Barry	\$702,889				\$702,889
Trout Fryxell, Rebecca		\$336	\$7,450		\$7,786
Wang, Hwa-Chain Robert	\$155,979		\$473		\$156,452
Totals	\$1,211,609	\$371,832	\$34,478	\$14,227	\$1,632,146

Criteria for Funding

Scientific merit

Potential to
lead to external
funding

Relevance to
the center's
objectives

Allocation of Funding

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. 27–39), have research interests in line with center objectives and a strong history of securing external funding using center funds. Junior members are those who have received seed money or bridge funding or are new faculty who have received start-up funds. Junior members are expected to actively pursue and eventually secure external 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

Bridge Funds

major externally-secured awards. Such funds are important and necessary on occasion for any academic researcher, but particularly now because of the national trend of low funding success rates. For example, in 2014, applicants for R series research grants (allowable direct cost per year at \$50,000 to \$500,000) at the National Cancer Institute had a 14.1% overall funding success rate. In other words, for every 100 grant proposals that are submitted, only about 14 are funded.

During fiscal year 2015, the center provided bridge funding to support Dr. Hwa-Chain Robert Wang while he pursued additional sources of external funding.

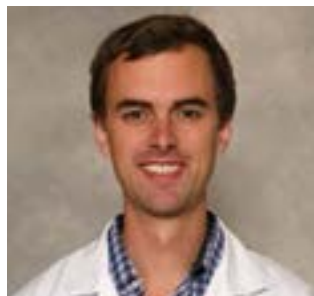
Bridge funds are short-term grants that serve as a bridge at times when scientists are in between

Start-Up Funds

The center provided \$80,834 in start-up funds for 13 junior faculty members to secure additional funding in 2015. Their research areas are described below.



Dr. Sara Allstadt
Effects of specific drugs to treat canine cancers
\$5,000



Dr. Jeffrey Biskup
Soft tissue and orthopedic surgery, minimally invasive techniques
\$6,667



Dr. Marc Caldwell
Production animal medicine, infectious diseases of livestock
\$8,333



Dr. Claire Cannon
Targeted therapies for canine osteosarcoma and feline oral squamous cell carcinoma
\$8,334



Dr. Richard Gerhold
Wildlife parasitology, including *Trichomonas gallinae* in birds
\$10,000



Dr. Luca Giori
Validating and establishing reference intervals for hormones in healthy alpacas, dogs, and horses
\$7,500



Dr. Amy Hodshon
Investigating the role of infection in chronic intervertebral disc herniations in dogs
\$5,000



Dr. Elizabeth May
Bacterial skin & ear infections, staphylococcal bacteria and mechanisms of resistance, coat disorders in Schipperkes
\$5,000



Dr. Deanna Schaefer
Red blood cells in health & disease, iron deficiency & metabolism, & analytical methods for red blood cell evaluation
\$5,000



Dr. John Schaefer
Diagnostic techniques for toxoplasmosis, a zoonotic disease of risk to pregnant & immunocompromised individuals
\$5,000



Dr. Olya Smrkovski
Immunomodulatory properties of the tyrosine kinase inhibitor masitinib in dogs with mast cell tumors
\$5,000



Dr. Mee-Ja Sula
Ear, reproductive, and naturally-occurring diseases
\$5,000



Dr. Katherine Tolbert
Feline gastrointestinal disease as a translational model for human disease
\$5,000

Infrastructure & 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. In support of the UTCVM's research enterprise in 2015, the center funded the purchase and installation of a **biosafety cabinet** (\$11,000) to update the Large Animal Clinical Sciences Laboratory (LACS) to biosafety level 2. Biosafety levels are set by the Centers for Disease Control and indicate the degree of protection provided to personnel, the environment, and the community. A level-2 laboratory builds upon level-1 and is suitable for work involving agents that pose moderate hazards to personnel and the environment. The addition of the biosafety cabinet insures that all procedures in which infectious aerosols or splashes may be created are physically contained.

The multi-purpose, multi-investigator LACS lab is dedicated to the study of equine and livestock health. Current research initiatives ongoing in that lab include equine and ruminant regenerative medicine, ruminant neuroendocrinology, equine lameness, and assessment and mitigation of pain in cattle.

Additionally, \$24,000 was used to purchase an **ultra-high resolution real-time location system** for the study of cattle health, behavior, and social interaction. When combined with computational analysis and modeling techniques, the data produced by this system reveal how animals use pen





locations, feed, and water, as well as develop and maintain social networks, without the imposition of human observers. This information can then be used to understand how the contact network between cattle influences their susceptibility to infectious diseases, and to understand how stress, pain, or disease influences the level of interaction with pen mates.

Also for livestock research, a small, **refrigeration-capable centrifuge** was purchased (\$5,864) so that clinical field services could use the equipment on-site to spin plasma samples collected for sensitive assays (for example, pain markers in cattle). Food animal researchers like Drs. Brian Whitlock and Marc Caldwell are benefitting from the convenience and reliability this machine allows. This same group of researchers is using a **semi-flexible endoscope**, also purchased with center funds (\$3,243), for investigating respiratory pathogens in cattle.

For a **microplate reader** to benefit oncology research, the center provided \$7,500. The equipment is used to assess the responses of cancer cells to various chemotherapeutic drugs to better predict the appropriate therapy to use in a patient. Such results allow for personalized treatment options, and preliminary results in dogs with osteosarcoma have been promising. The microplate reader benefits Dr. Maria Cekanova and facilitates translational studies conducted by the clinical oncology service at the College of Veterinary Medicine.

Also for oncology, the center helped purchase spectroscopy software (\$22,500) that performs **single voxel spectroscopy**, a technique used to produce images of tumors in the brain and other locations of the body. Specifically, the equipment helps clinicians to predict survival times, diagnose and classify muscle lesions, diagnose pancreatic cancer, and assess renal function. This software will benefit not only translational research by college oncologists, but also radiologists and internists.

For immunology research, the center purchased two microscopes. The **stereoscopic microscope** (\$1,207) is a dissecting microscope designed for low magnification observation of a sample. It has an attached camera and corresponding software to capture images of sections of tissues. The **hand-held slit lamp microscope** (\$19,735) is used by Dr. Barry Rouse for observing the eyes of mice to record disease progression and severity as related to herpes stromal keratitis.

A **flow cytometer** was purchased (\$20,000) to replace a defunct machine that had been used for research by Drs. Mei-Zhen Cui, David Bemis, Stephen Kania, Melissa Kennedy, and Hwa-Chain Robert Wang, as well as for diagnostic purposes in support of clinical studies. Flow cytometry is a technology used to count specific cell types and detect biomarkers that have been suspended in a fluid as that fluid passes through a laser. To learn more about how flow cytometry works, see below.

Lastly, a **rota rod** was purchased (\$6,500) to test muscle strength in an animal model of induced amyotrophic lateral sclerosis (ALS) disease, otherwise known as Lou Gehrig's disease. A rota rod will allow members of the cell biology and biopathology laboratories to determine the amount of neurodegeneration occurring in nerve cells in the brain and spinal cord by measuring and recording the progressive atrophy of muscles.

Maintenance (\$2,869) for tests and certification for two hoods in the **Tumor Biology Laboratory** (TBL) was supported by the center, as were supplies (\$4,072) for experiments run in the same laboratory. The TBL is used mostly by Drs. Madhu Dhar and David Anderson for their ongoing studies in regenerative medicine and adult mesenchymal stem cells. Additionally, the center funded TBL cell sorter service for the experiments of Drs. Louisa Rispoli (Animal Science) and Dhar (Large Animal Clinical Sciences), and doctoral students Sid Bhela, Fernanda Gimenez, Ujjaldeep Jaggi (Comparative and Experimental Medicine), and Karthik Varanasi (Genome Science and Technology). Dr. Maria Cekanova also uses the laboratory's equipment.

For Dr. Rouse's research, the center supported the repair of a **photomicroscope** (\$7,500). This microscope is used to quantify the amount of inflammation that occurs in the cornea of the eye following herpes simplex virus infection. This method is the most reliable, objective, and precise instrument to measure inflammation and is a necessity for the success of Dr. Rouse's research.



The center also gave \$150 toward printing of a poster that was presented at the American Society for Microbiology General Meeting (presenter Caroline Grunenwald—see p. 15 for more information).

To learn more about how flow cytometry works, visit http://unsolvedmysteries.oregonstate.edu/flow_o6.



Comparative & Experimental Medicine and Public Health Research Symposium

The center was a major sponsor of the Comparative & Experimental Medicine and Public Health Research Symposium, which brought together researchers from 16 different departments for a 2-day-long event that included special seminars on One Health, as well as the health risks of sedentary behavior and strategies to increase participation in the “stand-up” movement.

Featured was Dr. Carolyn J. Henry, professor of oncology and associate dean for research and graduate studies at the University of Missouri College of Veterinary Medicine. Also featured was Dr. Dale S. Bond, associate professor of psychiatry and human behavior at the Miriam Hospital and Alpert Medical School, Brown University. The symposium culminated with an awards reception.

Thirty-four researchers from the Institute of Agriculture presented talks, including heavy participation by members of the Biomedical and Diagnostic Sciences and Small Animal Clinical Sciences departments. They were among 45 new scientists to present, and at the end of the 2 days, the institute was able to boast five winners of travel awards in recognition for the quality of their presentations.

The center sponsored two of the 2014 award winners to present at two national scientific meetings during fiscal year 2015. Carolyn Grunenwald presented her research at the American Society for Microbiology General Meeting in New Orleans, and Doree Lynn Gardner presented at the American College of Sports Medicine Annual Meeting in San Diego.

The symposium was designed to allow sharing of research results, promote collaboration, and provide new investigators meeting-format experience via 10-minute presentations, with 5 minutes for questions from the audience. It remains an entirely unique, cross-campus, cross-disciplinary venue for presenting new research data on the Knoxville campuses of the university.

Dissemination of Research

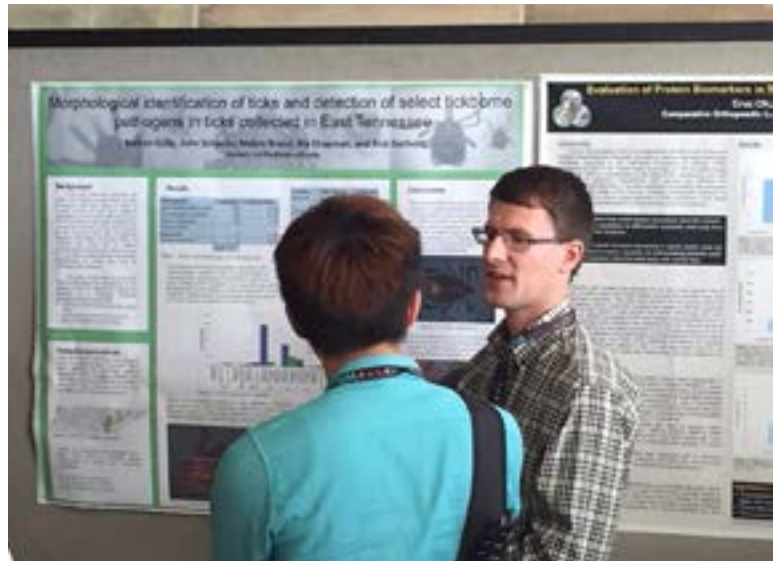
Faculty are encouraged to share their research via speaking engagements for professional groups, community groups, and civic groups. A complete list of faculty publications and presentations for the 2014 calendar year can be found in the Publications and Presentations section (pp. 40–47).

Through scientific conferences, Center of Excellence faculty share their research with a worldwide audience. The map below showcases where center faculty research was presented in 2014.



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 fiscal year 2015, the center funded four individuals (\$3,372), as outlined below.

Caroline Grunenwald presented her research as a poster at the American Society for Microbiology General Meeting in New Orleans in May 2015. Grunenwald is a PhD student studying Microbiology with Dr. Chunlei Su, associate professor in the Microbiology Department, and Dr. Richard Gerhold, assistant professor in the Biomedical and Diagnostic Sciences Department. Her travel was funded through an award given at the 2014 Comparative & Experimental Medicine and Public Health Research (CEMPH) Symposium.



Also a travel award winner from the CEMPH Symposium, **Dr. Samantha Parkinson** presented her research project, “Efficacy of orally administered acid suppressants in cats,” in March 2015, at the Comparative Gastroenterology Society Annual Conference in Placencia, Belize. Parkinson is a veterinary resident in the Small Animal Clinical Sciences Department.

Doree Lynn Gardner gave a poster presentation at the American College of Sports Medicine Annual Meeting. The meeting was held in San Diego in May 2015. Gardner’s abstract was titled “Oxygen consumption, physiological responses, and perceptions of two prenatal yoga DVD programs.” She is a graduate student in the Department of Kinesiology, Recreation and Sports Studies and is being mentored by Dr. Dawn Coe in the same department. Gardner was also a travel award winner at the 2014 CEMPH Symposium.

In addition, **Nathan Crilly**, a 2015 member of the Summer Student Research Program, attended and presented a poster at the Merial Veterinary Scholars Program 2015 Symposium at the University of California, Davis. His poster, entitled “Morphological identification of ticks and detection of select tickborne pathogens in East Tennessee,” is shown above.



Dr. Elizabeth May talks to the local ABC affiliate (WATE). Center faculty are often sought to provide expert advice to the East Tennessee community.

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 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 2015, the Facebook page had 5,859 "likes" from individuals from 45 different countries. Page administrators post clinical and research information for users. 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 presented. UTCVM is also on Twitter (2,684 followers), has a YouTube channel with 241 subscribers and 33,935 views since its inception in 2012, and a Pinterest presence with 188 followers. The Instagram account has 58 followers.

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





Leanne Fowler (R) with Dr. Dianne Mawby in the small animal intensive care unit

Summer Student Research Program

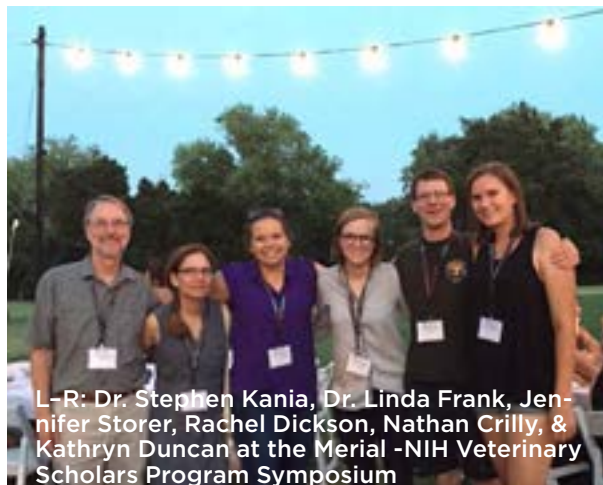
In an effort to foster interest in careers in biomedical research and enhance appreciation for scientific investigation, inquiry, and the acquisition of new knowledge, the center once again helped provide opportunities for veterinary students to do research at the UTCVM.

Twenty-one 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 52 peer-reviewed research articles.

The center fully funded 17 student salaries for the Summer Student Research Program. A grant from Merial partially funded two students (Rachel Dickson and Nathan Crilly), Morris Animal Foundation sponsored one student (Riley Thompson), and two grants from the American Veterinary Medical Foundation (AVMF) funded one student (Jennifer Storer) and assisted with her travel expenses to the 2015 Merial-NIH Veterinary Scholars Program Symposium at the University of California, Davis. Three more center-sponsored students (Julie Barnes, Crilly, and Dickson) attended the symposium, as well. 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 2015, four senior center faculty and four junior members participated in the program. The center will continue to encourage participation of its faculty interested in mentoring DVM students.

Summer Student Research Program



L-R: Dr. Stephen Kania, Dr. Linda Frank, Jennifer Storer, Rachel Dickson, Nathan Crilly, & Kathryn Duncan at the Merial -NIH Veterinary Scholars Program Symposium

Jessica Anne Baxter

Heiskell, TN • 2nd-year • BS, Animal Science, University of Tennessee, Knoxville • Faculty mentor: **Dr. Rebecca Trout Fryxell**

Summer Project: Trapped small mammals in Knox County, TN, and collected blood and ectoparasites to screen for diseases that can be transmitted to humans and the prevalence of these diseases. **Career Interests:** Large and small animal practice and veterinary research.

Julia Berger

Boca Raton, FL • 2nd-year • BS, Biology (Minor, Anthropology), University of Florida, Gainesville, FL • Faculty mentor: **Dr. Debra Miller**

Summer Project: Extracted blood from immature loggerhead turtles to run Western blot assays to check for the presence of a sex-determining protein (SOX9) in the blood. **Career Interests:** Small animal practice.

Ellen Camp

Louisville, KY • 3rd-year • BBA, Entrepreneurship, Belmont University, Nashville, TN • Faculty mentor: **Dr. Darryl Millis**

Summer Project: Studied the effects of exercise on pet dogs, particularly the cardiovascular response when dogs exercise on a ground treadmill, an underwater treadmill, and in a pool. Collect cardiovascular parameters, such as heart rate, systolic, diastolic, and mean arterial blood pressure; respiratory rate; and body temperature in dogs during exercise. The goal is to develop safe cardiovascular parameters when prescribing exercise for pet dogs. **Career Interests:** Small animal orthopedics and physical rehabilitation.

Casey Clements

Cary, NC • 2nd-year • BS, Biology and BA, Chemistry (Minor, Geography), University of North Carolina at Chapel Hill, Chapel Hill, NC • Faculty mentor: **Dr. Katherine Tolbert**

Summer Project: Studied the effects of long-term omeprazole (main Prilosec ingredient) administration on feline electrolyte and bone homeostasis. Analyzed serum electrolyte values and bone mineral density/content after 60 days of placebo and omeprazole administration. **Career Interests:** Small animal emergency and critical care medicine.

Nathan Crilly

Knoxville, TN • 2nd-year • BS, Food Science and Technology, University of Tennessee, Knoxville, Knoxville, TN • Faculty mentor: **Dr. Richard Gerhold**

Summer Project: Identified ticks collected from across East Tennessee to determine distribution of tickborne pathogens, including *Cytauxzoon felis*, *Borrelia burgdorferi*, and *Rickettsia rickettsii*. **Career Interests:** Parasitology, pathology, virology.

Rachel Dickson

Knoxville, TN • 2nd-year • BS, Chemical Engineering (Minor, Chemistry), University of Tennessee, Knoxville, TN • Faculty mentor: **Dr. Darryl Millis**

Summer Project: Evaluated cardiovascular parameters, such as blood pressure and heart rate, in normal pet

dogs during exercise. Exercise modalities being evaluated were the ground treadmill, underwater treadmill, and swimming pool. The goal of the project is to develop a safe range of cardiovascular parameters during exercise to aid in design of exercise or rehabilitation programs for the average dog. **Career Interests:** Veterinary cardiology, ophthalmology, and small animal internal medicine.

Kathryn Duncan

Knoxville, TN • 2nd-year • BS, Animal Science, University of Tennessee, Knoxville • Faculty mentor: **Dr. Richard Gerhold**

Summer Project: Identified gastrointestinal parasitic worms found within Tennessee wild turkeys. The goal is to understand the prevalence of these worms in local wild turkey populations and possibly gain insight into declining wild turkey populations in Middle Tennessee. **Career Interests:** Academia, laboratory animal medicine, diagnostic/biomedical medicine, veterinary research.

Leanne Fowler

Johnson City, TN • 2nd-year • BS, Animal Science, University of Tennessee, Knoxville • Faculty mentor: **Dr. Dianne Mawby**

Summer Project: Determined pharmacokinetics of the anti-fungal drug posaconazole, as well as the pharmacokinetics and bioavailability of brand name and compounded anti-fungal itraconazole in cats. Looked at how long these antifungals last in the cat's body, the absorption of different formulations, and the efficacy of compounded antifungals compared to brand name. **Career Interests:** Equine, internal, and alternative medicine.



Monica Rawson collects bone marrow to isolate adult stem cells



COE Summer students on a behind-the-scenes trip to the Knoxville Zoo

Elizabeth Franklin

Fletcher, NC • 2nd-year • BS, Biology (Minor, Psychology), High Point University, High Point, NC • Faculty mentor: **Dr. Stephen Kania**

Summer Project: Worked toward sequencing the CMAH enzyme gene in exotic felids and comparing the sequences to the blood types of the exotic cats and to results in domestic species. Collected samples, extracted DNA and RNA, created cDNA, ran polymerase chain reactions and gels for electrophoresis, and sent samples for gene sequencing. **Career Interests:** Equine, internal, and alternative medicine.

Canny Fung

Brooklyn, NY • 2nd-year • BA, Biology (Minor, Mathematics), Hunter College, New York, NY • Faculty mentor: **Dr. Melissa Kennedy**

Summer Project: Performed polymerase chain reactions on DNA samples collected between 2012 and 2014 from Zimbabwe communal dogs. The products were then amplified and sequenced to be analyzed to determine the presence and species of *Ehrlichia* and the prevalence of ehrlichiosis. **Career Interests:** Small animal surgery, nutrition, academic research.

Jessie Gammel-Kolodney

Denver, CO • 3rd-year • BS, Psychology (Minor, Biology/Neuroscience), Ursinus College, Collegeville, PA • Faculty mentor: **Dr. Zenithson Ng**

Summer Project: Examined the effects of human-animal interactions on the amount of drug needed to sedate children in the hematology oncology ward at the East Tennessee Children's Hospital. Children about to undergo anesthesia either interact with a therapy dog 10 minutes prior to being anesthetized or play on an iPad for those 10 minutes. The goal is to determine if children interacting with a dog are less anxious and require less medication to become sedate. **Career Interests:** Small animal general practice/internal medicine.

Katrina Gazzi

Lititz, PA • 3rd-year • BS, Biology (Minor, Psychology), Allegheny College, Meadville, PA • Faculty mentor: **Dr. Michael Jones**

Summer Project: Observed bald eagles to determine if they were left- or right-footed. Footedness is an indication of brain lateralization—the two halves of the brain are not exactly alike. Determining which side their cerebral cortex prefers can be extrapolated to indicate prey/predator interactions. **Career Interests:** Avian and small animal medicine.

Allison Graham

Chicago, IL • 2nd-year • BS, Biology (Minor, Environmental Science), University of Wisconsin-Madison, Madison, WI • Faculty mentor: **Dr. Debra Miller**

Summer Project: Ran multiple experiments in several species of frogs to determine the impact of ranavirus. Tested the impact of four herbicides on four amphibian species. The goal was to see if aquatic- and terrestrial-approved herbicides used at observed and recommended concentrations had an effect on amphibian mortality rates. **Career Interests:** Wildlife medicine.

Alyssa Helms

Old Hickory, TN • 2nd-year • BS, Animal Science (Minor, Environmental Science), University of Tennessee, Knoxville, Knoxville, TN • Faculty mentor: **Dr. Amy Hodshon**

Summer Project: Surveyed former clients to determine if a dog's physical activity has any effect on the rate of recurrence of clinical signs of intervertebral disk disease. **Career Interests:** Small animal medicine.

Jennifer Howard

Cincinnati, OH • 2nd-year • BS, Biology (Minor, Chemistry), Northern Kentucky University, Highland Heights, KY • Faculty mentor: **Dr. Debra Miller & Dr. Matthew Gray**

Summer Project: Tested the susceptibility of Eastern Hellbenders to ranavirus, chytrid fungus, and glyphosate herbicide. **Career Interests:** Wildlife and exotic, large animal, and small animal medicine.

Emily Liles

Escondido, CA • 3rd-year • BS, Biology, San Diego State University, San Diego, CA • Faculty mentor: **Dr. Joseph Weigel**

Summer Project: Determined if a new human movement analysis application developed for the iPad can be used in dogs. The app was compared to the gold standard kinematics machine that is currently used. The app can measure elbow joint angles as well as the gold standard. Further testing will be done on other joints. **Career Interests:** Surgery with a focus in orthopedics.

Monica Rawson

Memphis, TN • 2nd-year • BS, Biomedical Engineering (Minors, Chemistry & Biology), University of Memphis, Memphis, TN • Faculty mentor: **Dr. Madhu Dhar**

Summer Project: Performed in vitro adult mesenchymal stem cell culture using proliferation and differentiation assays. Collected cells from synovial fluid and bone marrow from goat and horse donors. Examined migration of stem cells in a horse animal model. **Career Interests:** Animal models of human disease, translational medicine research.

Dayton Schleicher

Gallatin, TN • 2nd-year • BS, Animal Science, Auburn University, Auburn, AL • Faculty mentor: **Dr. Marc Caldwell**

Summer Project: Tested the effects of a nonsteroidal anti-inflammatory drug on calves with shipping fever, a common and costly disease in calves sold for beef production. The goal is to gain knowledge about the effectiveness of this drug for managing bovine respiratory disease. **Career Interests:** Mixed-animal practice, pathology, public health.



Kathryn Duncan examines parasites collected from wild turkeys

Kelsey Smith

Baxter, TN • 2nd-year • BS, Animal Science, Tennessee Technological University, Cookeville, TN • Faculty mentor: **Dr. Julia Albright**

Summer Project: Worked to determine the effects of environmental noise pollution on effective sedation of dogs. Investigated animal behavior in the veterinary clinic and looked into animal-assisted interventions for children requiring sedation for treatment in the hematology/oncology unit of East Tennessee Children's Hospital (with Dr. Zenithson Ng). **Career Interests:** Large animal and equine medicine.

Jennifer Storer

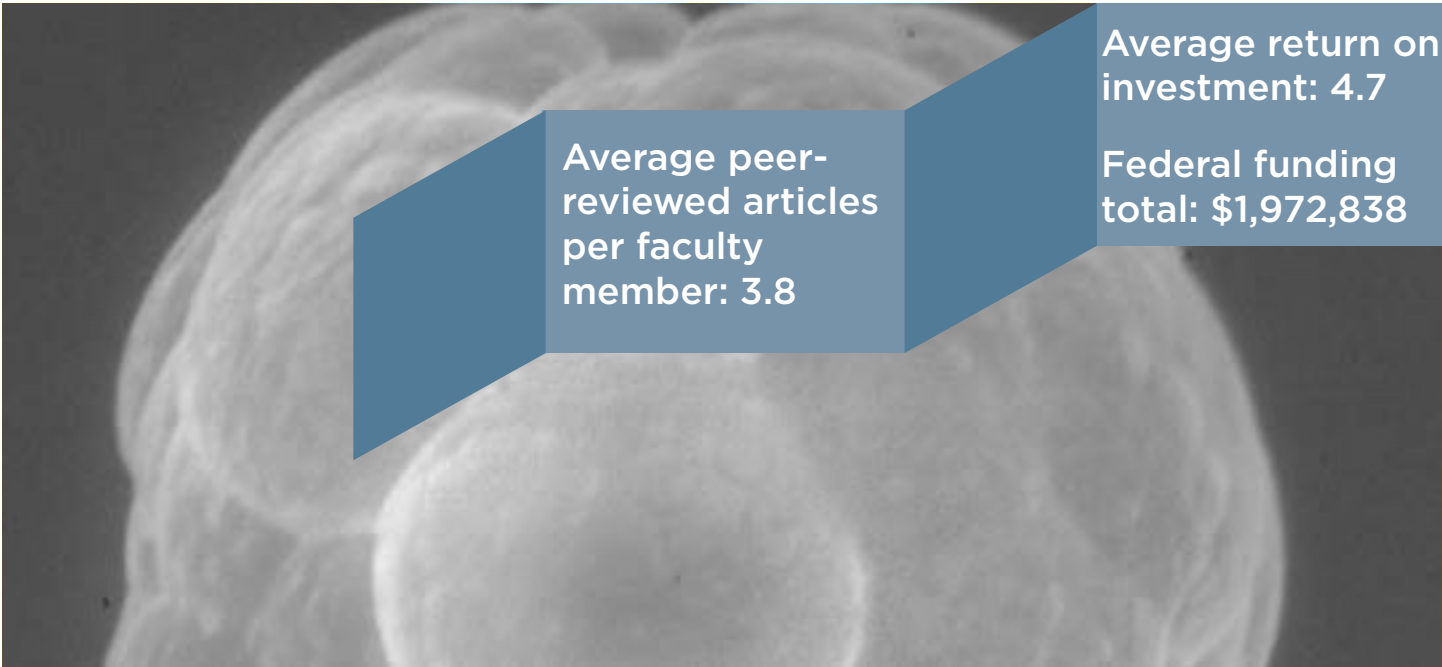
Fayetteville, TN • 3rd-year • BS, Animal Science, Ecology & Evolutionary Biology, University of Tennessee, Knoxville, Knoxville, TN • Faculty mentor: **Dr. Marc Caldwell**

Summer Project: Assessed the effects of nonsteroidal anti-inflammatory drugs in beef calves with pneumonia resulting from the most common bacterial pathogen in bovine respiratory disease: *Mannheimia haemolytica*. Used continuous data loggers to determine lying or standing behavior, the amount of feed eaten per day per calf, and where the calves were in relation to each other in the pens. These systems will allow for better observation and interpretation of the behavioral, clinical, and performance outcomes in affected calves. **Career Interests:** Food animal medicine, respiratory diseases, herd health management.

Christopher Brock Warren

Chattanooga, TN • 3rd-year • BS, Wildlife and Fisheries Management, Mississippi State University, Starkville, MS • Faculty mentor: **Dr. Debra Miller & Dr. Brian Alford**

Summer Project: Investigated a condition called intersex in fish in the upper branches of the Tennessee River. The condition causes gonadal changes in fish because of pollutants in the water from sources like wastewater treatment plants and agricultural runoff. This study was to partly determine prevalence of intersex in these rivers and to compare sections of the river that are considered less polluted to sections that are more polluted. Fish were caught and dissected in the field, and then histology was performed in the lab. **Career Interests:** Mixed-animal practice, public health with a focus on wildlife disease.



Five-Year Benchmark Data (2011–2015)

Productivity among center faculty has been stable during the last 5-year period. From 2011–2015, center faculty published 243 articles in peer-reviewed journals and gave 224 presentations at national and international meetings.

Total research funding was down from \$5,401,346 in 2011 to \$2,643,146 in 2015 (Figs. 3 & 4). Figure 3 shows federal funding from 2011–2015.

Expenditures per faculty member were \$116,582 in FY 2015. Over the past 5 years, the mean expenditure amount per faculty member has been \$180,183. The 5-year average return on the state’s investment in the center is 4.7:1, the ratio of research expenditures to the state’s appropriation. For comparison, benchmark data from 2011–2015 are summarized in Figs. 3–5.

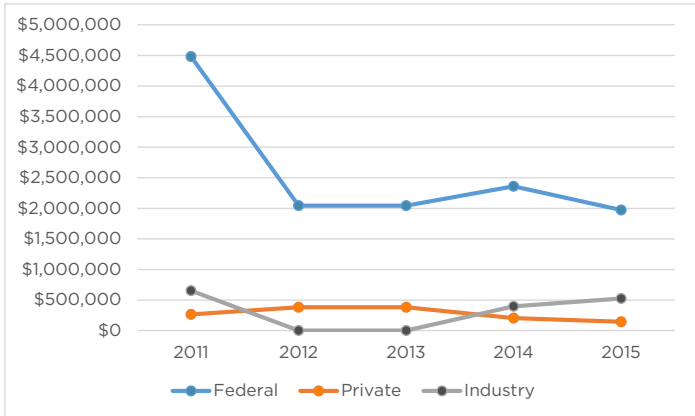


Fig. 3. Top Three External Funding Categories (FY 2011–2015)

Benchmark Summary (2011–2015)

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 fiscal year 2015 and, in particular, our more junior members, which bodes well for renewed growth of external funding coming into our center. The UTCVM will continue to look for new 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 greater technical grant writing assistance.

Fig. 4. External Funding by Source (FY 2011–2015)

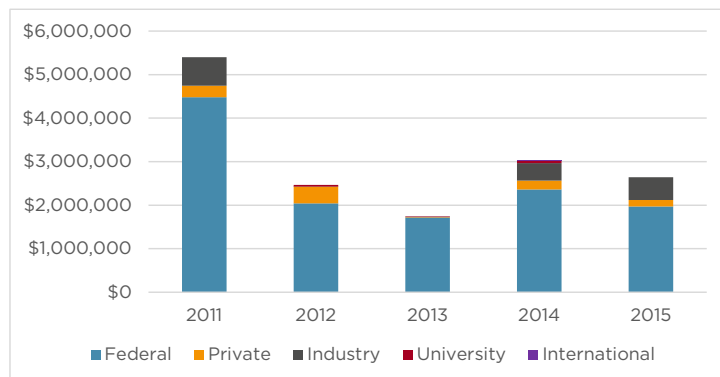
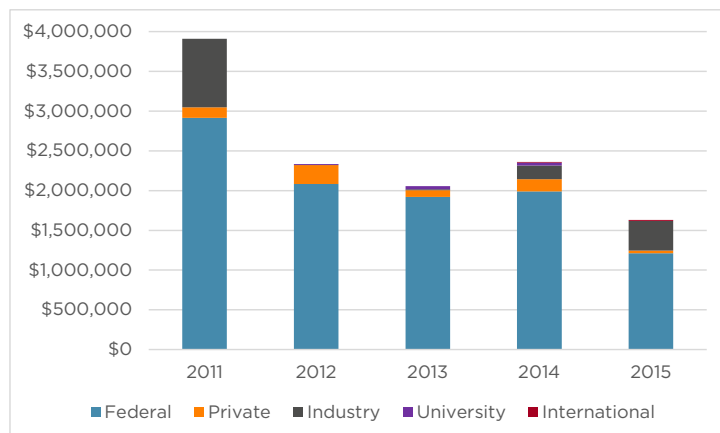


Fig. 5. Research Expenditures by Source (FY 2011–2015)





Future Plans: Looking Forward

With stagnation of research funding in recent years (federal, foundations, etc), center faculty members have experienced increased competition for fewer dollars with a consequent reduction in extramural funding for their programs; this has been true across the entire country. While center funding has been proven to be extremely valuable in growing our programs over the years, this support is arguably even more critical now in maintaining faculty research and program momentum. We are confident that declines in national funding will be reversed, and until then, the center will continue to position our members for this eventuality by helping them generate essential new data with operational support and new/updated equipment and facilities.

Collaboration is essential in attracting funding to address research problems that encompass diverse disciplines ranging from the laboratory bench to clinical application, and ranging from mathematics to systems biology and biochemistry. It has become much more difficult for individual investigators to thrive in isolation. To help address this, the dean of the College of Veterinary Medicine is working with the director of Gluck Equine Research Center at the University of Kentucky (<http://www2.ca.uky.edu/gluck/index.htm>) to arrange a trip to Lexington for UT faculty and students; this meeting is expected to facilitate collaboration between our respective institutions. Areas of mutual research interest include immunology/inflammation, infectious diseases (bacteriology, virology, parasitology), reproduction, musculoskeletal disease, pharmacology, and epidemiology. The Gluck faculty has extensive experience in these areas of equine research with the associated resources that could prove invaluable to our UT faculty, who bring their own expertise and resources to the table in establishing mutually beneficial collaborative relationships.

Along the same lines, but closer to home, center faculty members are working with directors of the Genome Science and Technology graduate program on the UT Knoxville campus to craft a joint training grant for submission to NIH for graduate student support. This grant award would raise our research profile across the board with enhancement of research credibility of the center, paving the way for additional training and research grants, and in facilitation of increased collaboration between center faculty members and other UT researchers. There remains a significant untapped wealth of expertise on the Knoxville campus that only requires greater interactions to build productive and sustained collaborative partnerships.

5 Faculty Reports

Dr. Sara Allstadt

Assistant Professor
Small Animal Clinical Sciences

Oncolytic viruses: Cancer's headache?

**About Dr. Allstadt:**

- DVM, Auburn University
- Supported by Morris Animal Foundation (FY2015 = \$126,468)
- 3 publications & 1 presentation in 2014

Collaborators: Federica Morandi, Amy K. LeBlanc (NIH National Cancer Institute), Shruthi Naik (Mayo Clinic)

Many common canine cancers are recognized models for human disease. Management of these cancers typically involves combinations of chemotherapy, surgery, and/or radiation therapy. In dogs and humans, these treatments are often expensive and may cause diminished quality of life.

Using viruses to kill cancer cells, known as oncolytic virotherapy, is a promising anticancer strategy. In a collaboration with the Mayo Clinic and the NIH National Cancer Institute, Dr. Allstadt is studying oncolytic viruses as anticancer tools in dogs toward advancing the field for human cancer studies. Specifically, she is examining the use of a novel strain of vesicular stomatitis virus in naturally-occurring canine cancers in client-owned dogs.

Her short-term goal is to determine the safety of repeated dosing and the effectiveness of the treatment. Long-term, Dr. Allstadt hopes the results from these studies in dogs will translate to human cancers.

Helping the cow help itself



About Dr. Almeida:

- MVD (DVM equivalent), Universidad del Litoral (Argentina)
- MSc, PhD, Iowa State University
- Supported by USDA Agriculture and Food Research Initiative & private industry (FY2015: \$590,585)
- 2 publications & 5 presentations in 2014

Collaborators: Oudessa Kerro-Dego, Stephen Kania

Development of an effective, low-cost vaccine to prevent *Streptococcus uberis* mastitis—a painful swelling of the udders that affects milk quality in dairy cattle—has been the ultimate goal for Dr. Raul Almeida’s research laboratory.

Mastitis caused by the bacterium *S. uberis* has been difficult to control once it is established. *S. uberis* is prevalent in the environment and has several characteristics that make it difficult to eradicate. These characteristics, known as virulence factors, facilitate the ability of *S. uberis* to cause disease.

Preliminary vaccination results in Dr. Almeida’s lab have been promising: the vaccination has decreased the number of *S. uberis* bacteria found in milk and decreased the number of infected mammary quarters compared to unvaccinated cows. This preliminary data has allowed him to narrow his focus to the involvement of bacterial surface proteins.

In his latest project, Almeida is analyzing three *S. uberis* surface proteins that have not yet been described, as well as working toward defining the protective role of antibodies against these proteins. Ultimately, his hope is that these proteins are capable of eliciting a cow’s immune response to infection to help improve its health, as well as prevent losses in milk production and, subsequently, dairy income.

Dr. Seung Baek

Associate Professor
Biomedical and Diagnostic Sciences

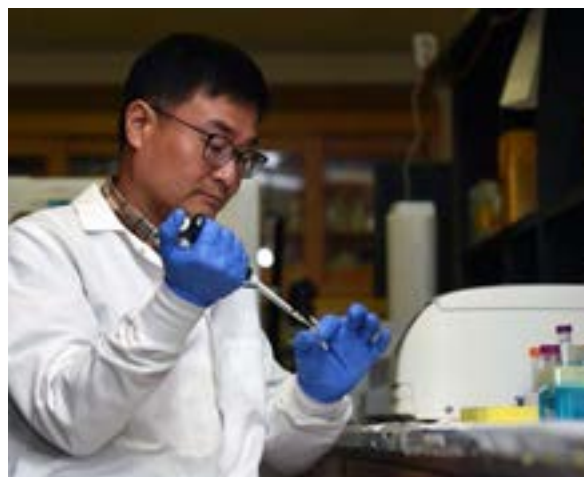
Treat and prevent: Fighting colorectal cancer

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 133,000 new colorectal cancer cases in the United States in 2015. Baek's ultimate goal is to contribute to the development of ways to prevent these new cases and treat existing ones.

**About Dr. Baek:**

- MS, Seoul National University (Korea)
- PhD, University of Maryland
- Supported by the American Cancer Society
- 7 publications & 6 presentations in 2014

Collaborators: Amila Orucevic (UT Graduate School of Medicine)

Dr. Marc Caldwell

Assistant Professor
Large Animal Clinical Sciences

Real-time location system offers real-life solutions

**About Dr. Caldwell:**

- DVM, Auburn University
- Supported by Merck Animal Health & the USDA National Institute of Food and Agriculture (FY2015: \$251,737)
- 1 presentation in 2014

Collaborators: Peter Krawczel, Agustin Rius

Dr. Caldwell is using a real-time location system to record the specific locations of dairy cattle in real time at the Little River Animal and Environmental Unit's dairy research farm on the East Tennessee Research and Education Center in Walland, TN.

Location systems are widely used in manufacturing, logistics, and other fields to locate objects. The system can collect cattle position data— with high precision and accuracy— in seconds. These location data can then be combined with additional computational methods and modeling techniques to generate information regarding the time animals spend at different pen locations and on feeding and group behavior.

This information can be transformed to generate contact and social networks describing animal-animal and animal-environment interactions. Dr. Caldwell expects to generate a novel, quantitative description of the dairy cattle contact structure and behavior. With this knowledge, cattle producers can better manage herd welfare and be able to detect clinical and subclinical diseases earlier than they can now.

In addition, this project will facilitate new collaborations among dairy scientists from diverse disciplines and departments, and will enhance their capabilities to perform dairy research to support the Tennessee dairy industry.

Dr. Claire Cannon
Assistant Professor
Small Animal Clinical Sciences

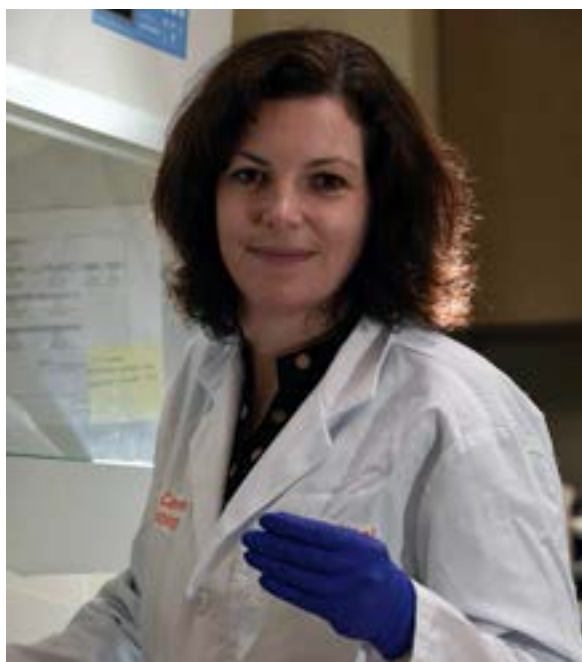
T-regs: A microscopic role?

Regulatory T cells (Tregs) allow tumors to evade the immune system, and the scientific community has recently begun to investigate Tregs and how they may influence therapy and outcomes.

Dr. Cannon is investigating whether Tregs are reduced in the blood of dogs with tumors at a high risk of spread (metastasis) once the tumor is removed. If Tregs remain high, this may indicate that there is more microscopic metastatic disease present and that patients may have poorer outcomes.

These results are easily translatable to human medicine because canine cancers behave similarly and share many of the same genetic alterations as human cancers. In addition, the shorter lifespan of dogs allows for rapid data collection.

Long-term, Dr. Cannon hopes to determine if a reduction in Tregs over time after surgery implies a better outcome, as well as to examine the effects of different therapies on Treg populations after tumor removal.



About Dr. Cannon:

- BVSc (DVM equivalent), University of Melbourne, Australia
- 4 presentations in 2014

Collaborators: Stephen Kania

Dr. Maria Cekanova

Research Associate Professor
Small Animal Clinical Sciences

Detecting cancer: A contrast view

**About Dr. Cekanova:**

- MS, RNDr, PhD, University of Pavol Jozef Safarik (Slovakia)
- Supported by the National Institutes of Health, AB Science, and the Physician's Medical Education and Research Foundation (FY2015: \$662,923)
- 4 publications & 10 presentations in 2014

Collaborators: Hassina Bilheux (Oak Ridge National Laboratory), Stuart E. Van Meter (UT Graduate School of Medicine)

Typically, once a tumor is detected, a biopsy is done to collect tissue samples to be evaluated by a pathologist. The pathologist first stains the cells so they achieve contrast and are visible under a microscope and then characterizes them by type and stage. Since a biopsy sample contains both normal and cancer cells, a diagnosis of cancer mostly relies on the pathologist's accurate assessment.

One major limitation to this method is that the tissue must be preserved in formalin and sliced thinly into sections. Processing the tissue this way renders it useless for further analysis. Although magnetic resonance imaging (MRI) and mammography have become standard ways to stage and monitor cancer recurrence, neither has been used to evaluate formalin-preserved tissue specimens due to their limited ("faint") contrast.

An alternative method to detect cancer is being studied by Dr. Cekanova. With investigators from the Oak Ridge National Laboratory, she is testing the use of neutron imaging as a way to objectively detect and assess tumor margins, with a focus on breast and lung cancers. Specifically, Dr. Cekanova hopes to use neutron imaging to detect normal and tumor tissues, and she is investigating various agents to enhance the contrast for detection of cancer. Additionally, because neutron imaging allows for 3D images of a tissue sample without destroying it, Dr. Cekanova will evaluate biopsy samples before they undergo slicing to determine tumor margins.

Dr. Madhu Dhar

Research Associate Professor
Large Animal Clinical Sciences

Stem cells: Strong building blocks

In the world of regenerative medicine, scaffolds are structures capable of supporting new tissue formation. In other words, they are the foundation for regeneration. One such scaffold, graphene, is the focus of Dr. Dhar's research.

Graphene is a thin sheet, or film, of latticed carbon atoms, and its strength mimics that of graphite, making it a reasonable foundation on which to rebuild bone. Furthermore, graphene-based biomaterials have been demonstrated to support the proliferation of human mesenchymal stem cells (MSCs), which are needed to promote regeneration.

However, there have been other reports that graphene inhibits cell proliferation. Dr. Dhar is therefore studying the potential applicability of graphene as a platform for regenerating bone using MSCs. Initially, this technique will be used to repair a tibial bone defect in goats, but if successful, its applicability will extend to use in humans with severe musculoskeletal injury.

**About Dr. Dhar:**

- MS, PhD, University of Poona (India)
- Supported by Medicus Biosciences, NellOne Therapeutics, the Egyptian Cultural and Educational Bureau, & Winn Feline Foundation
- 2 publications & 3 presentations in 2014

Collaborators: David Anderson, Silke Hecht, Alexandru Biris (University of Arkansas)

Dr. Shigetoshi Eda

Professor

Forestry, Wildlife and Fisheries

Adding up answers for bacterial infections in cattle

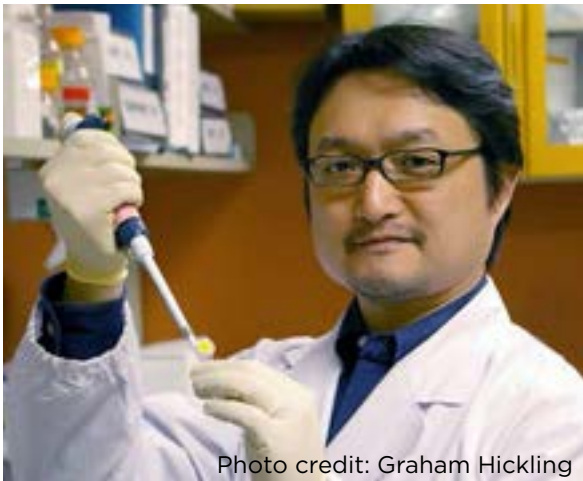


Photo credit: Graham Hickling

About Dr. Eda:

- MS, PhD, Tokyo University of Pharmacy and Life Science (Japan)
- Supported by private industry
- 4 publications & 3 presentations in 2014

Collaborators: Vitaly Ganusov (UT Theoretical Immunology Laboratory), Maria Prado, Brian Whitlock, Rachel Hill

Mycobacterial infections cause major health problems in both humans and in cattle. One of the features of many mycobacterial infections is the formation of granulomas, a small area of inflammation in tissue. Granulomas are thought to play an important role in containing the bacteria and limiting spread of infection. Nonetheless, granulomas and their roles in infection remain poorly understood.

In cattle, Johne's disease is a chronic infection caused by *Mycobacterium avium* subsp. paratuberculosis (MAP), and it can result in death. The disease causes an annual loss of around \$220 million in the U.S. agricultural economy. Granulomas are the initial and main battleground for an animal's immune system to attack MAP bacteria.

Dr. Eda's focus is on developing and optimizing conditions for growing these granulomas, as well as using mathematical models of granuloma formation to better determine factors that contribute to their size and dynamics. He then plans to use the data to predict immunological factors that are important for control or clearance of MAP in granulomas.

Dr. Stephen Kania

Professor
Biomedical and Diagnostic Sciences

Dr. David Bemis

Professor
Biomedical and Diagnostic Sciences

Stamping out *Staph.*

Staphylococci, bacteria that can infect humans and animals, have increased in antibiotic resistance to the point that some strains are resistant to all standard antibiotics. The development of other treatments has become a high priority for Drs. Kania and Bemis. Vaccines that promote the production of antibodies that attack the bacteria are a possible alternative to antimicrobial medicines; however, staphylococci produce special proteins that bind antibodies to the bacterial surface and neutralize them.

Drs. Kania's and Bemis's research has been focusing on the characterization of immunoglobulin binding proteins (IBP) and their interference with antibody-mediated destruction of staphylococci. They have identified the protein that anchors IBP to the surface of staphylococci and are testing the ability of compounds to inhibit its activity.

Working with collaborators at Oak Ridge National Laboratory, they are using powerful computers to predict which compounds will be most effective and to design new compounds that will have therapeutic potential.

**About Dr. Kania:**

- MS, Washington State University
- PhD, University of Florida
- Supported by Merial Limited & Winn Feline Foundation (FY2015 = \$5,000)
- 4 publications & 3 presentations in 2014

About Dr. Bemis:

- PhD, Cornell University
- Supported by Point of Care Diagnostics (FY2015 = \$15,000)
- 2 publications & 3 presentations in 2014

Dr. Barry Rouse

Distinguished Professor

Biomedical and Diagnostic Sciences

Reducing inflammation to prevent blindness

**About Dr. Rouse:**

- DSc, University of Bristol (England)
- MS, PhD, University of Guelph (Canada)
- Supported by National Institutes of Health (FY2015 = \$702,889)
- 7 publications & 2 presentations in 2014

Collaborators: Naveen K. Rajasagi

Herpes simplex virus-1 (HSV-1) can infect the cornea, causing herpes viral keratitis, which is a major cause of blindness worldwide. Long-term 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.

Dr. Rebecca Trout Fryxell

Assistant Professor
Entomology and Plant Pathology

Spotting a solution for tickborne *Rickettsia*

Ticks are hosts to numerous pathogens that may cause diseases, including bacterial *Rickettsia*. Some pathogenic *Rickettsia* include *R. rickettsii* (causative agent for Rocky Mountain spotted fever) and *R. parkeri* (causative agent for American Boutonneuse fever). Tickborne diseases can be transmitted to humans through the bite of a single infected tick.

Dr. Trout Fryxell is working to determine the prevalence of *Rickettsia* within Ixodidae species and characterize the microbiota of ticks with and without *Rickettsia* infection. Her research tests the hypothesis that different microbiota may exist in infected vs. uninfected ticks. Consequently, one part of her research program examines the tick microbiome (the collection of microbes that colonize the tick's body) for clues on how to best treat rickettsial infections.

The goal of the study is to build a foundation toward developing a new way to minimize *Rickettsia* infections like Rocky Mountain spotted fever in humans and animals.

**About Dr. Trout Fryxell:**

- MS, University of Kentucky
- PhD, University of Arkansas
- Supported by Bayer Animal Health & a private donor (FY2015 = \$20,000)
- 3 publications & 15 presentations in 2014

Collaborators: Jennifer DeBruyn

Shining the light on targeted therapeutics



About Dr. Wang:

- DVM equivalent, National Chung-Hsing University (Taiwan)
- MS, Auburn University
- PhD, University of Virginia
- Supported by the National Institutes of Health & Association of American Veterinary Medical Colleges (FY2015 = \$154,319)
- 2 publications & 11 presentations in 2014

Collaborators: Robert Donnell, Agricola Odoi, Steven Ripp (UT Center for Environmental Biotechnology)

Urinary bladder cancer is the most expensive cancer to treat because it requires long-term management. The current method of treating this cancer is often accompanied by unwanted side effects, such as hair loss and loss of appetite. Dr. Wang hopes to contribute to the new approaches being developed to control cancer and its recurrence with minimal side effects.

Dr. Wang's team has been working to develop a strategy that will allow human urinary bladder cancer cells to be temporarily illuminated under an imaging system so that their growth and metastasis may be easily monitored in real time. The team then determined the efficacy of two FDA-approved anti-cancer agents (romidepsin and cisplatin) to control tumor development in an animal model.

Success of this study would create a urinary bladder cancer model system to be used to identify ways of managing advanced urinary bladder cancer in humans. They expect the results to confirm the advantage of using bioluminescent imaging over conventional methods to determine tumor development, regression, or recurrence during therapeutic treatments.

Dr. Ximin Zeng

Research Assistant Professor
Animal Science

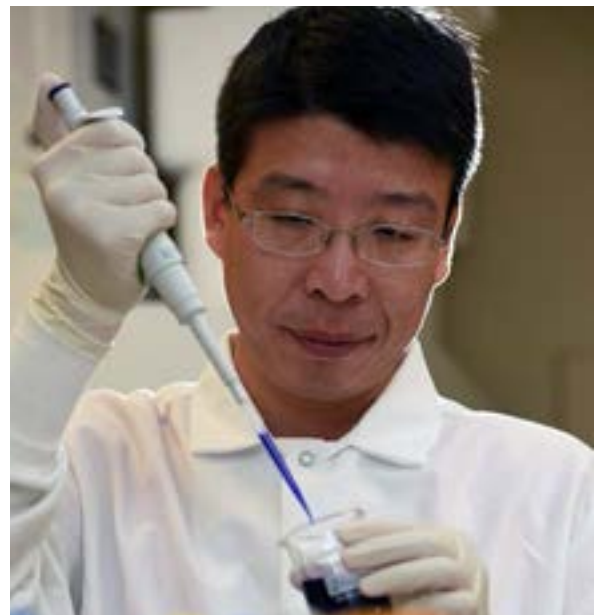
Control of *Staphylococcus aureus* in poultry by vaccination

Consumers and regulatory agencies are challenging the poultry industry to produce healthy chickens without using growth promoters or antibiotics. However, limiting antibiotic usage in feed can cause a range of problems. For example, *Staphylococcus aureus* (SA), a bacterium found in chickens, can lead to significant problems within poultry production systems. Infection with SA, which can cause problems ranging from leg deterioration to skin issues in young chickens, has the potential to be zoonotic.

The goal of Dr. Zeng's studies is to develop a vaccine to not only control, but also to prevent infection in broiler chickens. Vaccination is a practical and promising approach to address the issue and has been proven to be a safe, effective, and convenient method for protection of chickens against viral, bacterial, and protozoal diseases.

Dr. Zeng's research team began the study by looking at the characteristics of IsdB, an iron-binding protein, in SA. They will collect SA strains from poultry and define the prevalence of IsdB. After defining these characteristics, the researchers plan to develop and test a DNA vaccine intended to control SA infection.

The ultimate goal of the study is to develop a vaccine that will not only keep chickens healthier, but will potentially remediate chances of zoonotic activity between chickens and humans.

**About Dr. Zeng:**

- PhD, University of Tennessee
- 4 publications & 6 presentations in 2014

Collaborators: Irene Hanning, David Bemis, Jun Lin

6 Publications & Presentations

Sara Allstadt

Publications

Allstadt SD, Lee NL, Scruggs JL, Bernard J, Hecht S, Callens A, Seibert R, Bartges J. Clinical rounds: Transitional cell carcinoma. *Veterinary Medicine* 2014;109:327-333.

Frazier SDA, McKemie DS, Guerrero TA, LaChapelle H, Skorupski KA, Rodriguez CO. Phase I study of rosiglitazone in combination with carboplatin in cancer bearing dogs. *Veterinary*

Comparative Oncology 2014;12:1-9.

Wiggans KT, Skorupski KA, Reilly CM, **Frazier SA**, Dubielzig RR, Maggs DJ. Presumed solitary intraocular or conjunctival lymphoma in dogs and cats: 9 cases (1985-2013). *Journal of the American Veterinary Medical Association* 2014;244:460-470.

Presentations

Frazier SA, Hecht SH, Galyon G, Conklin G, Allett M. Effect of tissue sampling on the magnetic resonance imaging appearance of skin and lymph nodes in healthy dogs—pilot study. Mid-Year Proceedings of the Veterinary Cancer Society and Veterinary Society of Surgical Oncology. Asheville, NC, March 16–19, 2014.

Raúl Almeida

Publications

Kerro Dego O, Oliver SP, Saxton AM, Luther DA, Hauser LJ, **Almeida RA**. 2014. Transcriptome expression profiles of *S. uberis* during early time of co-culture with bovine mammary epithelial cells or infusion into mammary quarters of dairy cows. *BMC Microbiology* (In Revision).

Yuan Y, Kerro Dego O, Chen X, Abadin E, Chan S, Jory L, Kovacevic S, **Almeida RA**, Oliver SP. Conservation of *Streptococcus uberis* adhesion molecule gene in *Streptococcus uberis* strains from geographically diverse areas. *Journal of Dairy Science* 2014;97:7668–7673.

Presentations

Almeida R. Advances on the control of bovine mastitis: field experience. Invited talk. Course on quality, security and sustainability of food production chain. Camera di Commercio di Ragusa, Istituto Zooprofilattico di Sicily. Ragusa, Italy, July 2014.

Almeida RA. Pathogenesis of the intramammary infections of dairy cows. 2nd Annual Meeting of the Latin American Network of Mastitis Research (RELIM). San Carlos, Costa Rica, September 2014.

Almeida RA. Parlour routine: the correct way to control mastitis. XLVI Congress of the Italian Society for Buiatrics. Palermo, Italy, May 29–31, 2014.

Almeida RA. Use of vaccines for the prevention of mastitis. XLVI Congress of the Italian Society for Buiatrics. Palermo, Italy, May 29–31, 2014.

Almeida RA, Kerro-Dego O, Prado ME, Headrick SI, Gillespie BE, Siebert LS, Pighetti GM, Oliver SP. Immune response profiles following vaccination of dairy cows with recombinant *Streptococcus uberis* adhesion molecule (SUAM) during the dry period. Annual Meeting of the National Mastitis Council. Dallas, TX, January 2014.

Publications

Liggett JL, Zhang X, Eling TE, **Baek SJ**. Anti-tumor activity of non-steroidal anti-inflammatory drugs: Cyclooxygenase-independent targets. *Cancer Letters* 2014;46:217-224.

Liggett JL, Choi CK, Donnell RL, Kihm KD, Kim JS, Min KY, Noegel AA, **Baek SJ**. Nonsteroidal anti-inflammatory drugs suppress structural protein Nesprin-2 expression in colorectal cancer cells. *Biochimica et Biophysica Acta* 2014;40:322-331.

Chang JW, Kang SU, Choi JW, Shin YS, **Baek SJ**, Lee SH, Kim CH. Tolfenamic acid induces apoptosis and growth inhibition in anaplastic thyroid cancer: Involvement of NAG-1 expression and intracellular ROS generation. *Free Radical Biology and Medicine* 2014;7: 115-130.

Huang EC, Chen G, **Baek SJ**, McEntee MF, Minkin S, Biggerstaff J, Zhao Y, Whelan J. Zyflamend, a polyherbal mixture, down regulates class I and class II histone deacetylases and increases p21 levels in castrate-resistant prostate cancer cells. *BMC Complementary and Alternative Medicine* 2014;14:68.

Liggett JL, Min KW, Smolensky D, **Baek SJ**. A novel COX-independent mechanism of sulindac sulfide involves cleavage of epithelial cell adhesion molecule protein. *Experimental Cell Research* 2014;26:1-9.

Pan K, Luo Y, Gan Y, **Baek SJ**, Zhong Q. The pH-driven encapsulation of curcumin in self-assembled casein nanoparticles for enhanced dispersibility and bioactivity. *Soft Matter* 2014;10:6820-6830.

Chrysovergis K, Wang X, Kosak J, Lee SH, Kim JS, Foley JF, Travlos G, Singh S, **Baek SJ**, Eling TE. NAG-1/GDF15 prevents obesity by increasing thermogenesis, lipolysis and oxidative metabolism. *International Journal of Obesity* 2014;38:1555-1564.

Presentations

Baek SJ. Natural products as an anti-cancer drug. The Ph.D. Sandwich Program in The Strategic Scholarships Fellowships. Burapha University, Thailand. July 31, 2014.

Baek SJ. Natural products as an anti-cancer drug. Mahidol University, Thailand, August 4, 2014.

Baek SJ. NSAIDs as an anti-cancer drug. Ajou University, Suwon, Korea, August 7, 2014.

Baek SJ. NSAIDs and cancer prevention [invited lecture]. Kyungbuk National University, Taegu, Korea, October 14, 2014.

Baek SJ. NSAIDs and cancer prevention [invited lecture]. Yonsei University, Seoul, Korea, October 16, 2014.

Baek SJ. Molecular targets of inflammation-mediated tumorigenesis. The 10th Research Symposium on Human Natural Defense System in conjunction with PRAMS 2014. Seoul, Korea, October 18–21, 2014.

Publications

Flatland B, **Bemis DA**, Cocquyt CM. What is your diagnosis? Guttural pouch lesion in a horse. *Veterinary Clinical Pathology* 2014;43:607–608.

Bemis DA, MJ Bryant, PP Reed, RA Brahmhatt, SA Kania. Rothia nasimurium: a common cause of synergistic hemolytic reactions with *Staphylococcus* species in primary cultures of clinical specimens from dogs. *Journal of Veterinary Diagnostic Investigation* 2014;26:437–441.

Presentations

Kawamura Y, Kuwabara S, Kania SA, Kato H, Hamagishi M, Hayakawa S, Fujiwara N, Naka T, Sato T, Tomida J, Tanaka K, Yoshida Y, Morita Y, **Bemis DA**. 2014. *Porphyromonas pogonae* sp. Nov., a strong beta-hemolytic, low concentration oxygen-tolerant species from lizard and human clinical specimens [R2869]. 114th General Meeting of the American Society for Microbiology. Boston, MA, May 17–20, 2014.

Ramsay EC, Craig L, Tryon B, **Bemis DA**. 2014. *Salmonella osteomyelitis* in *Crotalus willardi*: A review of 25 years' experience. Joint Annual Meeting of the Association of Reptilian and Amphibian Veterinarians, the Associ-

Seung Baek

David Bemis

ation of Exotic Mammal Veterinarians, and the American Association of Zoo Veterinarians. Orlando, FL, October 18–24, 2014.

Kennedy R, Fling R, Bemis D, McPherson E, Zhao L, Chen J, Terry PD. Trichlorocarbanilide exposure during early life induces the overgrowth of _____ in offspring cecum content. Endocrine Society Fourth International Summit of Prenatal Programming and Toxicity: Environmental Stressors in Disease and Implications for Human Health. Boston, MA, October 26–29, 2014.

Marc Caldwell

Presentation

Caldwell M. Novel approaches to the diagnosis of respiratory disease in cattle. Livestock Economics Tri-state Conference. Abingdon, VA, 2014.

Claire Cannon

Presentations

Cannon C. Oncology—new opportunities for cancer patients in clinical trials. University of Tennessee College of Veterinary Medicine Veterinary Partners Appreciation Conference, 2014.

Cannon C. Evaluation of an alternating CCNU and doxorubicin chemotherapy protocol for canine histiocytic sarcoma. Veterinary Cancer Society Meeting. St Louis, MO, October 11, 2014.

Marquardt T, **Cannon C**, Rodriguez C, Thamm D, Childress M, Garrett L, Northrup N, Risbon R, Thomason J, Kraegel S, Regan R, Risetto K, Schleis S, Smith A. Evaluation of mitoxantrone in CHOP-like chemotherapy for canine lymphoma [poster]. Veterinary Cancer Society Meeting, St Louis, MO, October 9–11 2014.

Cannon C, Henson M, Borgatti A, Husbands B. Evaluation of an alternating CCNU and doxorubicin chemotherapy protocol in canine histiocytic sarcoma. Veterinary Cancer Society Meeting. St Louis, MO, October 9–11, 2014.

Maria Cekanova

Publications

Rathore K, Alexander M, **Cekanova M.** Piroxicam inhibits Mtsitinib-induced cyclooxygenase-2 expression in oral squamous cell carcinoma cells in vitro. *Translational Research* 2014;164:158–168.

Rathore K, **Cekanova M.** Animal model of naturally occurring bladder cancer: characterization of four new canine transitional cell carcinomas cell lines. *BMC Cancer* 2014;14:465.

Cekanova M, Rathore K. Animal models and therapeutic molecular targets of cancer: utility and limitations. *Journal of Drug Design Development and Therapy* 2014;8:1911–1922.

Bilheux H, **Cekanova M**, Rathore K, Voisin S, Bilheux JC, Legendre AM, Donnell R. Investigation of a Novel Approach to Forensic Analysis Using Neutron Imaging Techniques. U.S. Department of Justice, October 2014.

Presentations

Cekanova M, Donnell R, Bilheux H, Bilheux JC. Neutron imaging: Detection of cancer using animal model. IEEE Xplore. Oak Ridge, TN, May 6–8, 2014.

Bilheux HZ, Bilheux JC, Bailey WB, Keener WS, Davis LE, Herwig KW, **Cekanova M.** Neutron imaging at the Oak Ridge National Laboratory: Application to biological research. Biomedical Science and Engineering Center

Conference. Oak Ridge, TN, May 6–8, 2014.

Bilheux H, Katsaras J, Stanley C, Ramanathan A, Myles D, **Cekanova M**. Multi-scale applications of neutron scattering and imaging. Biomedical Science and Engineering Center Conference. Oak Ridge, TN, May 6–8, 2014.

Cekanova M. Neutron imaging for cancer detection [invited]. Biomedical Science and Engineering Center Conference. Oak Ridge, TN, May 6–8, 2014.

Cekanova M. Oncology—New opportunities for cancer patients in clinical trials. Veterinary Practitioner Appreciation Conference. Knoxville, TN, July 12, 2014.

Cekanova M. Regenerative medicine in small animals: From bench to bedside. UTCVM Annual Conference for Veterinarians 2015. Knoxville, TN, December 2, 2014.

Smolensky D, Rathore K, **Cekanova M**. AD198, a derivative of doxorubicin as novel chemotherapeutic agents for treatment of transitional cell carcinoma. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 21–22, 2014.

Rathore K, Alexander M, **Cekanova M**. Piroxicam inhibits masitinib-induced cyclooxygenase-2 expression in oral squamous cell carcinoma cells in vitro. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 21–22, 2014.

Sadler R, Schumacher J, Rathore K, Newkirk K, Cole G, Seibert R, **Cekanova M**. Cyclooxygenase enzymes in normal and traumatized skin and muscle tissues of ball pythons (*Python regius*). Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 21–22, 2014.

Sadler R, Schumacher J, Rathore K, Newkirk K, Cole G, Seibert R, **Cekanova M**. Cyclooxygenase enzymes in normal and traumatized skin and muscle tissues of ball pythons (*Python regius*). American Association of Zoo Veterinarians and American Reptile and Amphibian Veterinarians' Joint Annual Conference. Orlando, Florida, October 2014.

Publications

Villagran Cruz C, Amelse L, Neilsen N, Dunlap J, **Dhar M**. Differentiation of equine mesenchymal stromal cells into cells of neural lineage: potential for clinical applications. *Stem Cells International* 2014;891518.

Cruz Villagran C, Amelse L, Neilsen N, **Dhar M**. Differentiation of equine mesenchymal stromal cells into neural cells: potential for neuropathies. *FASEB Journal* 2014;28:596.4.

Madhu Dhar

Presentations

Cruz Villagran C, **Dhar M**. Equine mesenchymal stromal cells differentiate into cells of neural lineage: Promises for horse neuropathies. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 19–20, 2014.

Elkhenany H, **Dhar M**. Role of graphene in bone tissue engineering. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 19–20, 2014.

Cruz Villagran C, Amelse L, Neilsen N, **Dhar M**. Differentiation of equine mesenchymal stromal cells into neural cells: potential for clinical applications. Experimental Biology 2014. San Diego, CA, April 26–30, 2014.

Publications

Li S, Ren Y, Cui H, Wu J, **Eda S**, Jiang H. Alternating current electrokinetics enhanced in-situ capacitive immunoassay. *Electrophoresis* 2014;36:471–474.

Wadhwa A, Johnson RE, Eda K, Waters WR, Palmer MV, Bannantine JP, **Eda S**. Evaluation of ethanol vortex ELISA for detection of bovine tuberculosis in cattle and deer. *BMC Veterinary Research* 2014;10:147.

Magombedze G, **Eda S**, Ganusov VV. Competition for antigen between Th1 and Th2 responses determines the timing of the immune response switch during *Mycobacterium avium* subspecies paratuberculosis infection in

Shigetoshi Eda

ruminants. *PLoS Computational Biology* 2014:e1003414.

Li S, Cui H, Wu J, Yang K, Wadhwa A, **Eda S**, Jiang H. AC electrokinetics-enhanced capacitive immunosensor for point-of-care serodiagnosis of infectious diseases. *Biosensors and Bioelectronics* 2014;51:437–443.

Presentations

Eda S. Current thoughts and future directions on host response to MAP. International Colloquium on Paratuberculosis. Parma, Italy, June 22–26, 2014.

Cheng C, Cui H, Yuan Q, Wu J, **Eda S**. Rapid and no-wash detection of avian influenza A virus from clinical swab samples. Biomedical Engineering Society Annual Meeting. San Antonio, TX, October 22–25, 2014.

Cui H, Cheng C, Yuan Q, Wu J, **Eda S**. Development of a rapid and label-free affinity sensor for on-site biomolecular detection. Biomedical Engineering Society Annual Meeting. San Antonio, TX, October 22–25, 2014.

Stephen Kania

Publications

Newkirk KM, Hendrix DV, Anis EA, Rohrbach BW, Ehrhart EJ, Lyons JA, **Kania SA**. Detection of papillomavirus in equine perianal and penile squamous cell carcinoma. *Journal of Veterinary Diagnostic Investigation* 2014;26:131-135.

Anis EA, Wilkes RP, **Kania S**, Legendre AA, Kennedy MA. Effectiveness of small interfering RNA (siRNA) to inhibit feline

coronavirus replication. *American Journal of Veterinary Research* 2014;75:828-34

Bemis DA, Bryant MJ, Reed PP, Brahmabhatt RA, **Kania SA**. Synergistic hemolysis between β -lysin-producing *Staphylococcus* species and *Rothia nasimurium* in primary cultures of clinical specimens obtained from dogs. *Journal of Veterinary Diagnostic Investigation* 2014;26:437-441.

Bernstein JA, Frank LA, **Kania SA**. PCR amplification and DNA sequence identification of an unusual morphological form of *Demodex cati* in a cat. *Veterinary Dermatology* 2014;25:487-e80.

Presentations

Kania SA. Flow cytometry—The \$40,000 answer. UTCVM December Conference. Knoxville, TN, December 2014.

Kania SA. Antibiotic resistance in *Staphylococcus pseudintermedius*. Oak Ridge Institute for Continued Learning. Oak Ridge, TN, December 12, 2014.

Kania SA. Characterization of the predominant clonal populations of methicillin resistant *Staphylococcus pseudintermedius*. Association of Veterinary Microbiologists 39th Annual Symposium, Knoxville, TN, June 12, 2014.

Barry Rouse

Publications

Bhela S, Mulik S, Reddy P BJ, Richardson RL, Gimenez F, Rajasagi NK, Veiga-Para T, Osmand AP, **Rouse BT**. Critical role of microRNA-155 in herpes simplex encephalitis. *Journal of Immunology* 2014;192:2734–2743.

Sharma S, Rajasagi NK, Veiga-Parga T, **Rouse BT**. Herpes virus entry mediator (HVEM) modulates proliferation and activation of regulatory T cells following HSV-1 infection. *Microbes and*

Infection 2014;16:648–660.

Reddy PB, Sehrawat S, Suryawanshi A, Rajasagi NK, Khatri M, **Rouse BT**. An approach to control relapse of inflammatory lesions after discontinuation of primary therapy. *PLoS One* 2014;20:9(5):e98051.

Mayer CT, Lahl K, Milanez-Almeida P, Watts D, Dittmer U, Fyhrquist N, Huehn J, Kopf M, Kretschmer K, **Rouse B**, Sparwasser T. Advantages of Foxp3(+) regulatory T cell depletion using DEREg mice. *Immunity, In-*

Presentations

Rouse BT. Immunity or tissue damage to viruses—Can we exploit what we know? [invited seminar]. University of Nebraska Medical Center, Department of Pharmacology and Experimental Neuroscience. Omaha, NE, May 30, 2014.

Rouse BT. Immunopathology to virus-infection factors affecting the outcome [invited seminar]. University of North Texas Health Science Center. Fort Worth, TX, October 2, 2014.

Publications

Mays SE, Hendricks BM, Paulsen DP, Houston AE, **Trout Fryxell RT.** Prevalence of five tick-borne bacterial genera in adult *Ixodes scapularis* removed from white-tailed deer in western Tennessee. *Parasites and Vectors* 2014; 7:473.

Shrestha S, Mudge J, Miller NA, **Trout Fryxell RT,** Lamour K. SNP markers identify widely distributed clonal lineages of *Phytophthora colocasiae* in Vietnam, Hawaii, and Hainan Island, China. *Mycologia* 2014;106:676–685.

Trout Fryxell RT, Thompson Lewis T, Peace H, Hendricks BM, Paulsen D. Identification of avian malaria (*Plasmodium reticulum*) and canine heartworm () in the mosquitoes of Tennessee. *Journal of Parasitology* 2014;100:455–462.

Presentations

Trout Fryxell RT. Vector ecology in Tennessee: From molecule to ecosystem [invited]. Society of Vector Ecology Symposium: Feature Young Stars in Vector Ecology. San Antonio TX, September 2014.

Trout Fryxell RT. Is it Chikungunya time in Tennessee? [invited]. Tennessee Entomological Association. Knoxville, TN, October 2014.

Trout Fryxell RT. Ticks and their “friends”: A medical and veterinary problem with a One Health solution [invited]. OneHealth: Entomological Society of America. Portland, OR, November 2014.

Trout Fryxell RT. Extending knowledge and changing lives [invited]. American Mosquito Control Association. New Orleans, LA, March 2015.

Trout Fryxell RT, DeBruyn J. Unexpected discoveries from our tick microbiome projects. Society of Vector Ecology. Albuquerque, NM, September 2015.

Mays SE, Houston AE, **Trout Fryxell RT.** Comparing conventional and novel methods of tick collection [poster]. Southeastern Branch of the Entomological Society of America Annual Meeting. Greenville, SC, March 2014.

Trout Fryxell RT, Freyman K, Ulloa A, Hendricks B, Paulsen D, Moncayo A. Cemeteries are effective sites for surveillance of La Crosse virus and vector populations in Appalachia [poster]. Southeastern Branch of the Entomological Society of America Annual Meeting. Greenville, SC, March 2014.

Mays SE, Hendricks BM, Houston AE, **Trout Fryxell RT.** Pathogen associations of the Gulf Coast tick (*Amblyomma maculatum*) in western Tennessee. Southeastern Society of Parasitologists Annual Meeting. Statesboro, GA, April 2014.

Mays SE, Houston AE, **Trout Fryxell RT.** *Ehrlichia* and *Rickettsia* species associations of the Gulf Coast tick (*Amblyomma maculatum*) in western Tennessee. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, 2014.

Mays SE, Houston AE, **Trout Fryxell RT.** Habitat, host, and pathogen associations of the Gulf Coast tick in western Tennessee. Livestock Insect Workers Conference. San Diego, CA, June 2014.

Mays SE, Houston AE, **Trout Fryxell RT.** Tick trapping for dummies: comparison of novel and conventional trapping methods. Tennessee Entomological Society. Knoxville, TN, October 2014.

Rebecca Trout Fryxell

Urquhart C, Paulsen D, Moncayo A, **Trout Fryxell R**. Evaluation of surveillance methods for arboviral encephalitis vector *Aedes* and *Culex* mosquitoes of eastern Tennessee, USA. Tennessee Entomological Society. Knoxville, TN, October 2014.

Butler R, Long DL, Paulsen D, **Trout Fryxell RT**, Houston AE, Kennedy ML. Differential occurrence of ticks on *Sigmodon hispidus* and *Peromyscus leucopus* based on age and sex. Tennessee Academy of Science. Morristown, TN, November 2014.

Long DL, Butler R, Paulsen D, **Trout Fryxell RT**, Houston AE, Kennedy ML. Host-tick relationships among small mammals in western Tennessee. Tennessee Academy of Science. Morristown, TN, November 2014.

Mays SE, Houston AE, **Trout Fryxell RT**. Specifying host and pathogen associations of *Amblyomma maculatum* (Gulf Coast tick). Entomological Society Annual Meeting. Portland, OR, November 2014.

Hwa-Chain Robert Wang

Publications

Choudhary S, Sood S, **Wang HC**. Dipyridamole intervention of breast cell carcinogenesis. *Molecular Carcinogenesis* 2014;53:243-252.

Pluchino L, **Wang HC**. Chronic exposure to combined carcinogens enhances breast cell carcinogenesis with mesenchymal and stem-like cell properties. *PLoS One* 2014;9:e108698.

Presentations

Pluchino LA, **Wang H-CR**. Breast cell carcinogenesis induced by chronic exposure to multiple environmental and dietary carcinogens [abstract 17]. University of Tennessee/Oak Ridge National Laboratory Graduate School of Genome Science & Technology Annual Retreat. Knoxville, TN, March 7, 2014.

Pluchino LA, **Wang H-CR**. Chronic induction of breast cell carcinogenesis by multiple environmental and dietary carcinogens [abstract 1585]. American Association for Cancer Research International Meeting. San Diego, CA, March 2014.

Choudhary S, Sood S, Pluchino L, **Wang H-CR**. Combining FK228 and cisplatin synergistically induces cancer cell death and reduces clonogenic survival [abstract 5515]. American Association for Cancer Research International Meeting. San Diego, CA, March 9, 2014.

Pluchino LA, **Wang H-CR**. Chronic exposure to combined carcinogens enhances breast cell carcinogenesis with mesenchymal and stem-like cell properties. Comparative & Experimental Medicine and Public Health Research Symposium. Knoxville, TN, May 2014.

Wang H-CR, Pluchino LA. Reactive oxygen species-mediated breast cell carcinogenesis enhanced by chronic exposure to multiple carcinogens and intervened by dietary agents [abstract 700]. Ninth International Conference of Anticancer Research. Sithonia, Greece, October 2014.

Wang H-CR. Therapeutically-selective apoptosis of Ras-ERK-activated cancer cells [invited talk]. National Taiwan University Medical School and Teaching Hospital, Taipei, Taiwan, December 2014.

Wang H-CR. Therapeutically-selective apoptosis of Ras-ERK-activated cancer cells [invited talk]. National Defense Medical Center, Taipei, Taiwan, December 2014.

Wang H-CR. Therapeutically-selective apoptosis of Ras-ERK-activated cancer cells [invited talk]. National Yang-Ming University, Taipei, Taiwan, December 2014.

Wang H-CR. Environmental-chemical carcinogenesis of breast cells and intervention [invited talk]. Taipei Veterans General Hospital, Taipei, Taiwan, December 2014.

Wang H-CR. Environmental-chemical carcinogenesis of breast cells and intervention [invited talk]. Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan, December 2014.

Wang H-CR. Therapeutically-selective apoptosis of Ras-ERK-activated cancer cells [invited talk]. Taipei Medical University, Taipei, Taiwan, December 2014.

Publications

Lin J, Negga R, **Zeng X**, Smith K. Effect of bile salt hydrolase inhibitors on a bile salt hydrolase from *Lactobacillus acidophilus*. *Pathogens* 2014;3:947–956.

Smith K, **Zeng X**, Lin J. Discovery of bile salt hydrolase inhibitors using an efficient high-throughput screening system. *PLoS One* 2014;9(1):e85344.

Zhang H-W, **Zeng X**, Qi Q, Sun KL, Ma CJ, Hu XJ, Lin J. The in vitro interaction of CmeA with CmeC. *Chinese Science Bulletin* 2014;59:3114–3119.

Zeng X, Brown S, Gillespie B, Lin J. A single nucleotide in the promoter region modulates the expression of the beta-lactamase OXA-61 in *Campylobacter jejuni*. *Journal of Antimicrobial Chemotherapy* 2014;69:1215–1223.

Presentations

Zeng X, Wu Z, Ardeshtna D, Brown S, Gillespie B, Zhang Q, Lin J. Identification of the factors required for high frequency conjugation in *Campylobacter jejuni*. 95th Annual Meeting of the Conference of Research Workers in Animal Diseases. Chicago, IL, December 2014.

Ardeshtna D, Gillespie B, Lin J, **Zeng X**. Temperature-dependent conjugative gene transfer in *Campylobacter jejuni*. 95th Annual Meeting of the Conference of Research Workers in Animal Diseases. Chicago, IL, December 2014.

Zeng X, Ardeshtna D, Brown S, Lin J. Enhanced conjugation by heat shock treatment in *Campylobacter jejuni*. 54th Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, DC, September 2014.

Lin J, Jones L, Liu X, **Zeng X**. Construction of novel DNA vaccine for mitigation of *Campylobacter* in chickens. 114th General Meeting of the American Society for Microbiology. Boston, MA, May 2014.

Zeng X, Mo Y, Lin J. *Campylobacter jejuni* 81-176 can utilize hydrolyzed enterobactin products. 114th General Meeting of the American Society for Microbiology. Boston, MA, May 2014.

Zeng X, Ardeshtna D, Gillespie B, Lin J. Heat shock treatment of *Campylobacter jejuni* enhanced its conjugation efficiency. 114th General Meeting of the American Society for Microbiology. Boston, MA, May 2014.

Ximin Zeng

7 Research Funded Externally

Investigator	Project title	Funding agency	Project period	2015 Receipts	2015 Expenditures
Allstadt, Sara	Evaluation of orally-administered mTOR inhibitor rapamycin in dogs with osteosarcoma	Morris Animal Foundation	8/1/14–1/31/16	\$126,468	\$703
Almeida, Raúl	Southeast Quality Milk Initiative: Implementing science-based recommendations in the field to control mastitis & improve milk quality in the Southeast	USDA Agriculture and Food Research Initiative	2/1/13–1/31/16	\$541,000	\$232,732
	<i>Streptococcus uberis</i> surface proteins as vaccine candidates for the control of streptococcus uberis mastitis in dairy cows	Private industry	1/1/14–4/16/15	\$49,585	\$189,995
Baek, Seung	Prevention of colorectal cancer by tolfenamic acid	American Cancer Society	7/1/11–06/30/15	\$0	\$5,304
Bemis, David	Phase I UT/POCD project	Point of Care Diagnostics	10/1/14–3/31/15	\$15,000	\$4,734
Caldwell, Marc	Efferent lymph duct cannulation for mucosal immune response modeling of the oronasal cavity in cattle following vaccination using two different drugs	Merck Animal Health	10/29/14–12/31/15	\$206,271	\$5,086
	Development of microenvironmental sampling techniques of the nasal cavity of cattle and experimental nasal colonization of <i>Mannheimia haemolytica</i> in cattle	USDA National Institute of Food and Agriculture	10/1/14–9/30/16	\$18,571	\$0
	A real-time location system to enhance dairy health research and herd management	USDA National Institute of Food and Agriculture	4/15/15–9/30/15	\$26,895	\$26,895
Cekanova, Maria	Detection of COX-2-expressed cancers by fluorocoxib A	National Institutes of Health	8/11/14–7/31/17	\$414,939	\$93,114
	Grading of canine mast cell tumors from biopsy samples	AB Science	8/1/14–12/31/15	\$247,984	\$144,082
	Isolation and characterization of human primary cancer cell lines to evaluate novel therapeutic and imaging agents in vitro	Physician's Medical Education and Research Foundation	2/6/14–2/5/15	\$0	\$4,820

Investigator	Project title	Funding agency	Project period	2015 Receipts	2015 Expenditures
Dhar, Madhu	Assessment of cytotoxicity of SutureSeal on adult mesenchymal stem cells	Medicus Biosciences	6/5/14–6/4/15	\$0	\$5,491
	Testing the efficacy of Nell1 protein in wound healing using an equine model	NellOne Therapeutics	3/20/14–1/19/15	\$0	\$14,834
	Egyptian government graduate student sponsorship	Egyptian Cultural & Educational Bureau	10/1/13–9/30/15	\$0	\$6,837
	Egyptian government graduate student sponsorship	Egyptian Cultural & Educational Bureau	6/30/14–6/25/16	\$0	\$7,390
	Transduction of hematopoietic stem cells to stimulate RNA interference for treatment of feline infectious peritonitis	Winn Feline Foundation	1/22/14–6/30/15	\$0	\$11,372
Eda, Shigetoshi	Quantification of a component of an industry product	Private industry	4/6/12–4/26/17	\$0	\$2,785
Kania, Stephen	2015 Merial Veterinary Scholars Research Program	Merial Limited	3/26/15–8/31/15	\$5,000	\$2,490
	Merial Veterinary Student Research Program	Merial Limited	5/1/14–9/1/14	\$0	\$2,000
	Detection of dermatophytosis in cats by PCR	Winn Feline Foundation	5/1/13–10/30/14	\$0	\$4,358
Rouse, Barry	Mechanisms of herpetic keratitis	National Institutes of Health	1/1/13–12/31/16	\$464,506	\$374,919
	T regulatory cells in HSV immunity and immunopathology	National Institutes of Health	9/30/14-1/31/16	\$352,608	\$327,970
Trout Fryxell, Rebecca	Evaluation of entomopathogenic nematodes as a fly management option	Confidential donor	1/1/14–12/31/15	\$20,000	\$7449
	Evaluation of larvicides on calf behavior and as a fly management option	Bayer Healthcare, Animal Health	9/1/13–8/31/14	\$0	\$336
Wang, Hwa-Chain Robert	Intervention of Ras-ERK-activated cancers	National Institutes of Health	9/1/14–8/31/16	\$154,319	\$72,842
	International Multi-Task Cooperative and Exchange Program	Association of American Veterinary Medical Colleges	12/1/06–12/31/17	\$0	\$473
	GABA-BR-mediated prevention of pancreatic cancer	National Institutes of Health	9/28/09–8/31/15	\$0	\$83,137
TOTALS				\$2,643,146	\$1,632,146

ACTUAL, PROPOSED, & REQUESTED BUDGET

**The University of Tennessee College of Veterinary Medicine
Center of Excellence in Livestock Diseases and Human Health**

	FY 2014-15 Actual			FY 2015-16 Proposed			FY 2016-17 Requested		
	Matching	Appropriations	Total	Matching	Appropriations	Total	Matching	Appropriations	Total
Expenditures	504,344	1,009,435	1,513,779	531,705	1,063,410	1,595,115	456,448	912,894	1,369,342
Salaries									
Faculty	12,129	24,259	36,388	15,162	30,324	45,485	15,920	31,840	47,760
Other Professional	45,303	90,606	135,909	56,629	113,258	169,887	59,460	118,921	178,381
Clerical/Supporting	23,271	46,541	69,812	29,088	58,177	87,265	30,543	61,085	91,628
Assistantships	13,866	27,731	41,597	17,332	34,664	51,996	18,199	36,397	54,596
Total Salaries	94,569	189,137	283,706	118,211	236,422	354,633	124,121	248,243	372,364
Longevity (excluded from salaries; included in benefits)	1,255	2,509	3,764	1,568	3,137	4,705	1,647	3,293	4,940
Fringe Benefits	18,677	37,354	56,031	23,346	46,692	70,038	24,513	49,027	73,540
Total Personnel	114,500	229,000	343,501	143,125	286,251	429,376	150,281	300,563	450,844
Non-Personnel									
Travel	6,265	12,531	18,796	8,771	17,543	26,314	9,210	18,420	27,630
Software	7,697	15,393	23,090	10,775	21,551	32,326	11,314	22,628	33,942
Books & Journals			0	1,167	2,333	3,500	1,225	2,450	3,675
Other Supplies	42,312	84,625	126,937	59,237	118,475	177,712	113,012	226,023	339,035
Equipment	15,243	30,487	45,730	21,341	42,681	64,022	73,220	146,440	219,660
Maintenance	4,412	8,824	13,237	6,177	12,354	18,531	6,486	12,972	19,458
Scholarships	3,978	7,955	11,933	5,569	11,137	16,706	5,847	11,694	17,541
Consultants			0	0	0	0	0	0	0
Renovation			0	41,667	83,333	125,000	43,750	87,500	131,250
Other Expenses	1,093	2,186	3,279	1,530	3,061	4,591	1,607	3,214	4,820
Printing, Publications, Postage	2,707	5,414	8,121	3,790	7,580	11,370	3,979	7,959	11,938
Contract Special Services	23,484	46,968	70,452	32,878	65,755	98,633	34,522	69,043	103,565
Professional Serv/ Memberships	1,357	2,713	4,070	1,899	3,799	5,698	1,994	3,989	5,983
Total Non-Personnel	108,548	217,097	325,645	194,801	389,602	584,403	306,166	612,332	918,497
GRAND TOTAL	223,049	446,097	669,146	337,926	675,853	1,013,779	456,447	912,895	1,369,342
Revenue									
New State Appropriation		510,737	510,737		500,321	500,321		525,337	525,337
Carryover State Appropriation		498,698	498,698		563,089	563,089		387,557	387,557
New Matching Funds	255,369		255,369	250,161		250,161	262,669		262,669
Carryover from Previous Match Funds	248,975		248,975	281,544		281,544	193,779		193,779
Total Revenue	504,344	1,009,435	1,513,779	531,705	1,063,410	1,595,115	456,448	912,894	1,369,342