2013 Annual Report

Center of Excellence
in Livestock Diseases and Human Health

THE UNIVERSITY of TENNESSEE
INSTITUTE of AGRICULTURE
COLLEGE of VETERINARY MEDICINE
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

This report is produced by the University of Tennessee, College of Veterinary Medicine, Office of the Associate Dean for Research.

**Associate Dean for Research**
Dr. Michael McEntee

**Dean, College of Veterinary Medicine**
Dr. Jim Thompson

**Chancellor, Institute of Agriculture**
Dr. Larry Arrington

For more information
Ph: 865-974-0227
Fax: 865-974-4773

University of Tennessee
College of Veterinary Medicine
Office of the Associate Dean for Research
2407 River Dr, Rm A102
Knoxville, TN 37996-4550
Message from the Dean

We are pleased to present the 2013 annual report for the Center of Excellence in Livestock Diseases and Human Health. This marks the 30th year the center has been able to make an investment in both (1) new investigators who show professional promise and (2) established investigators for the conception of novel and innovative lines of research.

When the College of Veterinary Medicine proposed the center to Tennessee’s state government in 1984, administrators looked to focus on the college’s strengths in human health research with comparative models and farm animal health research. For 30 years, we have been able to maintain these strengths, and center faculty continue to strive for answers to difficult yet important research questions related to the center’s focus areas.

Within this report, you will see highlights of such faculty research projects funded by the center in fiscal year 2013. During 2013, the center supported the efforts of 12 faculty. 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 opening of our new Large Animal Hospitals will further facilitate such research.

Benchmark data are also included for fiscal years 2009–2013. Research funding steadied, and the return on investment, as the ratio of research expenditures to the state appropriation for the center, was 4.1:1.

Center faculty continue to garner national and international recognition for their research and scholarship. During calendar year 2012, center faculty published 51 peer-reviewed articles and gave 45 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 success; we hope you enjoy this summary presentation of center activities and accomplishments.

Dr. Jim Thompson, Dean
Center of Excellence
in Livestock Diseases and Human Health

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Editing
Misty R. Bailey

Photography
Greg Hirshoren
Phil Snow

Graphic Design
Misty R. Bailey

Writers
Misty R. Bailey
Dr. Michael McEntee

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# Comparative Summary of Accomplishments

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>2013 12 faculty</th>
<th>2012 12 faculty</th>
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<tr>
<td><strong>Publications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer-reviewed articles</td>
<td>51 (4.25)</td>
<td>39 (3.25)</td>
</tr>
<tr>
<td>Books or book chapters</td>
<td>0 (0)</td>
<td>2 (0.17)</td>
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<tr>
<td>Abstracts or posters</td>
<td>41 (3.42)</td>
<td>63 (5.25)</td>
</tr>
<tr>
<td><strong>Presentations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>30 (2.5)</td>
<td>9 (0.75)</td>
</tr>
<tr>
<td>National</td>
<td>10 (0.83)</td>
<td>40 (3.33)</td>
</tr>
<tr>
<td>State or local</td>
<td>5 (0.42)</td>
<td>14 (1.17)</td>
</tr>
<tr>
<td><strong>Research monies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External funding</td>
<td>$1,746,627</td>
<td>$2,466,712</td>
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<tr>
<td></td>
<td>($145,552)</td>
<td>($205,559)</td>
</tr>
<tr>
<td>Research expenditures</td>
<td>$2,057,499</td>
<td>$2,332,888</td>
</tr>
<tr>
<td></td>
<td>($171,458)</td>
<td>($194,407)</td>
</tr>
<tr>
<td>Return on investment</td>
<td>4.1:1</td>
<td>4.7:1</td>
</tr>
</tbody>
</table>

*Publications and presentations based on 2012 calendar year; research monies based on 2013 fiscal year.
†Publications and presentations based on 2011 calendar year; research monies based on 2012 fiscal year.

L–R: Drs. Hwa-Chain Robert Wang, Amy LeBlanc, Xuemin Xu, and Seung Joon Baek
Despite the persisting, sluggish funding environment, center faculty continue to make excellent progress in ongoing projects, gaining national and international recognition for their expertise and accomplishments. Details of current faculty research are provided in the Faculty Reports section (pp. 26–37).

During the 2012 calendar year, the 12 center faculty each averaged 4 peer-reviewed publications (51 total) and 3 presentations at prestigious national and international meetings (40 total). Figure 1 shows the number of times 2013 center faculty publications have been cited by others over the last six 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.

Particularly noteworthy articles in 2012 were by Drs. David Brian, Barry Rouse, Hildegarde Schuller, and Hwa-Chain Robert Wang. Drs. Brian and Rouse published articles in the Journal of Virology. Dr. Rouse’s work was also published in the Journal of Immunology. Both Drs. Schuller and Wang had articles published in Carcinogenesis. All these journals have an impact factor above 5.0. 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. 40–48) for more details.

The return on the state’s investment in the center was 4.1:1, calculated as ratio of expenditures from extramural funding to center appropriation. This calculation means that for every $1 of center funds spent, center faculty returned over $4 in extramural funding. Extramural funding totaled

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**External Funding:**
$1,746,627

**New Grants:**
$786,471
$1,746,627 this year, while expenditures for the year were $2,057,499. Figure 2 shows the percentage breakdown of external funding by source. The funding includes a new, multi-year award for Dr. Barry Rouse totaling $2,464,341 over the course of the project, and new, one-year awards for Drs. Maria Cekanova, Shigetoshi Eda, Stephen Kania, and Amy LeBlanc, totaling $304,071. See “Research Funded Externally” and “Research Expenditures” on p. 12 for the fiscal year 2013 data summary.

Fig. 2. FY 13 external funding by source.
Total = $1,746,627.
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
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, having served as interim director since February 2011. Dr. Stephen Kania chaired the Research Advisory Committee responsible for selecting 2013 funded proposals. Ms. Misty Bailey produces the annual report, and Ms. Kim Rutherford oversees submissions of faculty proposals for funds.

L–R: McEntee, Kania, Bailey, Rutherford
thyroid's ability to release T and T4 in response to thyroid hormones, which can lead to the development of hypothyroidism. More accurate test for hypothyroidism is to measure the levels of baseline values, which may be misleading and result in misdiagnosis. While there is an abundance of information regarding the metabolic disorders, energy metabolism, and obesity, there is still much to be learned about the role of hormones in these processes.

Dr. Sommardahl has been investigating genetic causes of obesity for several years. In collaboration with Dr. Madhu Dhar, Department of Nutrition, Dr. Sommardahl is also conducting studies to determine the effects of levothyroxine therapy on energy metabolism, and on the hypothalamic-pituitary-adrenal axis and immune system in horses.

Levothyroxine is prescribed to hundreds of horses each year to treat the seasonal breeding of racing horses, but its efficacy in treating hypothyroidism in horses is unknown. Levothyroxine therapy could be detrimental to healthy horses, but it also eliminates lethargy, improves performance, facilitates weight loss, increases fertility, and reduces the severity of laminitic episodes. However, levothyroxine therapy is not widely available. In addition, the frequency of hypothyroidism in horses is not widely recognized or understood, which is detrimental to healthy horses.

Because many so-called hypothyroid horses have been inadequately assessed, the actual frequency of this disorder is difficult to determine. The reason for this underreporting is due in large part to the difficulty in diagnosing the condition. Poor performance, lethargy, muscle soreness, infertility, obesity, and other clinical signs commonly attributed to hypothyroidism are not always associated with thyroid hormone abnormalities.

Measures, Cortisol, Lymphocyte Subsets, and Energy Metabolism in Horses

The Center of Excellence for the Study of Livestock Diseases and Human Health, as it was originally called, began operations at the start of the new fiscal year in July 1984 with a $250,000 grant from the Tennessee Better Schools Program. At the time, it was one of 14 centers established by the Tennessee Higher Education Commission (THEC) and was one of three centers targeted by THEC to have the greatest potential to bring national recognition to Tennessee.

By 1989, THEC had designated the center as “accomplished”; this designation, then earned by only four centers in the university, meant the center had met or exceeded all projected objectives and had achieved the recognition THEC predicted.

This year marks the 30th anniversary for the center, and to commemorate, we asked some of our most frequently center-funded faculty to recall their most proud research accomplishments.
Mastitis in Dairy Cows

Dr. Stephen Oliver (seen on p. 9, top left):

“Center support resulted in the generation of the necessary preliminary data that allowed us to be competitive at the national level. Our research on identification and characterization of Streptococcus uberis virulence factors resulted in the discovery of a molecule that we refer to as Streptococcus uberis Adhesion Molecule or SUAM. SUAM is a novel bacterial protein involved in the pathogenesis of Strep. uberis mastitis. SUAM has several potential applications, including use as an antigen/vaccine for the prevention of Strep. uberis mastitis in dairy cows, and use as a therapeutic in the treatment of cows with mastitis.

This discovery resulted in the submission of U.S. Non-Provisional Patent and PCT International Patent applications. SUAM now has patent protection in the United States, several countries in the European Union, Canada, Mexico, New Zealand, Australia, and Brazil. From 2004 to 2011, we received over $1 million from USDA for research on SUAM projects. We are in deliberations with a commercial partner to continue to develop SUAM technology. The center has been very meaningful to me as a research scientist and has helped move the science forward more expeditiously.”

Setting Interpretive Standards for Methicillin-Resistance

Drs. David Bemis (R) & Stephen Kania (L):

“Center-sponsored work led to a change in the way the Clinical Laboratory Standards Institute (CLSI) interprets methicillin resistance in Staphylococcus pseudintermedius isolated from dogs. The CLSI is an internationally-recognized organization that sets standards and publishes guidelines for all aspects of diagnostic laboratory operations. As a result of our center work, the CLSI document outlining susceptibility testing guidelines was altered to enable detection of a considerable number of strains that had previously tested negative due to the original interpretive criteria being based on S. aureus.”

Discovering Ways to Better Treat Coronaviruses in Animals

Dr. David Brian (seen on p. 9, top right):

“My work on coronaviruses began when I arrived at the UTCVM in 1976, a time when coronaviruses were known as serious pathogens in domestic animals but minor pathogens in humans.
(common cold, mostly); little was known about how coronaviruses replicate inside cells. Our goal was to identify targets for new therapeutic agents. We tackled coronavirus replication by studying the pig and cow coronaviruses that belong to separate coronavirus subgroups. Our major contribution came in 1989: the discovery that coronavirus messenger RNAs, unlike those in other known viruses, behave (in part) as mini replicons and undergo rapid amplification. Rapid amplification aids survival of this virus with the largest known RNA genome. This discovery was first presented at an International Coronavirus Conference in Cambridge, England, and was later published in the Proceedings of the National Academies of Science U.S.A (Coronavirus subgenomic minus-strand RNAs and the potential for mRNA replicons. 1989;86:5626–30). The finding changed the working model for how virologists think coronaviruses replicate and identified new potential target sites for blocking virus replication. Today, we know that there are several serious veterinary and human coronavirus pathogens. These include the recently-discovered SARS and MERS coronaviruses, which are zoonotic and harbored in bat reservoirs. Our lab remains focused on identifying potential targets for therapeutic agents against coronaviruses.”

**Bovine Viral Diarrhea**

**Dr. Leon Potgieter**

Dr. Potgieter was frequently funded by the center immediately after its inception in 1984. From 1995 to 2001, he was appointed as the assistant director of the center. When asked about the role the center played in his research, he talked about how “BVD had a primary role in enhancing the severity of other respiratory infections in cattle. The Center of Excellence helped with equipment and supplemental funding to continue our research program for the development of a ‘safe’ vaccine for the disease. Some of our COE funding went toward purchasing the first PCR [polymerase chain reaction] machine in a UT campus laboratory. I went to the Keystone Symposia in Colorado to learn PCR technique and then to a conference in North Carolina to learn DNA sequencing. Now, PCR is a necessity in every lab.”

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**Expenditures**

![Expenditures Graph](image_url)

**Total = $73,342,669**

Fig. 3. Expenditures from extramural funding since the inception of the center.

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**COE Faculty Have Published:**

- 2,443 peer-reviewed articles
- 303 books or book chapters
- **Presented:**
  - 3,339 talks or posters

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Program Report
## Research Funded* Externally FY 2013

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Federal</th>
<th>Industry</th>
<th>Foundation/Private</th>
<th>University</th>
<th>Totals</th>
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<td>$200,000</td>
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<td>Eda, Shigetoshi</td>
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<td><strong>Totals</strong></td>
<td>$1,709,257</td>
<td>$10,000</td>
<td>$14,370</td>
<td>$13,000</td>
<td>$1,746,627</td>
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*Represents FY 2013 receipts for active grants

## Research Expenditures FY 2013

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<thead>
<tr>
<th>Investigator</th>
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<th>Industry</th>
<th>Foundation/Private</th>
<th>University</th>
<th>Totals</th>
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<td>Baek, Seung Joon</td>
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<td>*$34,442</td>
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<td>Xu, Xuemin</td>
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<td>$86,385</td>
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*Federal flow-through (National Institutes of Health)
The Center of Excellence in Livestock Diseases and Human Health supports investigators and promotes research through a variety of mechanisms. Although it is not a primary source of research funding, the center facilitates established investigators’ efforts to maintain and expand their research programs, promotes new investigators’ potential to develop competitive research programs, and promotes new collaborative ventures.

Center faculty consist of senior members who 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 secure external funding within 2 years; members who fail to secure such funding will be placed on probation for 1 year. If, at the end of the probationary period, external funding has not been secured, the member will no longer be eligible for center funds.

Bridge funds
The center provided $92,235 in bridge funding to support Dr. Madhu Dhar and Dr. Cristina Lanzas while they pursue additional sources of external funding.

In fiscal year 2013, Dr. Dhar was funded by Morris Animal Foundation and the Physician’s Medical Education and Research Foundation. She had five publications published in peer-reviewed journals, including three articles in the FASEB Journal, which has an impact factor of 5.704. Her research focuses on harvesting and using adult equine stem cells in horse rehabilitation and healing.

Dr. Lanzas’ research interests include developing and applying mathematical and epidemiological approaches to study the dynamics and control of infectious diseases caused by zoonotic and gastrointestinal pathogens in human and animal populations. She published in PLoS One in calendar year 2012. PLoS One is one of the oldest and most well-respected open-access journals. Open-access journals provide free content to all readers rather than charging subscription fees.
The center provided $138,333 in start-up funds for 13 junior faculty members to secure additional external funding in 2013.

### Start-up Funds

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<thead>
<tr>
<th>Faculty Member</th>
<th>Area of Research</th>
<th>$ Amount</th>
<th>Faculty Member</th>
<th>Area of Research</th>
<th>$ Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biomedical &amp; Diagnostic Sciences</strong></td>
<td>Wildlife parasitology, including <em>Trichomonas gallinae</em> in birds</td>
<td>25,000</td>
<td>Radiation oncology, including optimizing contrast-enhanced, multidetector abdominal CT in sedated canine patients</td>
<td>1,250</td>
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</tr>
<tr>
<td>Dr. Richard Gerhold</td>
<td></td>
<td></td>
<td>Dr. Erica Fields</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Small Animal Clinical Sciences</strong></td>
<td>Cardiology, including heart disease in dogs, cats, and horses and specifically arrhythmias in the exercising animal</td>
<td>5,000</td>
<td>Palliative care for cancer patients; developing new radiation therapy protocols for small animal patients with various tumor types</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>Dr. Marc Caldwell</td>
<td>Production animal medicine, infectious diseases of livestock</td>
<td>8,333</td>
<td>Dr. Sara Frazier</td>
<td>Oncology, including effects of pioglitazone, rosiglitazone, carboplatin, mitoxantrone, and doxorubicin to treat canine cancers</td>
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</tr>
<tr>
<td>Dr. Karen McCormick</td>
<td>Large animal clinical medicine, including testing blood coagulation variation in horses</td>
<td>5,000</td>
<td>Dr. Sophy Jesty</td>
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<tr>
<td>Dr. M. Reza Seddighi</td>
<td>Pharmacokinetics/dynamics of anesthetic drugs with emphasis on the potency of inhalational anesthetics</td>
<td>10,000</td>
<td>Dr. Nathan Lee</td>
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<tr>
<td>Dr. Brian Whitlock</td>
<td>Large animal field service medicine and food animal theriogenology (reproduction medicine)</td>
<td>25,000</td>
<td>Dr. Elizabeth May</td>
<td>Bacterial skin and ear infections, staphylococcal bacteria and mechanisms of resistance, hair coat disorders in Schipperkes</td>
<td>5,000</td>
</tr>
<tr>
<td>Dr. Katie Tolbert</td>
<td>Feline gastrointestinal disease as a translational model for human disease</td>
<td>15,000</td>
<td>Dr. Adesola Odunayo</td>
<td>Emergency and critical care</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Dr. Valeria Tanco</td>
<td>Large and small animal theriogenology</td>
<td>2,500</td>
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</table>
Infrastructure and supplies
The center promotes the research infrastructure of both the UTCVM and the Institute of Agriculture through the purchase and maintenance of essential research equipment. The Research Advisory Committee reviews requests based on three criteria: justification of need, current availability of equipment, and number of investigators who may benefit. In support of the UTCVM’s research enterprise in 2013, the center funded tests and certifications for two fume hoods in research laboratories in the college ($200). Such tests ensure that faculty and staff who use these hoods are safe from harmful fumes and other potentially dangerous airborne substances; they also protect research cells by preventing their contamination. A total of $1,103.16 was paid for carbon dioxide gas to be used in incubators in the Tumor Biology Laboratory, as well as for liquid nitrogen to maintain frozen cells. Faculty members Dr. Madhu Dhar, Dr. Maria Cekanova, and Dr. Casey LeBlanc benefit from this laboratory equipment.

Various supplies for the Tumor Biology Laboratory totaled $1,600; however, cell sorter services provided by laboratory manager Nancy Neilsen for numerous faculty throughout the college and university earned the center $2,025 in income to more than offset the cost of supplies.

Training
To keep faculty, staff, and students abreast of new research and techniques and to increase our competitiveness in obtaining extramural funding, the center sponsors training and continuing education opportunities.

Dr. Stephen Kania received center funds to travel with two students in the Summer Student Research Program to present their work at the 2012 Merial-NIH Veterinary Scholars Program Symposium in Ft. Collins, CO, at Colorado State University. By attending this meeting, Dr. Kania was able to make an essential contact with a National Institutes of Health director for sponsored training programs, and as a direct result, drafted two applications to support pre- and post-doctoral students. If one of these is awarded, the entire research enterprise at the UTCVM will be enriched.
In further support of the Summer Student Research Program, the center provided meals ($137.93) during the student/faculty matching session, as well as during one of the students’ professional development sessions.

Ms. Rachel Dutkosky, one of the students in the 2012 Summer Student Research Program, received travel funds ($688) to present a poster at the American College of Veterinary Pathology Conference in December 2012. The poster was a result of her work with Dr. Marcy Souza and Dr. Kim Newkirk: evaluating the effectiveness of a subcutaneous implant to treat white nose syndrome in captive bats.

Likewise, Mr. Christopher Lee Emery, also a 2012 summer student, presented his work at the Association of Avian Veterinarians annual conference, which took place in August 2012 in Louisville, KY. Emery won the Student Manuscript Competition, which funded his conference registration. The center provided other travel-associated costs ($664.10). Emery’s work was on the pharmacokinetics of nebulized terbinafine in Hispaniolan Amazon parrots.

Center faculty member Dr. Maria Cekanova met with Dr. Lawrence Marnett’s cancer research group at Vanderbilt University to discuss current progress and future studies for clinical development of fluorocoxib use in humans and domestic animals. The meeting included Dr. Christopher Contag from Stanford University’s School of Medicine and Dr. William C. Kruka, executive vice president for corporate development and imaging business head unit at Perkin Elmer. Dr. Cekanova received center travel support ($600) to give a presentation about her progress using fluorocoxib A in dogs and cats with cancers.  

Dr. Cekanova was also partially funded by the center to present a poster at the Veterinary Cancer Society’s annual conference in Las Vegas, NV.

The center also provided $1,503 for a tuition waiver for one student in the Comparative and Experimental Medicine graduate program for 3 hours of coursework in summer 2013.
The center was a major sponsor of the Comparative & Experimental Medicine and Public Health Research Symposium, which brought together researchers from 17 different departments for a 2-day-long event that included special seminars on diagnosis of and outbreak investigations into fungal infections, translational disease intervention strategies, and one health.

Featured was Dr. Ralph Tripp (above, center) of the Department of Infectious Diseases at the University of Georgia College of Veterinary Medicine. Also featured were Dr. Marion Kainer of the Tennessee Department of Health and Dr. David Bemis, professor at the UTCVM and center co-investigator. Ms. Channa Palmer, lead university recruiter for the Oak Ridge National Laboratory, gave an overview of postdoctoral opportunities available at ORNL. The symposium culminated with an awards banquet and guest speaker Dr. Marcy Souza, known for her research on infectious and zoonotic diseases of exotic pets and wildlife.

Fifty-five 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 76 new scientists to present, and at the end of the 2 days, the institute was able to boast seven winners of travel awards.

The center sponsored five of the 2012 award winners to present at four national scientific meetings during fiscal year 2013. Dr. Ricardo Videla presented at the American Association of Immunologists meeting in Honolulu, HI. Dr. Tinting Xu traveled to San Antonio, TX, to present at the 52nd Annual Meeting of the Society of Toxicology. Dr. Maria Cekanova went to Las Vegas, NV, to present a poster and oral presentation to the Veterinary Cancer Society, and Dr. Eman Anis presented at the Conference of Research Workers in Animal Disease in Chicago.

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.

http://www.vet.utk.edu/research/symposium/
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 2012 calendar year can be found in the Publications and Presentations section (pp. 38–49).

Through scientific conferences, Center of Excellence faculty share their research with a worldwide audience. The map above showcases where their research was presented in 2012.
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. Within the last 2 years, UTCVM has also launched a Facebook page and a new VolVet Connect alumni e-newsletter. At the end of July 2013, the Facebook page had 3,122 “likes” from individuals from seven 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. UTCVM is also on Twitter (1,362 followers), has a YouTube channel with 65 subscribers and 3,062 views since its inception in 2012, and a Pinterest presence with 68 followers.

Our researchers are also occasionally featured in Tennessee Alumnus and Tennessee Land, Life & Science, tri-annual and bi-annual magazines produced by the University of Tennessee and the UT Institute of Agriculture, respectively. The center itself was featured in the spring 2012 issue of Tennessee Land, Life & Science (see Fig. 4).

The in-house newsletter Discovery keeps UTCVM researchers informed about each other’s work and research-related policies and resources. The quarterly newsletter Volunteer Vet features research activities and results and is distributed to donors and employees. The annual magazine Veterinary Vision carries features concerning ongoing research activities and the results of concluded research studies. It is written for a general audience.

![For Better Livestock & Human Health](image)

**T**he Center of Excellence in Livestock Diseases and Human Health, located in Knoxville, is the site of cutting-edge research into infectious animal disease and infectious human disease. This center has more than 1,000 full- and part-time faculty, research staff, and support staff.

**For Better Livestock & Human Health**

Develop new strategies to diagnose, treat, and prevent disease.

Center faculty began to achieve these goals in 1994, when the state of Tennessee created several centers of excellence for public higher education. UTCVM’s center was among the first to be funded. Through the competitive process, the center selected researchers receiving grants from the center for the funds in one of two ways: as seed money to establish preliminary results and become more competitive for larger grants, or as bridge funding to keep their laboratories competitive during times of reduced support. Researchers receiving grants from the center ran the funds in one of two ways: as seed money to establish preliminary results and become more competitive for larger grants, or as bridge funding to keep their laboratories competitive during times of reduced support. 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**The center was featured in the spring 2012 issue of Tennessee Land, Life & Science, a bi-annual magazine produced by the UT Institute of Agriculture.**
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.

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.

The center funded 19 student salaries. A grant from Morris Animal Foundation funded one student. Dr. Stephen Kania, a center faculty member, coordinated the program along with Dr. Linda Frank; they received a $10,000 grant from Merial to help support the program. From Merial, four additional student salaries were funded in summer 2013; these students also received travel funds from Merial to present their work as posters at the 2013 Merial-NIH Veterinary Scholars Program Symposium in East Lansing, MI, at Michigan State University. Three center-sponsored students attended the symposium, as well (see below). From 2008–2012, 30 peer-reviewed publications were produced as a result of past summer students’ work.

To maximize student participation, the program is open to both center and non-center faculty. During fiscal year 2013, five junior members participated in the program. The center will continue to encourage participation of its faculty.

$L10,000 from Merial helped fund the Summer Student Program$

L-R: Jose Grenet, Marissa Torre, Jessica Chin, Patrick Reilly, Kimberly Pompo, Brooke Giff, and Erin Felty at the 2013 Merial-NIH Veterinary Scholars Program Symposium. Photo: Courtesy, S. Kania
The students involved in the summer research program and a brief description of their activities follow:

**Victoria J. Balvin**, 2nd year. **Faculty Mentor**: Dr. Brian Whitlock. Bethesda, OH. BS in pre-veterinary studies and animal science from the University of Findlay, Findlay, OH. **Summer Project**: Studied the effects of beta-hydroxy-butyrate on luteinizing hormone in wethers. **Career Interests**: Food animal and equine medicine, field service.

**Jessica Chin**, 2nd year. **Faculty Mentor**: Dr. Angela Witzel. Brooklyn, NY. BS in biology from Trinity College, Hartford, CT. **Summer Project**: Retrospective study of dual absorptiometry x-ray (DEXA) scan data, which differentiates between bone mineral content, fat body mass, and lean body mass. Goal was to determine what portion of excess body weight in overweight and obese dogs and cats can be attributed to fat body mass versus lean body mass. Data will be useful in calculating energy needs and drug dosages for overweight pets because fat body mass does not metabolize drugs. **Career Interests**: Small animal or exotic medicine.

**Emily Credit**, 3rd year. **Faculty Mentor**: Dr. Julie Albright. Pittsford, NY. BA in organismal biology from Keuka College, Keuka Park, NY. **Summer Project**: Compiled data on how puppies develop and their use of different toys in play behavior. **Career Interests**: Small animal medicine.

**Mary Dell Deweese**, 3rd year. **Faculty Mentor**: Dr. Karen Tobias. Germantown, TN. Studied animal science at the University of Tennessee, Knoxville, TN. **Summer Project**: Predicting tracheal diameter using radiographs. Success would enable surgeons to obtain an ideal stent size pre-operatively, increasing survival time of dogs undergoing surgery to treat tracheal collapse. **Career Interests**: Surgery.

**Carrie Dobey**, 2nd year. **Faculty Mentor**: Dr. Richard Gerhold. Lawrenceville, GA. MS in wildlife biology from the University of Tennessee, Knoxville, TN; BS in biology from North Georgia College, Dahlonega, GA. **Summer Project**: Helped validate a recently-developed PCR test to detect *Parelaphostrongylus tenuis* (brain worm) in domestic and wild hoofed animals. Evaluated which lesions can be used to detect *P. tenuis* DNA when the worm itself is not present. **Career Interests**: Pathology and small animal surgery.

**Blake Everett**, 2nd year. **Faculty Mentors**: Dr. Agricola Odoi and Dr. David Bemis. Lewisburg, TN. BS in animal science from Middle Tennessee State University, Murfreesboro, TN. **Summer Project**: Compared three antibiotic-impregnated disks both singly and in combination to detect methicillin resistance in *Staphylococcus pseudintermedius* in dogs. **Career Interests**: Mixed-animal practice and surgery.

**Sloane Everett**, 2nd year. **Faculty Mentor**: Dr. Rebecca Wilkes. Collierville, TN. BS in biological sciences from the University of Missouri, Columbia, Missouri. **Summer Project**: Used PCR to analyze genomic differences between *Trichomonas foetus* in cats vs. the same species in cattle. Evaluated the genetic differences between three strains of *Trichomonas gallinae* from band-tailed pigeons. **Career Interests**: Laboratory animal medicine, pathology, research.

**Erin Felty**, 2nd year. **Faculty Mentors**: Dr. Angela Witzel and Dr. Nancy Howell. Collierville, TN. BS in biology from the University of Tennessee at Chattanooga, Chattanooga, TN. **Summer Project**: Evaluated the quality of...
veterinary nutrition programs at other veterinary colleges by surveying recent graduates’ perceived level of adequacy in nutrition knowledge, and gathered information about nutrition curriculum and requirements at U.S. veterinary schools. **Career Interests**: Feline medicine, small animal internal medicine, nutrition, and pathology.

**Jose Grenet**, 2nd year. **Faculty Mentor**: Dr. Edward Ramsay. Memphis, TN. BA in neuroscience and Latin American studies from Vanderbilt University, Nashville, TN. **Summer Project**: Studied epidemiological risk factors associated with red panda neonatal mortality to provide recommendations for captive red panda husbandry in order to improve neonatal survival. **Career Interests**: Conservation medicine, international medicine, zoo and wildlife medicine.

**Brooke Griff**, 2nd year. **Faculty Mentor**: Dr. Debra Lee Miller. Virginia Beach, VA. BS in zoology, North Carolina State University, Raleigh, NC. **Summer Project**: Evaluated the gray whale epidermis microscopically and measured mercury, selenium, and stable isotope levels to determine the effect of their different levels on the epidermis. **Career Interests**: Zoological and wildlife medicine.

**Benton Harvey**, 3rd year. **Faculty Mentor**: Dr. Brian Whitlock. Nashville, TN. BS in neuroscience, College of William & Mary, Williamsburg, VA. **Summer Project**: Collected over 800 blood samples from beef cattle in each Southeastern state to complete a survey of anaplasmosis and to complete a write-up of data from PCR and cELISA tests. **Career Interests**: Veterinary mission work in Central or South America.

**Lauren Henderson**, 2nd year. **Faculty Mentor**: Dr. Richard Gerhold. Hendersonville, TN. BS in animal science from the University of Tennessee, Knoxville. **Summer Project**: Collected samples and extracted DNA to analyze heart tissue samples of raccoons, opposums, and feral hogs in southern Appalachia for *Toxoplasma gondii* and *Trypanosoma cruzi*. **Career Interests**: Wildlife rehabilitation and conservation medicine, public health, international medicine, zoonotic disease research.

**Nicole Laia**, 3rd year. **Faculty Mentor**: Dr. Jacqueline Whittemore. Morgan Hill, CA. BS in biochemistry from California Polytechnic State University, San Luis Obispo, CA. **Summer Project**: Determining if administration of a probiotic helps prevent antibiotic-associated diarrhea in cats being given oral clindamycin. **Career Interests**: Small animal practice.

**Jacob Malugin**, 2nd year. **Faculty Mentor**: Dr. Valeria Tanco. Culleoka, TN. BS in veterinary science from the University of Tennessee at Martin, Martin TN. **Summer Project**: Evaluated the effects of gonadotropin-inhibitory hormone on luteinizing hormone surge and ovulation in dairy heifers. **Career Interests**: Mixed-animal practice (50/50 small and large animals), reproduction, and surgery.

**Kelly Miller**, 2nd year. **Faculty Mentor**: Dr. David Bemis. Kingsport, TN. BS in animal science from the University of Tennessee, Knoxville. **Summer Project**: Studied antimicrobial effects of Yerba mate tea extracts on methicillin-resistant staphylococci obtained from samples submitted to the UTCVM. Concentrations of tea extract as low as 20 mg/mL successfully killed all strains of bacteria tested. **Career Interests**: Dermatology, radiology, feline internal medicine, community practice.

**Kristen Niemann**, 2nd year. **Faculty Mentor**: Dr. Rebecca Wilkes. Youngsville, NY. BA in biology from Elmira College, Elmira, NY. **Summer
**Project:** Evaluated several different efficient delivery methods for the treatment of feline herpes using RNA interference.

**Career Interests:** Small animal medicine and research.

**Kimberly Pompo,** 2nd year. **Faculty Mentor:** Dr. Rebecca Trout-Fryxell. Syracuse, NY. BS in biology with medical concentration from Le Moyne College, Syracuse, NY. **Summer Project:** Collected ticks from UT Research and Education Centers across the state to determine the distribution of *Anaplasma marginale* within ticks. Bovine anaplasmosis has emerged in East Tennessee. It is an often fatal disease of humans and ruminants (including cattle). **Career Interests:** Mixed-animal practice, zoo or wildlife medicine.

**Brianna Potter,** 3rd year. **Faculty Mentor:** Dr. Sophy Jesty. Ramona, CA. BS in general biology from the University of California, San Diego, La Jolla, CA. **Summer Project:** Hypothesized that long-term, intense exercise can cause arrhythmias in the heart. Rarely, ventricular arrhythmias can cause sudden cardiac death in high-level athletes. Performed heart pacing protocols by exercising dogs on a treadmill. **Career Interests:** Cardiology specialization.

**Patrick Reilly,** 2nd year. **Faculty Mentor:** Dr. Debra Lee Miller. Collierville, TN. BAS in biology from the University of Memphis, Memphis, TN. **Summer Project:** Tested for differences in two ranavirus isolates among four host wood frog populations, as well as tested whether individual tadpoles infected with ranavirus can act as a superspreader. **Career Interests:** Wildlife research.

**Mike Robbins,** 3rd year. **Faculty Mentor:** Dr. Martha Cline. Medina, OH. BS in pre-veterinary medicine from the University of Findlay, Findlay, OH. **Summer Project:** Analyzed how different water bowls affect drinking habits in cats and if the bowl type makes a difference in urine concentration and the likelihood of certain stone formation. **Career Interests:** Small animal nutrition, academic medicine.

**Shannon Shuttle,** 2nd year. **Faculty Mentor:** Dr. Madhu Dhar. New Ipswich, NH. BS in biology from the University of Southern Main, Portland/Gorham, ME; studies in biology at Elmira College, Elmira, NY. **Summer Project:** Analyzed data from skin biopsy samples for a wound healing study in horses. Assisted with adult stem cell injections and biopsy sampling. **Career Interests:** Mixed-animal practice, incorporating research.

**Alicia Thomas,** 3rd year. **Faculty Mentor:** Dr. Olya Smrkovski. Midlothian, VA. BS in biochemistry from Virginia Tech University, Blacksburg, VA. **Summer Project:** Retrospective study on canine hemangiosarcoma. Collected specific information from patient medical records. Wrote and submitted an abstract for the Veterinary Oncology Conference. **Career Interests:** Small animal private practice, oncology or surgery residency.

**Marissa Torre,** 2nd year. **Faculty Mentor:** Dr. Stephen Kania and Dr. Linda Frank. Inwood, NY. BS in biology from Binghamton University in Binghamton, NY. **Summer Project:** Studied the diagnostic efficacy of real-time PCR on dermatophytosis. Extracted DNA from feline samples and tested them via real-time PCR and then compared the results to the gold standard, which is fungal culture, for each of the samples. **Career Interests:** Private practice, small animal medicine internship.
Five-Year Benchmark Data

Productivity among center faculty has been stable during the last 5-year period. From 2009-2013, center faculty published 255 articles in peer-reviewed journals and gave 207 presentations at national and international meetings.

Total research funding was down from $2.5 million in 2012 to $1.75 million in 2013 (Fig. 5); this downturn is a direct result of decreased federal support for our nation’s research efforts and increasing competition for these diminishing funds. Figure 6 shows federal funding from 2009 to 2013.

It is also important to note that center support may not garner extramural funding in the same year, potentially requiring years for the necessary preliminary studies to mature, and requiring additional time for the application cycle. For instance, when considering external research funding for 2013 obtained by investigators supported by the center during the previous 3 years, and not just 2013 (Fig. 5), it is apparent that such funding for these most recently supported faculty was considerably higher.

Over the past 5 years, center faculty have submitted 293 extramural grant proposals. Of those, 54 have been funded, and eight await decisions by the funding agencies. The 5-year funding rate for center faculty-submitted proposals is 18% (Fig. 7). This success rate is in line with

Fig. 5. External research funding by fiscal year. Column 2013b shows FY 13 funding from investigators supported by the center from FY 10–13.

Fig. 6. External research funding from the three major sources of fiscal year receipts.

Fig. 7. Number of proposals submitted by center faculty and success rate for fiscal years 2009 to 2013. *Eight proposals are still awaiting decision by the funding agency.
the overall National Institutes of Health success rate for the same time period (17.6%).
Expenditures per faculty member were $171,458 in FY 2013. Over the past 5 years, the mean expenditure amount per faculty member has been $215,948. The 5-year average return on the state’s investment in the center is 5.5:1, the ratio of research expenditures to the state’s appropriation. For comparison, benchmark data from 2009-2013 are summarized in Figs. 5–8.

**Benchmark Summary (2009-2013)**

- Average refereed articles per faculty member: 4
- Federal funding total: $11,769,436
- Average return on investment: 5.54:1
The center successfully endured several years of sluggish federal funding and is poised to advance with an even greater commitment to livestock and human health. This year (FY14) the center will expend approximately $204,088 to fund 11 projects. In addition, the center will continue to support core facilities and contribute to the purchase of essential research software and equipment. Already, 2014 center faculty have secured approximately $375,000 in external funding.

In recent years, the center has emphasized comparative medicine and human health and has contributed significantly to innovation and scientific literature in these areas. In fact, center faculty are responsible for a large proportion of federal biomedical research funds granted across all Knoxville campuses of the University of Tennessee, in particular those funds from the National Institutes of Health. While these programs are anticipated to continue and grow with center support, we are also looking forward to a larger emphasis on livestock health research to bring our agricultural mission into greater focus. With the opening of both a new Equine Hospital and a new Farm Animal Hospital, the College of Veterinary Medicine is poised to be an academic and professional leader in the study of livestock infectious disease, tissue repair, and reproductive health. In addition, the research emphasis of the newly-hired department head in the UTCVM Large Animal Clinical Sciences Department, Dr. David Anderson, will ensure our faculty actively seek opportunities to positively influence livestock research.

The center will again be a major contributor to the Comparative & Experimental Medicine and Public Health (CEMPH) Research Symposium. The CEMPH Symposium provides a venue for new investigators (graduate students, postdocs, and research assistant professors) to gain experience presenting their research as oral presentations in scientific meeting format. The symposium grew from 15 student presentations at the inaugural 2007 event to nearly 80 presentations at the 2013 symposium with participants representing 17 UT departments and programs. More than 300 people attended the 2-day event. An additional goal of the symposium is to promote and facilitate the development of research collaborations among biomedical scientists from the different campuses of the university, a goal that closely parallels important objectives of the center.

Additionally, we will continue to participate conceptually and materially in strategic planning to develop areas of investigative strength in the UTCVM and the Institute of Agriculture, as well as across the University of Tennessee campuses and with other regional universities.
Ways to Prevent and Treat Colorectal Cancer

Colorectal cancer is the third-most common cancer in the United States, and it is the third deadliest, with more than 140,000 new cases each year. Obesity and chronic inflammation may increase the risk of colon cancer.

Nonsteroidal anti-inflammatory drug activated gene-1 (NAG-1) is a gene that exhibits anti-inflammatory, anti-obesity, and anti-tumorigenic activities. How this gene accomplishes these activities is poorly understood and is the subject of Dr. Baek’s research.

Dr. Baek’s preliminary data suggest that NAG-1 is somehow linked to a signaling pathway that has already been determined to play an important role in obesity/inflammation-related colorectal cancer. By changing the way the body expresses NAG-1, this pathway–termed TGF-beta signaling–may also be altered. By manipulating these potentially connected processes, we can become one step closer to finding a way to prevent or treat colorectal cancer.
Early Bladder Cancer Detection

Like people, as dogs age, their risk for developing cancer increases. The early detection of cancer is imperative for diagnosis and treatment of human and canine patients to increase survival and quality of life. In her study, Dr. Cekanova is evaluating a new optical imaging agent, fluorocoxib A, for use in detecting cyclooxygenase-2 (COX-2)-expressing, naturally-occurring urinary bladder tumors in dogs as a model for human cancers.

Fluorocoxib A accumulates in tumors and generates fluorescence, which can then be used to detect the tumors during endo/cystoscopy, a minimally-invasive procedure that allows clinicians to examine the bladder, urethra, colon, small intestine, esophagus, mouth, and nose.

Results from this pre-clinical study will improve the identification of COX-2-expressing tumors in dogs and have an immediate veterinary application; the results can then be translated for use in humans, who will develop over a million new cases of cancer in 2013 in the United States alone.

The dual images in the Table of Contents show fluorocoxib A uptake in tissues during a cystoscopy procedure in a dog.
Using Foam Cells to Fight Atherosclerosis

Atherosclerosis, a chronic inflammatory disease, results in part from the accumulation of modified lipoproteins in the arterial wall and formation of lipid-laden “foam cells.” These foam cells surround fatty deposits (usually cholesterol) on blood vessel walls and help form plaques (build-ups).

Lysophosphatidic acid (LPA) is abundant in atherosclerotic plaques, and Dr. Cui’s research group recently discovered that LPA helps induce foam cell formation. Understanding how LPA mediates foam cell formation is the focus of her current investigation.

Because LPA regulates a range of physiologic and pathologic processes, it is emerging as a target for a new class of therapeutics for cardiovascular disease. Dr. Cui’s research is the first step in developing new ways to treat atherosclerotic lesions and thus prevent unnecessary deaths from heart attacks.
Host Immunity to *Staphylococcus pseudintermedius*

*Staphylococcus pseudintermedius* is the primary cause of pyogenic skin infections in dogs and is responsible for numerous other canine infectious diseases. The resistance to multiple classes of antibiotics that has developed throughout our geographic region (estimated at 30% by Dr. Kania’s group) has left few therapeutic choices.

Recognizing that conventional antibiotic therapy will no longer be an option, control strategies are shifting to new approaches, like Dr. Kania’s project to determine how dogs’ immune systems fight *S. pseudintermedius* and reveal *S. pseudintermedius* vulnerabilities toward the long-term goal of developing new, effective treatments.

These results will translate to human medicine since the problems encountered in dogs with *S. pseudintermedius* are analogous to those seen with *S. aureus* in humans.

Dr. Stephen Kania

Professor, Biomedical and Diagnostic Sciences
PhD, University of Florida
4 refereed publications in 2012
178 article citations in 2012
In addition to center funds, Dr. Kania’s research is supported by the American Kennel Club Canine Health Foundation, Winn Feline Foundation, and Merial Limited.

Co-investigator: Dr. David Bemis

The red petri dish image in the Table of Contents shows *Staphylococcus pseudintermedius* growth.
Stress and Pancreatic Cancer

Smoking, psychological stress, and alcohol consumption are all known risk factors for pancreatic ductal adenocarcinoma (PDAC). These risk factors simultaneously sensitize the nicotinic acetylcholine receptors (nAChRs) that stimulate PDAC and desensitize the nAChRs that inhibit PDAC.

Dr. Schuller’s goal is to determine the ways in which this pathologic process works. Her data emphasize the role of two types of molecules on a cell’s surface that receive chemical signals from outside the cell. These receptors appear to contribute to PDAC via the activation of multiple signaling pathways by stress neurotransmitters.

Dr. Schuller’s results could lead to clinical trials and eventually to improving survival rates of PDAC patients and preventing the development of PDAC in individuals at risk.
Intervening in Obesity-associated Breast Cancer

During summer 2013, the American Medical Association officially declared obesity a disease. Over 35% of women in the United States are considered obese. Growing evidence indicates a link between obesity and increased risk for developing breast cancer. Sorting through the details of this link and developing methods for intervention are the foci of Dr. Wang’s research.

Using an in vitro cell model created in his laboratory, Dr. Wang studies the effects of cumulative exposures of carcinogens B[a]P and PhIP on normal and pre-cancerous breast cells. Exposure to these carcinogens comes from various places, including from smoke (burning wood and cigarettes) and red meat cooked at high temperatures (like grilled meats).

Studies suggest that carcinogens like B[a]P and PhIP may also induce carcinogenesis of obesity-involved cells. Dr. Wang is assessing the ability of certain types of carcinogen-exposed cells to increase the likelihood of breast cells becoming cancerous, as well as agents (like green tea catechins) capable of blocking such cancer progression.
Dissecting the Intricacies of Alzheimer’s Disease

Apoptosis, a type of cell death regulated by the body, is believed to be a springboard for the neuronal degeneration that leads to Alzheimer’s disease. Determining the way this process happens is the focus of Dr. Xu’s research.

Dysfunction in mitochondria, the powerhouse of the cell, can lead to apoptosis, and Dr. Xu wants to know how that connection may lead to Alzheimer’s disease. In his laboratory, they are studying PSAP, a cellular protein expressed in the mitochondria in neurons in the brain. Dr. Xu has found that when PSAP is overexpressed, cells undergo apoptosis associated with mitochondrial dysfunction.

Therefore, his goal is to determine the pathological role of PSAP in order to lead to new therapeutic targets for treatment and prevention of Alzheimer’s disease.
Role of *Streptococcus uberis* in Dairy Cattle Mastitis

Mastitis occurs worldwide and is characterized by inflammation of mammary tissue, which severely affects milk production and quality. In the dairy industry, mastitis is the most costly disease of dairy cattle, costing U.S. dairy producers over $2 billion annually. Mastitis is caused by bacterial pathogens, and among them *Streptococcus uberis* is showing an alarming increasing prevalence.

In spite of this, how *S. uberis* affects mammary tissue to cause mastitis is still not understood and is the focus of Dr. Almeida’s research. Thus far, he has identified a list of genes associated with early bacterial infection events, and his immediate goal is to describe the roles of three of these genes in relation to *S. uberis*.

The long-term goal of this research is to develop vaccines to prevent or control *S. uberis* mastitis to not only minimize the negative financial impact but also to improve the health and comfort of dairy cattle.
Halting Bovine Coronavirus Replication

Coronaviruses cause common upper respiratory and gastrointestinal infections in mammals and birds, including humans and livestock. One type of coronavirus causes severe acute respiratory syndrome (SARS) (discovered in 2002) and another is the more recently-found (in 2012) Middle Eastern respiratory syndrome (MERS), which is seen in bats in the wild.

Both the SARS and MERS coronaviruses are zoonotic, and in humans, infections cause high death rates (approaching 10% and 50%, respectively). Coronaviruses may also be a cause of multiple sclerosis in humans.

Coronaviruses harbor the largest, single-stranded RNA virus genome known. Dr. Brian’s group studies how the coronavirus genome replicates with the goal of characterizing the inter-molecular steps required for reproduction. These steps involve RNA-RNA interactions, protein-RNA interactions and protein-protein interactions. Once characterized, these interactive sites may be useful targets for anti-coronaviral drug design.
On-site Diagnosis of Johne’s Disease in Dairy Cattle

The U.S. Department of Agriculture describes Johne’s disease (JD) as “a contagious, chronic and usually fatal infection that affects the small intestine of ruminants.” It is caused by a hardy bacteria related to the agents of leprosy and tuberculosis. The disease is causing significant economic loss to the global dairy industry.

Dr. Eda’s research group seeks to develop an on-site (cow-side) device for diagnosis of JD on dairy farms. The current method suffers from low sensitivity to detect the infection, high cost, and delayed diagnosis. These drawbacks discourage farmers from testing their herds.

Dr. Eda is using nano-scale science in a diagnostic device about the size of a smartphone. The protocol is now being optimized and validated to maximize the test’s sensitivity and specificity. So far, a provisional patent application has been submitted for the device.
Using Viruses to Kill Tumor Cells

Dr. LeBlanc’s research group is using a technique known as oncolytic virotherapy as a new form of cancer treatment. This promising experimental approach to cancer treatment uses viruses that target specific cancer cells.

This strategy has demonstrated success in preclinical studies, and work is underway to determine which cancers seem most likely to respond to these viruses. The results produced in dogs will be translatable to humans.

In collaboration with researchers at Mayo Clinic, who develop, manufacture, and study recombinant vesicular stomatitis virus and other oncolytic viruses, Dr. LeBlanc’s team has determined a well-tolerated dose of a novel oncolytic virus in dogs in preparation for clinical trials in pet dogs with cancer.

Dr. LeBlanc will also characterize viral shedding and assess the dog’s ability to neutralize the virus through a natural immune response.

If successful, application of this strategy will help eliminate the requirement for long-term, potentially toxic and expensive chemotherapy.
Bringing Clarity to Immunopathogenesis of Corneal Disease

For optimal vision, the cornea must be transparent so light goes to the retina without interruption. To maintain transparency, the cornea normally suppresses all tissue-damaging inflammatory and immune reactions.

However, this control system breaks down in response to some events, such as herpes simplex virus-1 (HSV-1) infection of the cornea. This infection can result in stromal keratitis (SK), which is the most common infectious cause of blindness in developed countries.

A key feature of SK is the establishment of new blood vessels in the cornea (angiogenesis), but how virus infection results in angiogenesis is poorly understood and is the focus of Dr. Rouse’s research.

Distinguished Professor, Biomedical and Diagnostic Sciences
PhD, MSc, University of Guelph, Canada; BVS, University of Bristol, UK
6 refereed publications in 2012
533 article citations in 2012
In addition to center funds, Dr. Rouse’s research is supported by the National Institutes of Health.
Raul Almeida (p. 34)


Kerro Dego O, Oliver SP, Almeida RA. Host–pathogen gene expression profiles during infection of primary bovine mammary epithelial cells with *Escherichia coli* strains associated with acute or persistent bovine mastitis. *Veterinary Microbiology* 2012;155:291–7.


Seung Joon Baek (p. 27)


Nualsanit T, Rojanapantth P, Gritsanapan W, Lee SH, Lawson DB, Baek SJ. Damcanantal, a Noni compo-


David Brian (p. 35)


Maria Cekanova (p. 28)


Tanco V, Rathore K, Wright L, Carters A, Cekanova M. Effects of environmental carcinogens on canine mes-


Mei-Zhen Cui (p. 29)


Mao G, Cui M-Z, Li T, Jin Y, Xu X. Pen-2 is dispensable for endoproteolysis of presenilin 1, and nicastrin-Aph subcomplex is important for both γ-secretase assembly and substrate recruitment. *Journal of Neurochemistry* 2012;123:837–44.


Cui M-Z. Lysophosphatidic acid signaling in vascular smooth muscle cells [invited plenary talk]. 2nd World Congress on Clinical & Experimental Cardiology. Omaha, NE. March 2012.

**Shigetoshi Eda (p. 36)**


**Stephen Kania (p. 30)**


**Amy LeBlanc** (p. 37)


LeBlanc AK. Companion animals in imaging research IEEE-EMBS [invited lecture]. UT Graduate School of Medicine Fall Seminar. Knoxville, TN. October 2012.

Suryawanshi A, Veiga Parga T, Reddy PB, Rajasagi NK, **Rouse BT**. IL-17A differentially regulates corneal VEGF-A and sVEGFR-1 expression and promotes ocular neovascularization after herpes simplex virus infection. *Journal of Immunology* 2012;188:3434–46.


**Rouse BT**. Galectins influence whether immunity or tissue damage results from viral infections–Therapeutic implications [invited lecture]. Molecular Basis of Disease Program Distinguished Lecture Series. Georgia State University. 2012.

**Rouse BT**. Host factors that influence whether immunity or tissue damage results from viral infections–Therapeutic implications [invited seminar]. Bristol Immunology Group, University of Bristol. Bristol, UK. September 2012.


**Rouse BT**. Invited seminar. Immunology Seminar Series, Cleveland Clinic Lerner Research Institute. Cleveland, OH. October 2012.

Hildegard Schuller (p. 31)


Al-Wadei MH, Al-Wadei HAN, Schuller HM. Pancreatic normal duct epithelial and cancer cells express an autocrine catecholamine loop that is activated by the alpha3, alpha5 and alpha7 nicotinic acetylcholine receptors [abstract]. AACR Annual Meeting. Chicago, IL. March 2012.
Hwa-Chain Robert Wang (p. 32)


**Wang H-CR**. Intervention of chronically-induced breast cell carcinogenesis [invited talk]. Workshop for Aging and Cancer Research, China Medical and Pharmaceutical University. Taichung City, Taiwan. August 2012.


**Wang H-CR**. Research approaches of molecular biology, cell biology, and biochemistry for studying biologi-


**Wang H-CR.** Teaching professional and graduate students in the areas of medicine and biomedical sciences [invited talk]. Guangdong Ocean University. Zhanjiang City, Guangdong Province, China. October 2012.


**Xuemin Xu (p. 33)**

Shi J, Dong Y, Cui M-Z, **Xu X.** Lysophosphatidic acid induces increased BACE1 expression and Aβ formation. *Biochimica et Biophysica Acta–Molecular Bases of Disease* 2012;1771:883–92.

Mao M, Cui M-Z, Li T, Jin Y, **Xu X.** Pen-2 is dispensable for endoproteolysis of presenilin 1, and nicastrin-Aph subcomplex is important for both γ-secretase


*Publications and presentations listed are for the 2012 calendar year. The reporting method for this report was changed in 2009 to more accurately reflect the total number of publications and presentations by including all items from the previous calendar year. Past reports included only items from the current calendar year through the publication date of the report. Some items may be duplicated between individual investigators.*
<table>
<thead>
<tr>
<th>Investigator</th>
<th>Project Title</th>
<th>Funding Agency</th>
<th>Project Period</th>
<th>2013 Receipts</th>
<th>2013 Expenditures</th>
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<tr>
<td>Baek, Seung Joon</td>
<td>Prevention of colorectal cancer by tolfenamic acid</td>
<td>University of Maryland (National Institutes of Health flow-through)</td>
<td>7/01/11–6/30/15</td>
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<td>Brian, David</td>
<td>Coronavirus RNA replication</td>
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<td>6/01/08–5/31/13</td>
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<td>Cekanova, Maria</td>
<td>New staging techniques &amp; evaluation of therapies for oral squamous cell carcinomas</td>
<td>Winn Feline Foundation</td>
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<td>Role of estrogen receptor beta in breast cancer</td>
<td>The Physician’s Medical Education and Research Foundation</td>
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<td>Potential use of neutron imaging for biomedical and biological application</td>
<td>UT-Battelle, LLC–Oak Ridge National Laboratory</td>
<td>8/03/11–8/02/12</td>
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<td>Detection of COX-2 expressing canine tumors by new optical imaging tracer</td>
<td>Vanderbilt University Medical Center</td>
<td>11/01/11–6/30/13</td>
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<td>1/28/11–9/30/13</td>
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<td>Evaluation of neutron radiography and computed tomography for detection of cancer using COX-2-targeted boronated contrast agents</td>
<td>Oak Ridge National Laboratory/Spallation Neutron Source/U.S. Department of Energy</td>
<td>6/01/13–10/30/13</td>
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<td>Cui, Mei-Zhen</td>
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<td>National Institutes of Health</td>
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<td>Investigator</td>
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<td>Eda, Shigetoshi</td>
<td>A portable and rapid assay system to detect levels of circulating D-dimer protein</td>
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<td>Kania, Stephen</td>
<td>Genomic resources for the control of canine pyoderma</td>
<td>AKC Canine Health Foundation</td>
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<td>Effectiveness of small interfering RNA (siRNA) to inhibit feline coronavirus replication</td>
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<td>Detection of dermatophytosis in cats by PCR</td>
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<td>5/01/13–4/30/14</td>
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<td></td>
<td>Veterinary student research program</td>
<td>Merial Limited LLC</td>
<td>5/01/13–9/01/13</td>
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<td>$10,000</td>
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<td>LeBlanc, Amy</td>
<td>Imaging properties and toxicity of selected near-IR dyes in dogs</td>
<td>UT-Battelle, LLC–Oak Ridge National Laboratory</td>
<td>9/26/12–4/10/13</td>
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<td>Rouse, Barry</td>
<td>Mechanisms in herpetic keratitis</td>
<td>National Institutes of Health</td>
<td>1/1/13–12/31/16</td>
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<td>T-Regulatory cells in HSV immunity and immunopathology</td>
<td>National Institutes of Health</td>
<td>2/02/11–1/31/16</td>
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<td>Schuller, Hildegard</td>
<td>The GABA-B receptor is a novel drug target for pancreatic cancer</td>
<td>National Institutes of Health</td>
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<td>Modulation of cancer prevention by social stress</td>
<td>National Institutes of Health</td>
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<td>GABA-BR-mediated prevention of pancreatic cancer</td>
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<td>Xu, Xuemin</td>
<td>The role of the new zeta cleavage in Abeta formation</td>
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<td>4/01/07–3/31/14</td>
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<td>Vascular risk factors in Alzheimer’s disease</td>
<td>American Health Assistance Foundation</td>
<td>4/1/09–3/31/14</td>
<td>$0*</td>
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<td>Role of presenilin-associated protein (PSAP) in apoptosis and Abeta formation</td>
<td>National Institutes of Health</td>
<td>4/15/11–3/31/13</td>
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<td><strong>Totals</strong></td>
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<td>$1,746,627</td>
<td>$2,057,499</td>
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</table>

*All funds were awarded in year 1.

*No-cost extension granted, resulting in no new funds in the current year.

*Expenditure amounts, if any, are from carry-over from the previous year.
# Schedule 7

## Center of Excellence in Livestock Diseases and Human Health

**ACTUAL, PROPOSED, AND REQUESTED BUDGET**

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>FY 2012-13 Actual</th>
<th></th>
<th>FY 2013-14 Proposed</th>
<th></th>
<th>FY 2014-15 Requested</th>
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<td>Matching</td>
<td>Appropri.</td>
<td>Total</td>
<td>Matching</td>
<td>Appropri.</td>
<td>Total</td>
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<td><strong>Expenditures</strong></td>
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<td>374,577</td>
<td><strong>561,866</strong></td>
<td>261,661</td>
<td>523,321</td>
<td><strong>784,982</strong></td>
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<td><strong>Salaries</strong></td>
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<td>Other Professional</td>
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<td><strong>143,497</strong></td>
<td>54,823</td>
<td>109,662</td>
<td><strong>164,484</strong></td>
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<td>68,565</td>
<td><strong>102,847</strong></td>
<td>37,514</td>
<td>75,028</td>
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<td>16,169</td>
<td><strong>24,253</strong></td>
<td>6,111</td>
<td>12,222</td>
<td><strong>18,333</strong></td>
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<td><strong>Total Salaries</strong></td>
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<td>192,927</td>
<td><strong>289,391</strong></td>
<td>98,448</td>
<td>196,912</td>
<td><strong>295,360</strong></td>
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<td>2,170.28</td>
<td><strong>3,255</strong></td>
<td>891</td>
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<td>46,389</td>
<td><strong>69,584</strong></td>
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<td>36,080</td>
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<td>241,487</td>
<td><strong>362,230</strong></td>
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<td>234,774</td>
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<td><strong>Non-Personnel</strong></td>
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<td>Travel</td>
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<td>8,330</td>
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<td>Books &amp; Journals</td>
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<td>559</td>
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<td>4,657</td>
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<td>Services</td>
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<td><strong>25,632</strong></td>
<td>19,775</td>
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<td><strong>Total Non-Personnel</strong></td>
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<td>141,861</td>
<td>283,722</td>
<td><strong>425,583</strong></td>
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<td><strong>GRAND TOTAL</strong></td>
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<td><strong>548,732</strong></td>
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<td>252,555</td>
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<td>261,661</td>
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