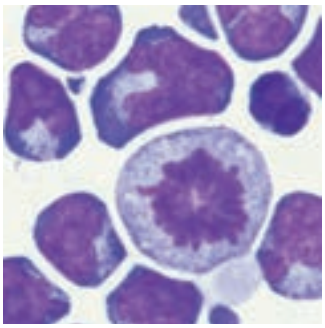
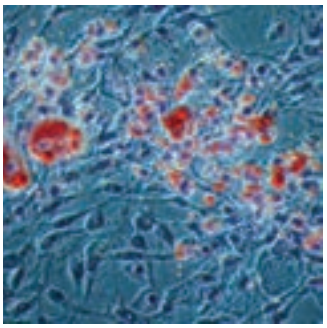
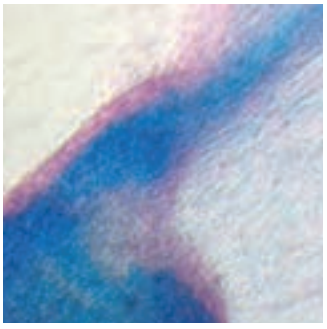
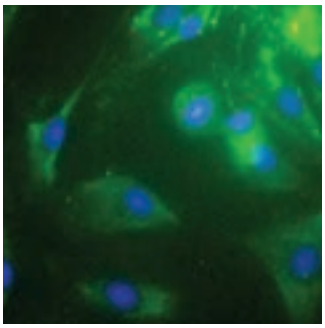
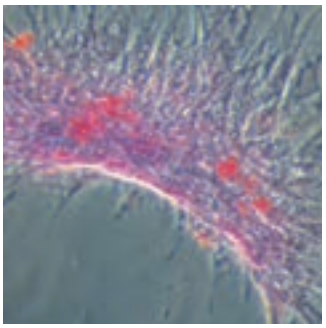
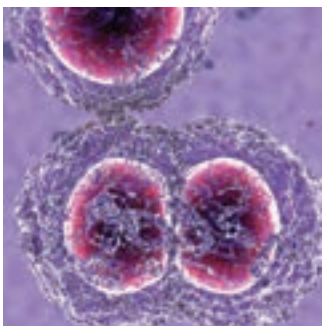
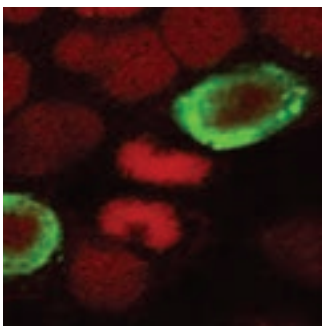
Center of Excellence in Livestock Diseases and Human Health

2010 Annual Report

THE UNIVERSITY of TENNESSEE
INSTITUTE of AGRICULTURE
COLLEGE of VETERINARY MEDICINE

Welcoming Remarks

We are pleased to present the 2010 annual report for the Center of Excellence in Livestock Diseases and Human Health. Along with benchmark data for fiscal years 2006-2010, this report includes highlights of faculty research projects funded by the center in fiscal year 2010.

The center continues to adapt to the changing extramural funding environment. With the precipitous increase in competition for decreasing federal research funds, the center has concentrated on maintaining competitiveness of active research programs, providing bridging funds to keep important research programs viable, and promoting the start-up of new College of Veterinary Medicine (UTCVM) investigators. In addition, the center is investing in initiatives that promote translational research, the coordinated movement of bench-level research to the clinic. Thus, the areas of active research in the UTCVM impacted by the center have increased.

During 2010, the center supported the efforts of 15 faculty members. 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. Research funding grew, and the return on investment, as the ratio of research expenditures to the state appropriation for the center, was a slightly improved 6.1:1. Key performance indicators predict a similar extramural funding environment for fiscal year 2011.

Center faculty continue to garner national and international recognition for their research and scholarship. During calendar year 2009, center faculty published 47 peer-reviewed articles and gave 59 presentations at regional, national, and international meetings.

We are proud of the progress made by center faculty, and we hope you enjoy this summary presentation of center activities and accomplishments.

Jim Thompson, Dean

Leon N.D. Potgieter, Interim Director

Misty R. Bailey, Editor

L-R: Bailey, Thompson, Potgieter

Center of Excellence in Livestock Diseases and Human Health

2010 Annual Report

Contents

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THE UNIVERSITY of TENNESSEE
INSTITUTE of AGRICULTURE
COLLEGE of VETERINARY MEDICINE

Comparative Summary of Accomplishments

Benchmark	*2010 (15 faculty in center)*	*2009 (15 faculty in center)*
Publications*		
Peer-reviewed articles	47	59
Books or book chapters	6	8
Abstracts or posters	69	26
Presentations*		
International	18	9
National	31	15
State or local	10	2
Research monies†		
External funding	$5,039,087	$3,030,150
Research expenditures	$3,597,130	$3,167,426
Return on investment	6.1:1	5.8:1

*Based on 2009 calendar year
†Based on 2010 fiscal year

Center of Excellence faculty share their research with a worldwide audience through scientific conferences. The map showcases where their research was presented in 2009.

Comparative & Experimental Medicine and Public Health Research Symposium

The Center of Excellence was a major sponsor of the Comparative & Experimental Medicine and Public Health Research Symposium, which brought together researchers from 20 different departments across four UT campuses for a 2-day-long event that included special seminars on adult stem cell use, iron biology, exercise as medicine, and postdoctoral opportunities. Featured was Dr. Arnold Caplan of Case Western Reserve University; he presented his research on adult mesenchymal stem cells and their use in various therapies. The symposium culminated with an awards banquet and guest speaker Sam Venable, known locally for his storytelling and humor column in the *Knoxville News Sentinel* newspaper.

Fifty-five researchers from the Institute of Agriculture presented talks at the symposium, including heavy participation by members of the Animal Science and Pathobiology departments. These 55 representatives were among 81 new scientists to present, and at the end of the 2 days, the institute was able to boast six winners of travel awards. The center sponsored nine of the 2009 award winners to present at scientific meetings during fiscal year 2010, including one international and eight national conferences.

The symposium was designed to allow sharing of research results, promote collaboration, and provide new investigators meeting-format experience via 10-minute presentations. Last year's symposium resulted in a collaboration between center faculty members Dr. Hildegard Schuller and Dr. Maria Cekanova (described on p. 5).

http://www.vet.utk.edu/research/symposium/

< One of 81 presentations over the 2-day symposium.

< Dean Thompson welcomes presenters and attendees.

Dr. Paul Erwin introduces Dr. Asha Kallianpur: keynote on iron biology. v

< Interdepartmental sharing of ideas.

> Last-minute presentation preparation.

^ Keynote speaker Dr. Arnold Caplan discusses stem cells.

Program Report

Introduction

The center was created in 1984 to 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; and develop new strategies for the diagnosis, treatment, and prevention of disease.

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 role in developing these focused areas of strength in both the UTCVM and the Institute of Agriculture.

Personnel

Dr. Leon N.D. Potgieter began serving as interim director of the center in January 2010, replacing Dr. Robert N. Moore, who took a position as executive director of the University of Tennessee Space Institute in Tullahoma, TN.

Collaborations

Stem Cell Initiative

Dr. Madhu Dhar and Dr. Maria Cekanova are pursuing collaborative research between both laboratories and departments. Drs. Dhar and Cekanova are part of the College of Veterinary Medicine's exciting new Stem Cell Initiative. The first phase of the project examines the effect of hyperbaric

***Fig. 1**–These slide images show differentiated (left) and undifferentiated (right) cells collected from adipose tissue in a horse. The left image contains mesenchymal stem cells that have demonstrated the ability to transform into adipose (fat) cells.*

oxygen therapy (use of oxygen at a level higher than atmospheric pressure) on adult stem cell population in the blood. These researchers theorize that increased stem cell populations in circulating blood may be responsible for the healing effects of hyperbaric oxygen therapy. Dr. Dhar's focus has been improving tissue healing in horses, while Dr. Cekanova is focusing on canine tissue healing. Further testing includes confirming that the cells collected are actually stem cells and not some other type of cell. The cells shown in Figure 1 were collected from fat tissue in a horse; only the left image contains differentiated stem cells, proven by their ability to develop (differentiate) into fat cells.

GABA Project

As a result of Dr. Hildegard Schuller's keynote address at the 2009 Comparative & Experimental Medicine and Public Health Research Symposium, Dr. Maria Cekanova and Dr. Shelley Newman (associate professor, Pathobiology Department) established a collaboration with Dr. Schuller to screen a large number of canine tumors to see if any of them expressed GABA in response to nicotine or other environmental carcinogens. GABA (gamma-aminobutyric acid) is an inhibitor in the central nervous system that offsets the effects of nicotine or stress on hyperactivity of a cancer-associated pathway known as cAMP.

Accomplishments

External Funding:
$5,039,087

New Grants:
$2,210,993

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. 17–31) and are excellent in terms of benchmarks for fiscal year 2010. Center faculty have successfully adapted to the increased competition for federal funds and are also aggressively and successfully seeking more awards from foundations and other private and industry sources. Figure 2 shows the percentage breakdown of external funding by source.

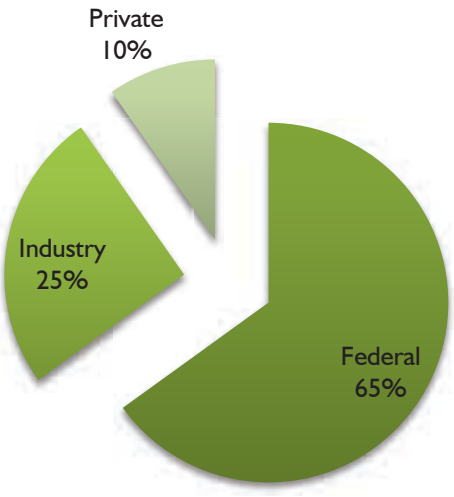


Fig. 2. *FY 10 external funding by type. Total = $5,039,087.*

During this reporting year, the 15 center faculty averaged three peer-reviewed publications (47 total) and 4 presentations at prestigious national and international meetings (59 total). See Publications and Presentations (pp. 32–43) for details.

The return on the state's investment in the center was 6.1:1, calculated as ratio of expenditures from extramural funding to center appropriation. Extramural funding totaled $5,039,087 this year, while expenditures for the year were $3,597,130. The total funding includes new, multi-year awards for Drs. Baek and Schuller, totaling $1,136,993, and new, one-

year awards for Drs. Oliver, Cekanova, and Kania, totaling $1,074,000. Research expenditures continued to stabilize at $3,597,130. See "Research Funded Externally" and "Research Expenditures" on p. 8 for the fiscal year 2010 data summary.

Success Story

In April 2009, the scramble was on around the country for researchers to apply for a piece of the millions of dollars in new NIH Challenge Grant funds, made possible by the American Recovery and Reinvestment Act (ARRA). At the end of the funding cycle, over 20,000 applications were received, but only 841 were funded–an approximate 4% payline and a dismal funding rate compared to the usual 10%.

Center faculty member Dr. Hildegard Schuller's application was one of those funded grants, and the only one funded from UT Knoxville. In addition, it was one of only 152 in the country to be funded at the full level of $1 million over 2 years. Dr. Schuller's application, entitled "Modulation of cancer prevention by social stress," focuses on how chronic psychological stress might stimulate the development and progression of cancer, thus counteracting the effects of cancer preventive agents, particularly in lung and pancreatic cancers. A full description of her research is found on p. 22.

Dr. Schuller also secured two additional NIH grants this fiscal year, totaling $566,743. Her accomplishments made her the perfect candidate for the esteemed Chancellor's Award in Research and Creative Achievement at UT, which she won in 2010. Dr. Schuller was also a recipient of the award in 1991, a testimony to the continuous drive of center faculty to find the answers to the most difficult questions.

Research Funded* Externally FY 2010

Investigator	Federal	Industry	Foundation/ Private	Totals
Baek, Seung Joon	$270,179		$180,000	$450,179
Brian, David	$352,193			$352,193
Cekanova, Maria		$23,000	$15,000	$38,000
Dhar, Madhu			$45,000	$45,000
Frank, Nicholas		$25,982	$53,930	$79,912
Kania, Stephen		$20,000	$13,000	$33,000
Oliver, Stephen	$375,000	$1,202,481		$1,577,481
Rouse, Barry	$661,756			$661,756
Schuller, Hildegard	$1,066,743		$50,000	$1,116,743
Wang, Hwa-Chain Robert	$263,098			$263,098
Xu, Xuemin	$288,392		$133,333	$421,725
Totals	**$3,277,361**	**$1,271,463**	**$490,263**	**$5,039,087**

*Represents FY 2010 receipts for active grants

Research Expenditures FY 2010

Investigator	Federal	Industry	Foundation/ Private	Totals
Baek, Seung Joon	$205,284		$60,219	$265,503
Brian, David	$349,008			$349,008
Cekanova, Maria		$21,171		$21,171
Dhar, Madhu			$15,830	$15,830
Frank, Nicholas		$6,912	$4,727	$11,639
Kania, Stephen		$30,863	$5,788	$36,651
Oliver, Stephen	$123,519	$505,547		$629,066
Rouse, Barry	$882,064			$882,064
Schuller, Hildegard	$844,556		$44,085	$888,641
Wang, Hwa-Chain Robert	$148,761			$148,761
Xu, Xuemin	$248,799		$99,996	$348,796
Totals	**$2,801,992**	**$564,493**	**$230,645**	**$3,597,130**

Allocation of Funding

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

Research Advisory Committee's Three Main Criteria for Funding

- Scientific merit
- Potential to lead to external funding
- Relevance to the center's objectives

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.

Start-up and Bridge Funds

The center provided start-up and bridge funds for two faculty members to secure additional external funding. Dr. Brian Whitlock was awarded $25,000 to continue the research he began last year, when he was hired as an assistant professor. His studies are detailed in the Faculty Reports section on p. 31. Dr. Mei-Zhen Cui received $30,000 to serve as a bridge to continue her research while she works on securing additional funding for her laboratory. A description of her research is found on p. 19.

Graduate Student Support

The center supported three stipends and tuition waivers for Comparative and Experimental Medicine graduate students of center faculty. These stipends allow the students to work half-time in faculty laboratories to perform research for their theses or dissertations.

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, the center funded service contracts for several pieces of equipment purchased previously with COE funds. Service for an ultracentrifuge and a flow cytometer totaled $7,299. The ultracentrifuge is a college-wide resource that benefits nearly every investigator in the college, including clinicians. The flow cytometer is shared by center faculty members Dr. Barry Rouse and Dr. David Brian and is used almost daily.

$27,495 helped fund service contracts and supplies

In addition, the center gave $473 to support faculty and students in their use of the university's Biology Service Facility. This group provides scientific instrument services, including repair of hoods, refrigeration equipment, and other biomedically engineered devices.

Supplies for a multi-investigator GABA project, described in detail on p. 5, allowed for histology and DNA sequencing to aid research between center faculty members Dr. Cekanova and Dr. Schuller. The center purchased additional supplies and services to continue an ongoing project in Dr. Gina Pighetti's laboratory, as well. The center used $19,284 for these studies, and an additional $439 supported replacing a lamp in a centrally-located microscope used by most center faculty.

Training

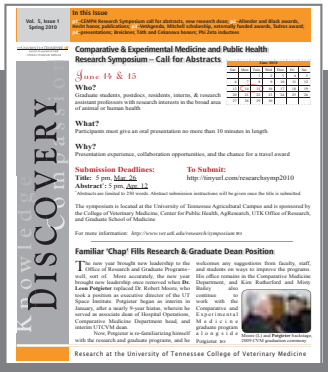
To keep faculty abreast of new research techniques and to increase their chances of obtaining extramural funding, the center sponsors training opportunities. Dr. Maria Cekanova attended the Cancer Research Imaging Camp, held by the National Cancer Institute in partnership with the American Association for Cancer Research annual meeting. The center also purchased for its members a digital slide and audio presentation CD entitled "Winning More Grants!: Best Tactics for Use on the New NIH Short Form."

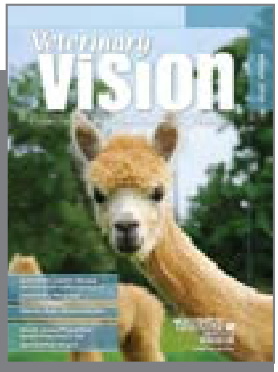
Dissemination of Research

Faculty are encouraged to share their research by speaking to professional groups, community groups, and civic groups. The center partially supported travel expenses for one faculty member, four graduate students, and one staff member to be able to attend national scientific meetings (total $3,566) in Breckenridge, CO; Buellton, CA; Baltimore, MD; and Anaheim, CA. One graduate student and one faculty member also received partial support to travel to international meetings in Leipzig, Germany, and Alberta, Canada (total $2,892). The center covered the cost of a scientific poster to report research results, as well ($80). A complete list of faculty publications and presentations for the 2009 calendar year can be found in the Publications and Presentations section (pp. 32–43).

Travel awards totaling $6,276 for nine new investigators involved in the 2009 Comparative & Experimental Medicine and Public Health Research Symposium allowed them to disseminate their research at nine different local, national, and international meetings.

In addition, 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 three UTCVM news publications described below are available on the UTCVM Web site (http://www.vet.utk.edu/publications/index.php), which also provides an overview of the types of research conducted by UTCVM and center faculty.





L–R: The quarterly, 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.

COE summer students accompany zoo medicine specialist, Dr. Ed Ramsay, to the Knoxville Zoo.
Back row L-R: *Melissa Daniels, Amanda Mitchell, Jennie Jankovsky, Laura Burgette, Ramsay, Sarah Willard-Eroh, Randall Kania (undergraduate student);* Front row: *Michael Nystrom, Sasha Pfotenhauer, Krista Andrews, Anna Tipton, Bridgid Lammers, Kim Lucy*

Center of Excellence Summer Student Research Program

In an effort to foster interest in careers in biomedical research, the center helped provide opportunities for 23 veterinary students to do research at the UTCVM during the summer.

In addition to participating in laboratory and field research, students attended weekly professional development seminars, during which guest speakers addressed topics such as career opportunities in research, compliance issues in laboratory animal care, scientific 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.

Dr. Stephen Kania, a center faculty member, coordinated the program along with Dr. Linda Frank; Dr. Kania received a $4,000 grant from Morris Animal Foundation to help support the program.

$9,000 from Morris Animal Foundation and the Comparative Gastroenterology Society helped fund the Summer Student Program

Dr. Jacqui Whittemore, who mentored two students this summer, also secured $5,000 from the Comparative Gastroenterology Society to fund one student. To maximize student participation, the program is open to both center and non-center faculty. During fiscal year 2010, five COE faculty participated in the program. The center will continue to encourage participation of its faculty.

The students involved in the summer research program and a brief description of their activities follow:

Krista Andrews studied under the direction of Dr. Maria Cekanova treating several types of primary canine cancer cell lines with six different drugs and studying their effects. Andrews has a BS in biology from Siena College in Loudonville, NY, and calls Wallkill, NY, her hometown. As a 2nd-year student, small animal medicine is her focus for a potential career.

Working with center faculty member Dr. Madhu Dhar was **Kate Beatty,** a 2nd-year student from Knoxville, TN. Their summer research project focused on the differentiation of equine stem cells of three different origins. Differentiation is the process by which a less specialized cell becomes a more specialized cell. Beatty holds a BS in biology from Maryville College, Maryville, TN.

Dr. Robert Donnell served as mentor for 2nd-year student **Richard Blake,** from Strawberry Plains, TN. In keeping with Blake's career interests in pathology and large animal medicine, their project involved examining the pathology of cloned Jersey cattle and their offspring. Blake attended the University of Tennessee, Knoxville, and majored in animal science.

Laura Burgette is a 2nd-year student from Chattanooga, TN. She earned her BA degree from the University of the South in Sewanee, TN, where she majored in anthropology and religion. She worked with Dr. Linda Frank on a retrospective study evaluating cases of methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) in dogs. Evaluating the cases retrospectively allows for evaluating data on the outcomes of MRSP-causing skin infections and their treatment. Burgette is interested in veterinary public health after graduation.

Studying under Dr. Joe Bartges this summer was **Melissa Daniels**. She participated in evaluating three herbal compounds used for management of lower urinary tract disease in cats. Her career interests lie in small animal medicine, but she is also considering laboratory animal medicine. Daniels is a 2nd-year student who graduated with a BS in biological sciences from the University of Mississippi. Her hometown is Greenville, MS.

An interest in large animal medicine led to 3rd-year student **Melissa Henn**'s choice for a mentor this summer. She and Large Animal Department faculty member Dr. Reza Seddighi evaluated the minimum concentration of two drugs needed to prohibit movement during anesthesia. Henn graduated from the University of Tennessee, Knoxville, with a BS in animal science and calls Lenoir City, TN, home.

For her project, **Monica Huerta** reviewed radiograph (X-ray) and MRI images to determine the frequency of metallic bullets or pellets seen in animals undergoing imaging at the UT Veterinary Medical Center and also the ability of these objects to interfere with the diagnostic quality of the images. This project with Dr. Silke Hecht corresponds with Huerta's career interests in radiology and anatomy. Huerta is from Dickson, TN, and holds a BS in biochemistry and molecular biology from Rhodes College, Memphis, TN.

Jennie Jankovsky, from Talbott, TN, has a BS degree in biology from Youngstown State University in Youngstown, OH. Dr. Shelley Newman served as her mentor on a project studying expression of C-kit, a receptor that, in altered forms, is associated with some types of cancer. In particular, she examined C-kit as it relates to noncutaneous melanosarcomas in dogs.

Former University of Georgia ecology student **Bridgid Lammers** worked with Dr. Marcy Souza this summer. Their research focused on the prevalence of salmonella in hellbenders, giant salamanders indigenous to the streams of the Great Smoky Mountains. Lammers is in her 2nd year in the DVM program and plans to focus her career in wildlife and exotics.

Whitney Long hails from Morristown, TN, and completed her BS in nutrition at the University of Tennessee, Knoxville. Her summer project with Dr. Reza Seddighi involved researching the minimum alveolar concentration (MAC) of two different drugs in dogs. The MAC is the concentration of the drug needed to prevent movement during anesthesia. Long was able to practice anesthesia induction, maintenance, and recovery. A 3rd-year student, she hopes to go into small animal medicine.

For **Kim Lucy**, working alongside Dr. Maria Cekanova in the summer program was a way to explore career options for this undecided 2nd-year student from Valrico, FL. Lucy attended Rollins College in Winter Park, FL, and earned a BA with a double major in biology and environmental studies.

For the second year, **Amanda Lutzy** participated in the summer program. This year, she worked with Dr. Patricia Coan examining the feasibility of using canine thyroid-stimulating hormone to test thyroid function in psittacine parrots and chickens. Lutzy is a 3rd-year student from Knoxville, TN, and earned a BS in biology from Rhodes College in Memphis, TN. Her career interests lie in wildlife and exotics medicine.

Laura McDougal is a 3rd-year student from Miami, FL; she holds a BS in animal science from the University of Florida. Dr. Mark Bohling served as her summer mentor on a project evaluating a traditional versus new method of placing tracheal stents in dogs with collapsing trachea. After graduation, McDougal hopes to become board certified in surgery.

Third-year student **Amanda Mitchell** worked closely with Dr. Jacqui Whittemore to test the ability of a device that measures opposition to blood flow to detect correct versus incorrect Veress needle placement. Mitchell is from Milan, TN, and earned a BS in cell and molecular biology from the University of Tennessee at Martin.

Hailing from Cary, NC, is 2nd-year student **Michael Nystrom**. This summer, he performed indirect blood pressure measurement in cats to determine if a correlation exists between body condition score and pressure differences measured at the paw and tail. Dr. Jacqui Whittemore and Dr. Diane Mawby served as his mentors. Nystrom majored in pre-professional biology and chemistry at Appalachian State University in Boone, NC, and plans to specialize after earning his DVM, although he is still exploring specific areas of specialization.

Sasha Pfotenhauer is a 2nd-year student from Nashville, TN, and she earned a BS in animal science from UT-Knoxville. Her interest in large animal medicine led her to Dr. Brian Whitlock for mentorship. The two of them worked to design tests to examine the expression of the Kiss-1 gene in equine melanomas. Kiss-1 is known to inhibit the spread of several types of cancer in humans and may do the same in horses.

Second-year student **Eliza Ruffner** studied under Dr. Stephen Kania to isolate bacteriophages from *Staphylococcus pseudintermedius.* Bacteriophages are viruses that attack bacteria, and the bacteria *S. pseudintermedius* is one of the most common causes of skin infections in dogs. Ruffner hopes to focus on small animal and equine medicine after graduation. This 2nd-year student from Wilmington,

NC, holds a BA degree in communication from North Carolina State University.

Also a North Carolina State University alumna is **Amy Schuver**. This 3rd-year student worked alongside Dr. Nicholas Frank on a project investigating a field practitioner-friendly oral glucose test for insulin-resistant horses. This was her second summer in the program gaining experience in equine medicine, which she hopes to focus on after graduating. Schuver is from Charlotte, NC, and majored in animal science at NCSU.

Holly Taylor hails from Blairsville, PA, and attended Pennsylvania State University, majoring in animal bioscience. Her mentors for the summer were Dr. Stephen Kania and Dr. David Bemis. Her project involved determining how many copies of the 16S gene are in the *Staphylococcus pseudintermedius* bacterium–*S. pseudintermedius* is the causative agent for many skin lesions in dogs. Taylor, a 2nd-year student, has an interest in pathology and public health and would like to pursue a residency or a USDA-type job after graduation.

Second-year student **Anna Tipton**, from Dickson, TN, earned a BS degree in animal science from Middle Tennessee State University in Murfreesboro. Tipton and Dr. Cheryl Greenacre focused on evaluating the pharmacokinetics of several opioid drugs and a non-steroidal anti-inflammatory drug in bearded dragons. Pharmacokinetic studies involve examining how the body absorbs, metabolizes, and distributes drugs.

Julie Wheeler is a 3rd-year student from Champaign, IL; she holds a BA in religion from Trinity College in Hartford, CT. Wheeler's summer project involved working with Dr. Christine Egger on Yunnan baiyao, a Chinese herb that has been reported to increase blood clotting times and could be beneficial in surgeries.

An interest in conservation medicine is what led **Sarah Willard-Eroh** to Dr. Ed Ramsay to work on red pandas. The King George, VA, native helped conduct a lungworm survey in red pandas in North America. Willard-Eroh holds a BS in biology from Bridgewater College in Bridgewater, VA.

Diana Wray calls Knoxville, TN, home. This 2nd-year student holds BS and BA degrees in biology and theater, respectively, from Mary Baldwin College in Staunton, VA, and an MS in wildlife science from North Carolina State University. Her career interests are broad and include alternative medicine, in which her summer mentor Dr. Christine Egger is also interested. The two researchers spent the summer evaluating the effect of the Chinese herb Yunnan baiyao, a remedy used to stop bleeding, on dogs.

Five-Year Benchmark Data

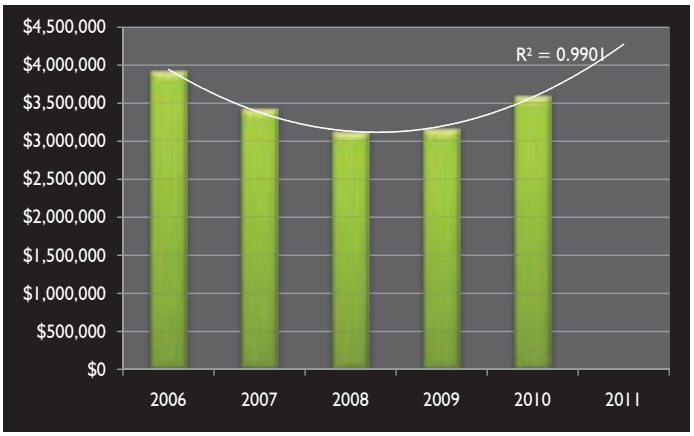


Fig. 3. *Research expenditures by fiscal year.*

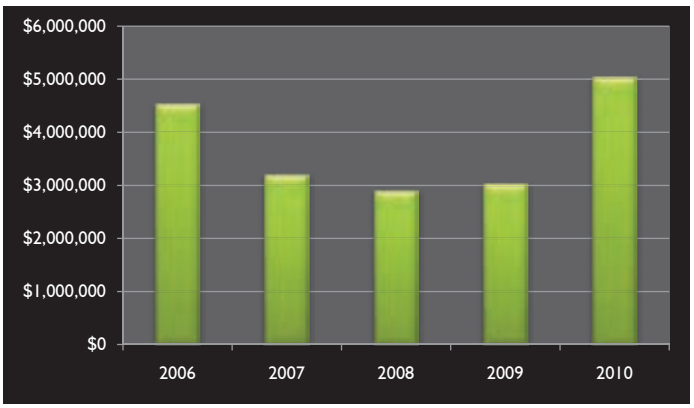


Fig. 4. *External research funding by fiscal year receipts.*

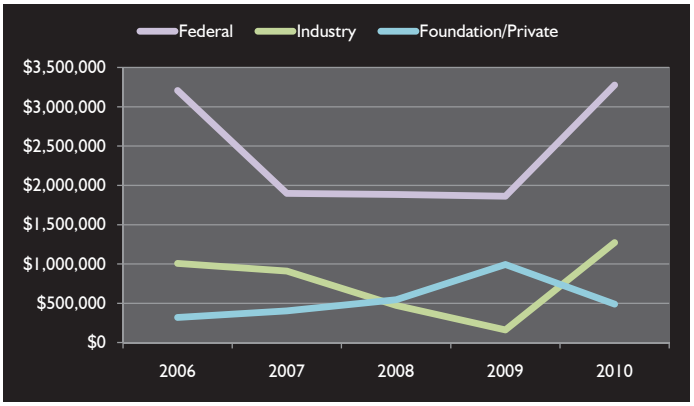


Fig. 5. *External research funding from the three major sources by fiscal year receipts.*

Benchmark Summary (2006-2010)

Average refereed articles per faculty member: 3

Private and foundation funding increased: $1,440,772

Average return on investment: 6.2:1

Productivity among center faculty has been outstanding during the last 5-year period. From 2006-2010, center faculty published 307 articles in peer-reviewed journals and gave 198 presentations at national and international meetings.

Total research funding was up from $3.03 million in 2009 to $5.04 million in 2010; this upward trend is shown in the polynomial trendline in Fig. 3. Funding from foundations and other private sources increased dramatically from $320,954 in 2006 to $1,761,726 in 2010. This shift in funding dynamics reflects the faculty's aggressive and successful search for support in response to the increased competition for diminished federal funds beginning in 2006.

Grant and contract expenditures per center faculty member had steadily decreased to a nadir of $155,000 in FY 2008 (Table 1). However, **expenditures per faculty member increased to $239,800 in FY 2010, exceeding the FY 2005 pre-downturn level of $222,000.** These indicators promote confident projections that the center is recovering vigorously.

The 5-year average return on the state's investment in the center is 6.2:1, the ratio of research expenditures to the state's appropriation. For comparison, benchmark data from 2006-2010 are summarized in Figs. 3–5.

Table 1. Average expenditures per faculty member by fiscal year.

Fiscal Year	*$ Expenditures*
2006	195,000
2007	189,000
2008	155,000
2009	213,000
2010	239,800

FUTURE Plans

The center has successfully endured 3 years of sluggish federal and corporate funding and is poised to advance with an even greater commitment to livestock and human health. This year (FY11) the center will expend approximately $425,500 to fund 17 projects. In addition, the center will continue to support core facilities and contribute to the purchase of essential research software and equipment. Already, external funding from center faculty is projected to be approximately $4.5 million in FY11.

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 80 presentations at the 2010 symposium with participants representing 20 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.

The center will continue to increase its involvement in research training of veterinary students and graduate students by providing increased opportunities for summer internships, matching travel grants, and stipend upgrades to help recruit and retain superior graduate students.

In addition, the UTCVM is aggressively pursuing initiatives in several different areas of research pertinent to the center. A primary goal of these initiatives is rapid movement of bench-level science to the clinic or farm, i.e., translational research. Established initiatives include investigations of equine and canine stem cells. Developments include early stage interactions with biomedical investigators at Vanderbilt University in the general areas of pathology and laboratory animal medicine, oncology, obesity, and diabetes. The center is funding stem cell initiatives and is providing early funding for developing interactions with Vanderbilt investigators. The oncology initiative is enhanced by earlier center investment in a developing collaboration between UTCVM oncologists and the preclinical imaging group at the Knoxville branch of the UT Health Sciences Center. That earlier initiative has resulted in the UTCVM participating in the National Cancer Institute Comparative Oncology Trial Consortium as well as having developed a mature collaboration involving PET/CT scanning of client-owned animals, one of the few such interactions in the country.

The center will continue to participate conceptually and materially in strategic planning to develop areas of investigative strength in the UTCVM and the Institute of Agriculture.

Taking Aim at Cancer Cells

Non-thermal (cold) atmospheric pressure plasma system

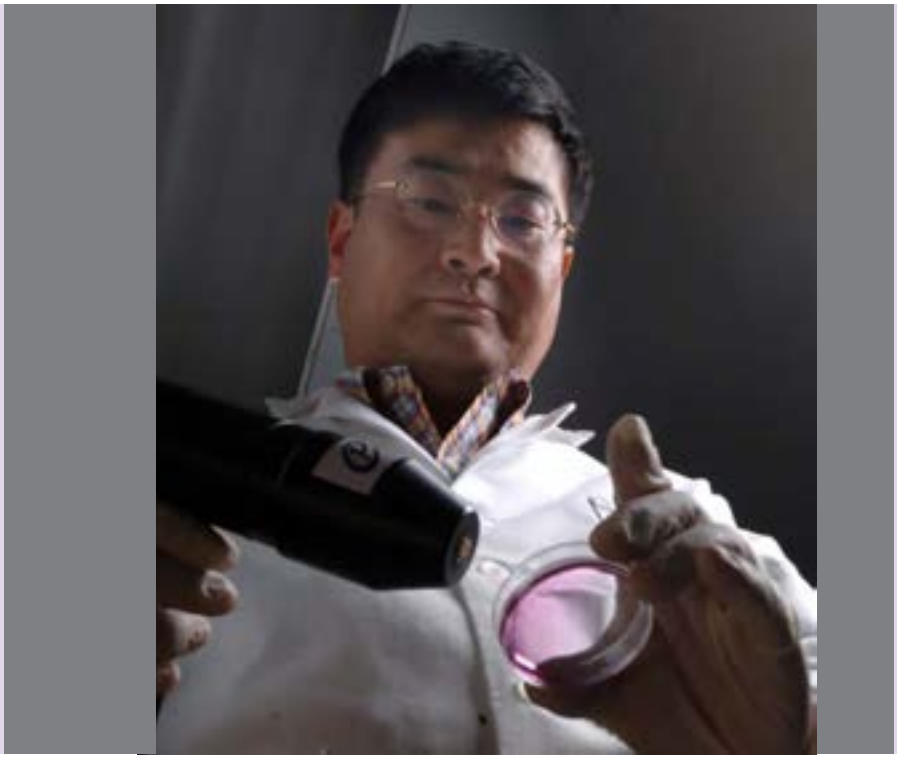
The National Cancer Institute estimates that over 11 million Americans are living with cancer. The traditional theory of cancer prevention and therapy is to block cancer development and/or slow or reverse the progression of the disease via drugs or herbs.

Dr. Seung Joon Baek hopes to expand that traditional theory to include the small amounts of energy present in plasma as a treatment option. Scientists have found that the same substance used in televisions and fluorescent light bulbs (cold plasma) has promising biomedical applications. Dr. Baek seeks to determine whether plasma exposure affects the growth of specific types of colorectal, breast, prostate, lung, and bone cancer cells. He is shown below aiming a plasma torch at a cell-filled petri dish.

Plasma technology is an exciting new field of treatment that has already proven to be useful in promoting wound healing. Its ability to attach to cancer cells while leaving minimal damage to healthy cells is part of its allure.

The results of Dr. Baek's research will help clinical scientists direct and narrow their studies of plasma therapy to specific cancer types.

Seung Joon Baek



Associate Professor

Pathobiology Department

PhD, University of Maryland

6 refereed publications in 2009

In addition to center funds, Dr. Baek's research is supported by the National Institutes of Health and the American Cancer Society.

Image-ining New Solutions

The center embraces translational research like that between Drs. Maria Cekanova and Alfred Legendre

When the body senses the presence of some types of precancerous or cancerous tissues, it produces cyclooxygenase (COX) enzymes, types of chemical messengers that promote inflammation. Therefore, one way to catch these cancers in their earliest stages and improve prognosis is to detect COX.

Dr. Maria Cekanova and Dr. Alfred Legendre hypothesize that a PET-CT combination (positron emission tomography and computed tomography) will allow them to detect COX-2 in dogs and cats. First, they will test the feasibility of using specific radioactive solutions and fluorescent dye tracers to identify COX-2 in tissues from a repository of naturally-occurring cancers in dogs and cats; but the results of the experiments will serve as a prototype for early and more precise imaging of COX-2-positive cancers in humans. These include certain colorectal, pancreatic, lung, and breast cancers.

If COX-2 expression could serve as a marker for early detection, then PET-CT could join the ranks with mammography, colonoscopy, and other tests for recommended screening procedures to improve cancer prognoses.

Maria Cekanova

Research Assistant Professor

Small Animal Clinical Sciences Department

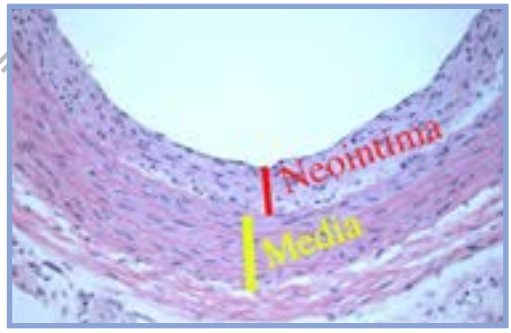
PhD, University of P.J. Safarik in Kosice, Slovak Republic

2 refereed publications in 2009

In addition to center funds, Dr. Cekanova's research is supported by the Winn Feline Foundation and Fort Dodge Animal Health.

LPA Smooths the Way for Heart Disease

Mei-Zhen Cui



A proliferation of smooth muscle cells forms the neointima inside the artery

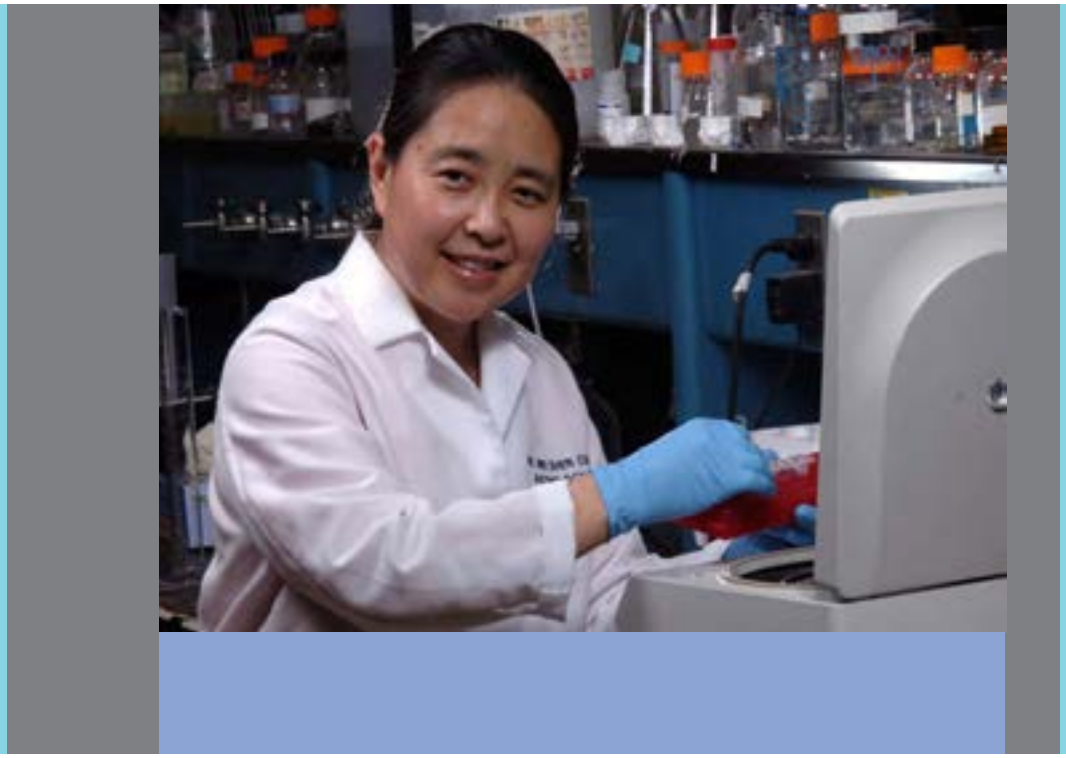
When oxidized low-density lipoprotein (LDL), the so-called "bad cholesterol" found in the blood, produces lysophosphatidic acid (LPA), this LPA accumulates in high concentrations, contributing to the formation of lesions in arteries and leading to atherosclerosis.

This form of heart disease causes the intima of the arterial walls to thicken, narrowing the pathway for blood flow to the heart and brain. An estimated 16 million U.S. adults were living with atherosclerosis in 2005, and Tennessee was one of the top 10 states in stroke and heart attack-related deaths.

Dr. Mei-Zhen Cui has been investigating how LPA contributes to arterial wall thickening, specifically the proliferation and migration of smooth muscle cells that build up inside the wall. She theorizes that CYR61, an LPA-induced protein highly expressed in atherosclerotic lesions, contributes to smooth muscle cell proliferation and migration, and she seeks to determine how CYR61 is regulated.

Research performed in Dr. Cui's lab will help clinical scientists in developing prevention and treatment measures for people living with heart disease and help reduce the mortality associated with it, as well as decrease the estimated $503 billion cost to society each year.

Mei-Zhen Cui



Associate Professor

Pathobiology Department

PhD, Tokyo Institute of Technology, Japan

3 refereed publications in 2009

A Healing Combination

Dr. Dennis Geiser leads a horse into the hyperbaric oxygen chamber

Hyperbaric oxygen therapy (HBOT) is shown to be effective in improving and accelerating the healing process in many diseased tissues. In fact, HBOT reduces healing time by half in some patients.

Dr. Madhu Dhar's research focus lies in determining how HBOT achieves this effect, and particularly the involvement of adult mesenchymal stem cells (MSCs). These stem cells are pluripotent – able to differentiate into a variety of cell types – and have been used for tendon and ligament repair in competition horses. Dr. Dhar hypothesizes that HBOT may improve tissue healing by increasing stem cells circulating in the blood, thereby making more stem cells available at the site of injury. These cells, thought to originate from bone marrow, may then help the body repair itself.

Her studies to successfully isolate MSCs from fat tissue and blood in both horses and dogs will provide useful information for using hyperbaric oxygen and stem cell therapy synergistically in both species. Dr. Dhar's research group also may generate information beneficial to human diseases.

Madhu Dhar

Research Associate Professor

Large Animal Clinical Sciences Department

PhD, University of Poona, India

2 refereed publications in 2009

In addition to center funds, Dr. Dhar's research is supported by the American Diabetes Association.

Mapping Methicillin Resistance

Co-investigator Dr. David Bemis

It took only 2 years (1959-1961) for some penicillin-resistant staphylococci bacteria to become resistant to the antibiotic methicillin. The continued spread of methicillin resistance has become a serious public health concern in the treatment of humans, companion animals, and more recently, livestock. Anecdotal reports indicate regional differences in the incidence of methicillin resistance in the United States.

To confirm these reports, Dr. Stephen Kania and Dr. David Bemis have mapped SCCmec, the set of chromosomes responsible for transferring the methicillin-resistant gene in *Staphylococcus pseudintermedius* isolates. In the East Tennessee region, the *S. pseudintermedius* SCCmec is identical to that found in *S. aureus*. This is the first discovery of identical SCCmec that affect both humans (*S. aureus*) and animals (*S. pseudintermedius*) and suggests an exchange of methicillin-resistant genes between species of bacteria.

Their next step is to determine the genetic backgrounds of *S. pseudintermedius* isolates collected from various regions in the United States to provide insights into the mechanisms of gene transfer among bacteria and open doors to methods of control.

Stephen Kania

Professor

Comparative Medicine Department

PhD, University of Florida

8 refereed publications in 2009

In addition to center funds, Dr. Kania's research is supported by Discover Life in America, Morris Animal Foundation, Sci-Tec, and other private industry funds.

Stress and Cancer: A Smoking Gun

Nicotine and stress may work synergistically against cancer treatment.

Stress. It's what motivates some of us to get things done. Still, increases in stress hormones enhance our vulnerability to numerous diseases. In particular, stress may be a potent driving force in cancer development and progression. The American Cancer Society's 2009 statistics show that low socioeconomic status, which often creates chronic stress, is associated with higher incidence and mortality of all cancers.

With her unique new project, Dr. Hildegard Schuller is examining how chronic stress together with chronic nicotine exposure counteract cancer prevention. Nicotine alone and stress hormones alone activate adenylyl cyclase, an enzyme that synthesizes cyclic adenosine monophosphate (cAMP) signaling, which is important in many biological processes. An inhibitor in the central nervous system known as gamma-aminobutyric acid (GABA) normally counterbalances the activity of these pathways by inhibiting adenylyl cylase activation. However, the combination of the effects of smoking and stress virtually shuts down GABA production. It is Dr. Schuller's belief that treatment with GABA will reverse all negative effects of cAMP signaling by restoring the body's ability to repair itself through inhibition of adenylyl cyclase activation.

Hildegard Schuller

Professor

Pathobiology Department

PhD, Justus Leibig University, Germany

5 refereed publications in 2009

In addition to center funds, Dr. Schuller's research is supported by the National Lung Cancer Partnership and the National Institutes of Health.

Nature's Cancer Prevention

Green tea and grape seed extract as cancer prevention measures

Breast cancer is the most common type of cancer among women in North America, and over 70% of breast cancer cases are attributable to environmental carcinogen exposure. Some breast cancers are carcinomas that evolve from precancerous duct cells, which are considered the earliest form of breast cancer. It has recently been postulated that this early form of breast cancer is generated and maintained by a type of stem cell.

Dr. Hwa-Chain Robert Wang's research group hypothesizes that these stem cells may be logical targets for early prevention of progressive breast cancer. His laboratory has developed a cell model system in which extremely low doses of carcinogens can be introduced to breast cells to mimic the day-to-day exposure encountered in humans. They have been able to induce precancerous carcinomas in these cells in order to test the benefits of dietary therapeutics found in green tea and grape seed extract.

Completion of this research will aid developers of dietary supplements for treatment and prevention of breast cancer, as well as influence dietary regimens in those at risk for cancer and those living with cancer.

Hwa-Chain Robert Wang

Professor

Comparative Medicine Department

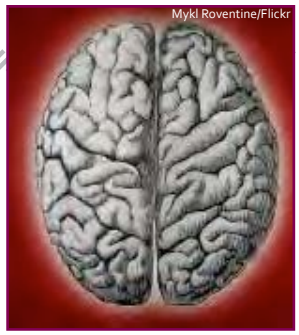
PhD, University of Virginia

DVM equiv., National Chung-Hsing University, Taiwan

1 refereed publication in 2009

In addition to center funds, Dr. Wang's research is supported by the National Institutes of Health.

Solving the Alzheimer's Mystery



Dr. Xu is unlocking the secrets of the Alzheimer's brain

Alzheimer's disease is the fifth leading cause of death in the United States. Between 2000 and 2006, Alzheimer's deaths increased by 46.1%, whereas other causes of death, such as heart disease, have decreased. This dramatic and alarming rise in Alzheimer's deaths makes understanding the disease all the more important.

The mechanisms that cause neuron death associated with Alzheimer's disease are still not well understood, but one of the proposed mechanisms is apoptosis, which is a genetically-determined process of cell self-destruction.

Dr. Xuemin Xu's research group believes that presenilin-associated protein (PSAP) may serve as an adaptor molecule to relay apoptotic signals, and thus may play an important role in the neuronal degeneration found in Azheimer's disease. The goal of his studies is to determine PSAP's role in order to further the foundation for future clinical research aimed at preventing and treating this devastating disease.

Xuemin Xu

Professor

Pathobiology Department

PhD, Tokyo Institute of Technology, Japan

3 refereed publications in 2009

In addition to center funds, Dr. Xu's research is supported by the National Institutes of Health, the American Health Assistance Foundation, and the Alzheimer's Association.

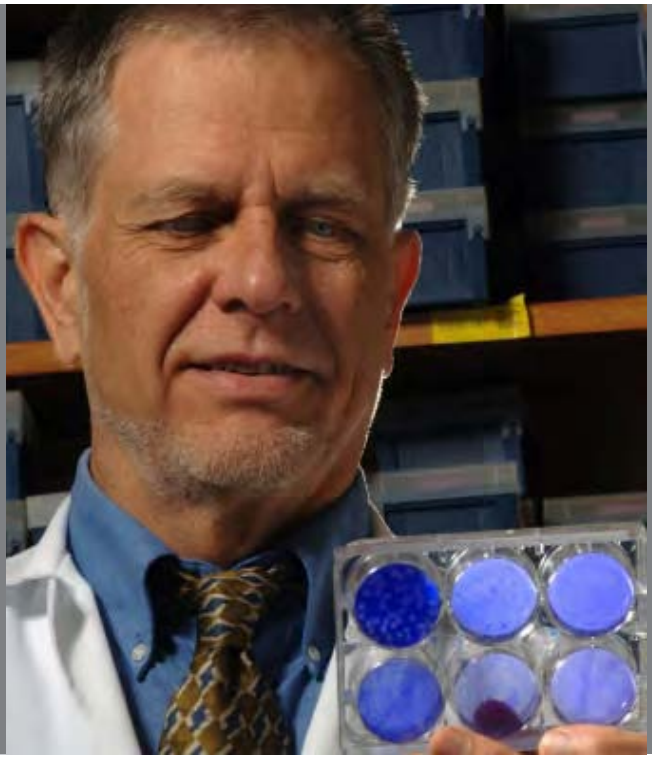
Riboswitch: On the Right Track to a Coronavirus Cure

Coronavirus is a virus found in mammals (including humans) and birds that affects the respiratory and gastrointestinal tracts, as well as the central nervous system. It is responsible for the common cold and more serious illnesses like SARS (severe acute respiratory syndrome) in humans but also impacts the farm industry in swine, cattle, and chickens. Like other viruses, it is contains a specific protein structure.

In 1999, Dr. David Brian discovered a riboswitch in the coronavirus. A riboswitch is a unique regulatory RNA molecule that a virus generally exploits for its own replication and suppression of protein synthesis. Since his discovery, he has been working on determining the exact function of the riboswitch in the coronavirus. With one of his recent experiments, he observed a dramatic suppression of cellular protein synthesis in coronavirus-infected cells, and he believes that this change is indicative of an internal ribosome entry site (IRES) of the coronavirus. This IRES allows for initiation of protein building in the middle of a messenger RNA sequence versus at the end. If the coronavirus enters at this point, it stands to reason that the virus would suppress the protein synthesis.

This uncharacteristic mechanism of entry may allow scientists to exploit the regulation of the riboswitch in coronavirus-infected cells, and thus develop ways to treat the virus in animals and humans alike.

David Brian



Professor

Pathobiology Department

DVM, PhD, Michigan State University

1 refereed publication in 2009

In addition to center funds, Dr. Brian's research is supported by the National Institutes of Health.

Diagnosing Insulin Resistance in Horses

Medical resident Dr. Ferenc Tóth performs a lameness exam with a lameness locator

In horses, diagnosing insulin resistance is important because this resistance predisposes the animal to laminitis, an inflammatory condition that, in its worst form, causes the hoof wall to separate from the bone. If not treated appropriately, laminitis can result in permanent lameness, forced retirement, or euthanasia.

Insulin resistance is often diagnosed by measuring glucose concentration within a single blood sample, as with humans who do their own diabetic testing. Reference ranges for glucose and insulin concentrations are available for humans, but appropriate ranges have not been determined for horses.

Dr. Nicholas Frank hypothesizes that blood insulin concentrations are affected by factors other than insulin resistance, and these must be identified and quantified. He is focused on measuring hour-to-hour, day-to-day, and month-to-month variability in blood glucose and insulin levels in healthy and insulin-resistant horses. In addition, he is assessing the effects of diet by collecting and analyzing pasture grass and hay samples.

His ultimate goal is to improve the accuracy of diagnostic testing for insulin resistance in horses.

Nicholas Frank

Associate Professor

Large Animal Clinical Sciences Department

DVM, PhD, Purdue University

5 refereed publications in 2009

In addition to center funds, Dr. Frank's research is supported by the Grayson Jockey Club, SmartPak Equine, American College of Veterinary Internal Medicine, and Lloyd, Inc.

Bovine Stem Cells that Renew and Repair

Stem cells may be a way to treat mastitis in dairy cattle

Mastitis is an inflammatory condition in cows that can last for months or even years, negatively affecting milk production by causing abnormal milk or lowering production quantity. Preliminary research shows that the bacterial pathogens that cause mastitis may be affected by bovine mammary gland stem cells.

Mammary gland epithelial tissue develops from stem cells capable of self-renewal (for tissue renewal) and differentiation (for tissue maintenance or repair). This past year, Dr. Margo Holland sought to separate the stem cells into undifferentiated (self-renewal) and differentiated subpopulations and then to profile the genes of these pure populations to develop genetic fingerprints of self-renewal and differentiation.

Control of these mechanisms may enable the manipulation of stem cells for the development of cell and tissue-based replacement therapies for damaged or dysfunctional tissues, like those affected by mastitis. Her results will provide insight on the direction for future research on the interaction of stem cells with mastisis-causing bacterial pathogens.

Margo Holland

Associate Professor

Comparative Medicine Department

DVM, Tuskegee University; PhD, Michigan State University

In October 2009, Dr. Holland joined the USDA as the national program leader for veterinary molecular immunology and microbiology in the National Institute of Food and Agriculture.

Mastitis Vaccine Production

A mastitis vaccine would help Tennessee farmers financially

Mastitis, an inflammatory condition of the udder, is the most common and most costly disease in dairy cattle. The disease creates discomfort for the animal, as well as abnormalities and lower yield in the milk the cow produces.

Dr. Stephen Oliver has been studying mastitis caused by *Streptococcus uberis* bacteria for over a decade. His research resulted in the discovery of a novel bacterial protein, the *S. uberis* Adhesion Molecule (SUAM), which is a factor in the development of *S. uberis* mastitis.

This past year, Dr. Oliver's focus was to characterize the mutant gene sua in an *S. uberis* strain on the way to creating a vaccine to prevent and control *S. uberis* mastitis in dairy cows. This vaccine would enhance immunity at times when mammary glands are more susceptible, like around the time of calving and during non-lactating periods. He believes that deleting the sua gene will inhibit SUAM production and reduce virulence of the *S. uberis* bacteria that cause mastitis.

Stephen Oliver

Professor

Animal Science Department

PhD, The Ohio State University

9 refereed publications in 2009

In addition to center funds, Dr. Oliver's research is supported by Fort Dodge Animal Health, DeLaval, Pfizer Animal Health, USDA, and other private industry.

Heat Stress and Mastitis in Cattle

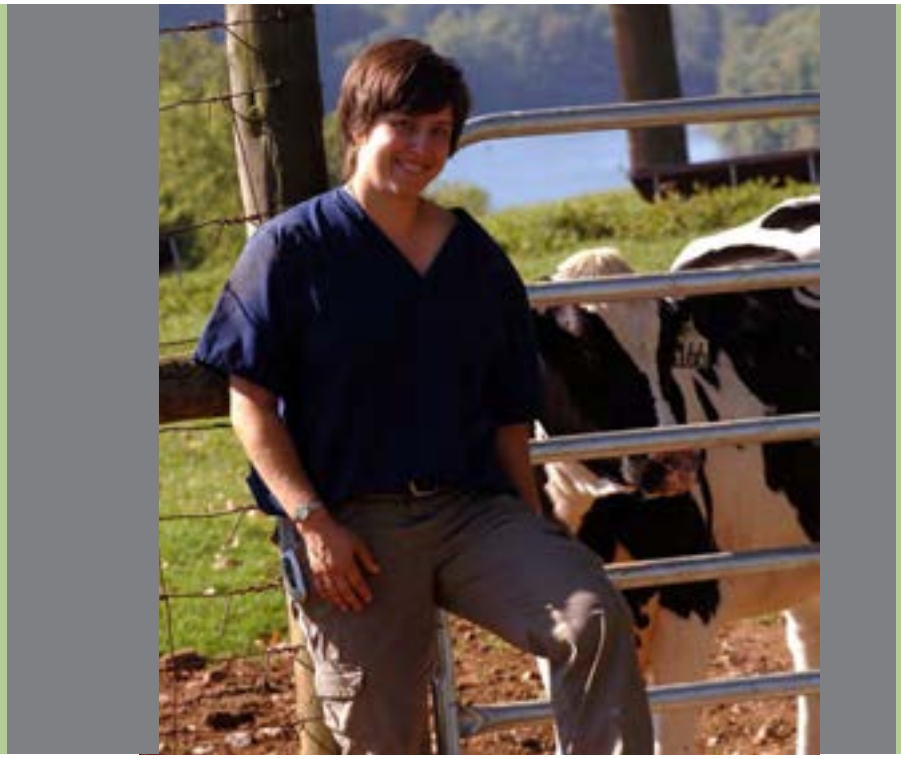
Farm and lab collide in Pighetti's research

We have heard the warnings before: when the temperature rises outside, drink plenty of fluids, take it easy, and stay inside in the cool air as much as possible. We know heat stress can affect humans, but what about cows? Cattle are fairly adept at adapting to weather conditions, but extreme heat can have an effect on them, too.

Heat stress dramatically increases the incidence, morbidity, and mortality of mastitis in cows. Mastitis, an inflammatory-based infectious disease of the cow's udders, is economically devastating to the dairy industry, which loses approximately $2 billion each year to the disease.

Dr. Gina Pighetti has been studying the effects of heat stress on mastitis and ways to reduce excessive inflammatory responses to bacterial infection during stress. In particular, she is looking at how heat stress affects concentrations of norepinephrine, a stress hormone, in milk and plasma. Norepinephrine may then be used as a biomarker to predict cows more susceptible to infection. The information gained from these studies may also be used to develop drugs to target the norepinephrine pathway to alleviate and/or moderate the risk of mastitis during the summer.

Gina Pighetti



Associate Professor

Animal Science Department

PhD, Pennsylvania State University

Controlling Stromal Keratitis

Galectin-1 protein may reduce the severity of stromal keratitis.

Infection of the eye with herpes simplex virus-1 (HSV-1) results in a chronic, inflammatory reaction known as stromal keratitis, which can result in blindness. Controlling inflammatory diseases is challenging, particularly if treatment begins late after initial infection.

Recent studies suggest that galectins, a family of carbohydrate-binding proteins, play a crucial role in regulating immune response to inflammation. Among these, galectin-1 has emerged as a key player in regulating the body's inflammatory response to HSV-1.

Dr. Barry Rouse and his research team propose that administering galectin-1 as a treatment will drastically reduce the severity of stromal keratitis lesions in the eye. Their studies focus on how galectin-1 achieves its effect, particularly as it relates to the primary orchestrators of HSK lesions, $CD4^+$ cells. They believe that galectin-1 therapy may represent a new, practical strategy to control HSV-1-induced lesions, the most common cause of blindness in the industrialized world.

Barry Rouse

Distinguished Professor

Pathobiology Department

BVSc, DSc, University of Bristol, England; PhD, University of Guelph, Canada

2 refereed publications in 2009

In addition to center funds, Dr. Rouse's research is supported by the National Institutes of Health.

Improving Reproduction in Cattle

Reproductive efficiency is important to Tennessee cattle farmers.

Reproductive inefficiency in farm animals such as dairy cattle and sheep is a worldwide problem for farmers and consumers alike. Even slight improvements in reproductive performance could have large effects on food animal production. The neuropeptide kisspeptin stimulates growth hormone release and is required for normal reproduction. However, the mechanisms underlying kisspeptin's effect on growth hormones have not been determined in large ruminants.

Dr. Brian Whitlock's research foci are how different physiologic conditions affect growth hormone release via kisspeptin, as well as how kisspeptin affects ovulation in cattle . He has determined that kisspeptin stimulates circulating growth hormone concentrations after pretreatment with gonadal reproduction steroids. His early data support the notion that kisspeptin may be useful in inducing ovulation in cattle. These studies, then, may have clinical applications on the farm.

Brian Whitlock

Assistant Professor

Large Animal Clinical Sciences Department

DVM, PhD, Auburn University

Publications and Presentations

Seung Joon Baek (p. 17)

Baek SJ, Sukhthankar M. Green tea catechins in colorectal cancer. In: McKinley H, Jamieson M, eds. *Handbook of Green Tea and Human Health.* New York: Nova Science Publishers;2009:325–346.

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Choi HJ, Chung YS, Kim HJ, Moon UY, Choi YH, Van Seuningen I, **Baek SJ**, et al. Signal pathway of 17b-estradiol-induced MUC5B expression in human airway epithelial cells. *American Journal of Respiratory Cellular and Molecular Biology* 2009;40:168–178.

Fry MM, Kirk CA, Liggett JL, Daniel GB, **Baek SJ**, et al. Changes in hepatic gene expression in dogs with experimentally-induced nutritional iron deficiency. *Veterinary Clinical Pathology* 2009;38:13–19.

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Iguchi G, Chrysovergis K, Lee SH, **Baek SJ**, Langenbach R, Eling TE. A reciprocal relationship exists between nonsteroidal anti-inflammatory drug-activated gene-1 (NAG-1) and cyclooxygenase-2. *Cancer Letters* 2009;282:152–158.

Peretich A, Cekanova M, Hurst S, **Baek SJ**, Dhar M. PPAR agonists down-regulate the expression of *Atp1oc* mRNA during adipogenesis. *Open Obesity Journal* 2009;1:41–48.

Kambe S, Yoshioka H, Kamitani H, Watanabe T, **Baek SJ**, Eling TE. The cyclooxygenase inhibitor sulindac sulfide inhibits EP4 expression and suppresses the growth of glioblastoma cells. *Cancer Prevention Research* 2009;2:1088–1099.

Baek SJ. Special seminar. Invited presentation at: University of Alabama at Birmingham, Division of Hematology/Oncology; April 2009.

Baek SJ. Proapoptotic protein NAG-1 suppresses inflammation. Presented at: 2nd World Cancer Congress; June 22, 2009; Beijing, China.

Baek SJ. Green tea and anti-carcinogenesis. Presented for: The Royal Golden Jubilee PhD Program, Mahidol University; October 14, 2009;Bangkok, Thailand.

Sukhthankar M, Cekanova M, **Baek SJ**. Green tea catechins: Suppression of a novel potential cell proliferator, NUDT6, in human colorectal cancer. Presented at: American Association for Cancer Research 100th Annual Meeting; April 18, 2009; Denver, CO.

Lee SH, Krisanapun C, **Baek SJ**. Capsaicin activates anti-tumorigenic protein NAG-1 through PKC-, GSK3 beta, and C/EBP beta-mediated pathway. Presented at: American Association for Cancer Research 100th Annual Meeting; April 18, 2009; Denver, CO.

Krisanapun C, Lee S-H, Perez-Albela L, Sams C, Peunvicha P, **Baek SJ**. Anti-proliferative activity of apigenin in colorectal and breast cancer cells. Presented at: American Association for Cancer Research 100th Annual Meeting; April 18, 2009; Denver, CO.

Sun X, **Baek SJ**, Lee S-H, Zemel M. NAG-1 promotes a lean phenotype by stimulating mitochondrial biogenesis and fatty acid oxidation. Presented at: The 27th Annual Scientific Meeting of the Obesity Society; October 2009; Washington, DC.

David Brian (p. 25)

Gustin KM, Guan B-J, Dziduszko A, **Brian DA**. Bovine coronavirus p28 (nsp1) is an RNA binding protein that binds terminal genomic cis-replication elements. *Journal of Virology* 2009;83:6087–6097.

Brian DA. Invited seminar presented at: University of Tennessee, College of Veterinary Medicine, Pathobiology Department; September 2009; Knoxville, TN.

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Maria Cekanova (p. 18)

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Choudhary S, **Wang H-CR.** Reactive oxygen species in the ability of pro-apoptotic H-Ras to enhance apoptosis induced by histone deacetylase inhibitors [abstract]. In: *Proceedings of the Comparative & Experimental Medicine and Public Health Research Symposium*; June 2009; Knoxville, TN. Abstract 82.

Rathore K, **Wang H-CR**. Precancerous model of human breast epithelial cells induced by NNK & benzo[a]pyrene and the role of green tea catechins in breast cancer prevention [abstract]. In: *Proceedings of the Comparative & Experimental Medicine and Public Health Research Symposium*; June 2009: Knoxville, TN. Abstract 88.

Wang H-CR. Northern American veterinarian education and licensing. Invited presentation at: Seventh Annual Meeting for Deans of Chinese Veterinary Medical Colleges; May 22, 2009; Yanglin (Xi'an) City, China.

Wang H-CR. US Veterinary education, licensing, and UTCVM. Invited presentation at: Northwest Agricultural and Forestry University, College of Animal Science and Veterinary Medicine; May 26, 2009; Yanglin City, China.

Wang H-CR. US Veterinary education, Northern American veterinarian licensing, and UTCVM. Invited presentation at: Jilin University College of Animal Science and Veterinary Medicine; May 28, 2009; Chungchun City, China.

Wang H-CR. US Veterinary education and licensing. Invited presentation at: China Agricultural University College of Veterinary Medicine; June 2, 2009; Beijing, China.

Wang H-CR. Reactive oxygen species in selective apoptosis of oncogenic ras-transformed cells by histone deacetylase inhibitors. Invited presentation at: China Agricultural University College of Veterinary Medicine; June 2, 2009; Beijing, China.

Wang H-CR. Veterinary education in the USA. Invited presentation at: Northwest Agricultural and Forestry University, College of Animal Science and Veterinary Medicine; October 2009; Yanglin City, China.

Wang H-CR. Graduate research education in the USA. Invited presentation at: Northwest Agricultural and Forestry University, College of Animal Science and Veterinary Medicine; October 2009; Yanglin City, China.

Wang H-CR. Oncogenes and cell signaling. Invited presentation at: Northwest Agricultural and Forestry University, College of Animal Science and Veterinary Medicine; October 2009; Yanglin City, China.

Wang H-CR. Target therapeutics on oncogene-activated cells. Invited presentation at: Northwest Agricultural and Forestry University, College of Animal Science and Veterinary Medicine; October 2009; Yanglin City, China.

Wang H-CR. Precancerous carcinogenesis for dietary prevention and proapoptotic oncogenesis for anticancer therapeutics. Presented at: UT-ORNL Genome Science Technology Graduate Program, Knoxville, TN, March 22, 2009.

Brian Whitlock (p. 31)

Sartin JL, **Whitlock BK**, Wilborn RR, Daniel JA. Hormonal and neurotransmitter mechanisms regulating feed intake. Presented at: 60th Annual Meeting of the European Association of Animal Production; August 2009; Barcelona, Spain.

Wilborn RR, **Whitlock BK**, Daniel JA, Steele BP, Sartin JL. Kisspeptin-induced LH response in diestrous and anestrous mares. Presented at: Society for Theriogenology/American College of Theriogenologists Annual Meeting; September 2009; Albuquerque, NM.

Hes M, Prado T, **Whitlock BK**. Hemicastration in a stallion with a testicular hematoma. Presented at: Society for Theriogenology/American College of Theriogenologists Annual Meeting; September 2009; Albuquerque, NM.

Peck J, **Whitlock BK**, Prado T. Feline ovarian remnant syndrome. Presented at: Society for Theriogenology/American College of Theriogenologists Annual Meeting; September 2009; Albuquerque, NM.

Whitlock BK. Calving problems: When to intervene and how. Invited presentation at: Cattle Health Producer Conference; December 2009; Knoxville, TN.

Whitlock BK. Congenital defects in alpacas. Invited presentation at: Southeastern Alpaca Association Conference; August 2009; Lookout Mountain, GA.

Whitlock BK. Ultrasound use in bovine reproduction. Invited presentation at: Mississippi Veterinary Medical Association Winter Meeting; February 2009; Starkville, MS.

Whitlock BK. Use of pregnancy-associated glycoproteins to assess pregnancy status in cattle. Invited presentation at: Mississippi Veterinary Medical Association Winter Meeting; February 2009; Starkville, MS.

Whitlock BK. Use of pregnancy-associated glycoproteins to assess pregnancy status in cattle. Invited presentation at: Auburn Annual Veterinary Conference; April 2009; Auburn, AL.

Whitlock BK. Comparison of techniques used to correct left displaced abomasums. Invited presentation at: Mississippi Veterinary Medical Association Winter Meeting; February 2009; Starkville, MS.

Whitlock BK. Comparison of techniques used to correct left displaced abomasums. Invited presentation at: Auburn Annual Veterinary Conference; April 2009; Auburn, AL.

Whitlock BK. Heritable bovine fetal anomalies. Invited presentation at: Mississippi Veterinary Medical Association Winter Meeting; February 2009; Starkville, MS.

Whitlock BK. Heritable bovine fetal anomalies. Invited presentation at: Auburn Annual Veterinary Conference; April 2009; Auburn, AL.

Whitlock BK. Heritable bovine fetal anomalies. Invited presentation at: 21st Annual Coley Veterinary Services Client Dinner and Meeting; 2009; New Market, TN.

Whitlock BK. Heritable bovine fetal anomalies. Invited presentation at: Annual White/Van Buren County Cattlemen's Meeting; 2009.

Whitlock BK. Heritable bovine fetal anomalies. Invited presentation at: Steak and Potatoes Field Day, Plateau AgResearch and Education Center; August 2009; Crossville, TN.

Xuemin Xu (p. 24)

Tan J, Mao G, Cui M-Z, Kang S-C, Lamb B, Wong B-S, Sy M-S, **Xu X.** Residues at P2-P1 positions of epsilon- and zeta-cleavage sites are important in formation of beta amyloid peptide. *Neurobiology of Disease* 2009;36:453–60.

Mao G, Tan J, Cui M-Z, Chui D, **Xu X.** The GxxxG motif in the transmembrane domain of APP plays an essential role in the interaction of CTFβ with γ-secretase complex and formation of Aβ. *Journal of Alzheimer's Disease* 2009;18:167–76.

Tan M, Hao F, **Xu X,** Chisolm G, Cui M-Z. Lysophosphatidylcholine activates a novel PKD2-mediated signaling pathway that controls monocytic THP-1 cell migration. *Arteriosclerosis, Thrombosis and Vascular Biology* 2009;29:1376–1382.

Xu X. Molecular mechanism of amyloid beta peptide formation in Alzheimer's disease. Invited presentation at: Fudan University; July 28, 2009; Shanghai, China.

Xu X. PEN-2 is dispensable for presenilin endoproteolysis and subcomplex of nicastrin and Aph1 is required for interaction with CTFβ but not presenilin. Invited presentation at: Society for Neuroscience 39th Annual Meeting; October 2009; Chicago, IL.

Tan J, Mao G, Cui M-Z, Li T, **Xu X**. Determine the contribution of isoforms of Aph1 to gamma-secretase-mediated APP processing and Abeta formation. Presented at: Society for Neuroscience 39th Annual Meeting; October 2009; Chicago, IL.

Hao F, Tan M, Wu D, **Xu X**, Cui M-Z. Lysophosphatidic acid induction of interleukin 6 secretion from human aortic smooth muscle cells. Presented at: Arteriosclerosis, Thrombosis and Vascular Biology Annual Conference; Washington, DC; April 29-May 1, 2009.

Cui M-Z, Hao F, Tan M, Chisolm G, **Xu X**. Protein kinase D2 mediates lysophosphatidylcholine-induced monocyte migration. Presented at: 44th Annual Southeastern Regional Lipid Conference; Cashiers, NC; November 2009.

Hao F, Tan M, Wu D, **Xu X**, Cui M-Z. LPA1, protein kinase C and p38α mediate lysophosphatidic acid-induced interleukin-6 secretion from human aortic smooth muscle cells. Presented at: 44th Annual Southeastern Regional Lipid Conference; Cashiers, NC; November 2009.

*Publications and presentations listed are for the 2009 calendar year. The reporting method for this report was changed 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.

Research Funded Externally – Detail

Investigator	*Project Title*	*Funding Agency*	*Project Period*	*2010 Receipts*	*2010 Expenditures*
Baek, Seung Joon	PPAR-gamma ligands in colorectal cancer	National Institutes of Health	07/01/06–05/31/11	$199,929	$137,575
	Gene alterations by NSAIDs	American Cancer Society	07/01/06–06/30/10	$180,000	$60,219
	Development of noninvasive bioluminescence imaging for cancer diagnosis and therapeutic testing	National Institutes of Health	05/01/07–04/30/10	*	*
	Combinational anti-cancer effects of capsaicin and 3,3'-diindolylmethane in colorectal cancer	National Institutes of Health	07/01/09–06/30/11	$70,250	$67,709
Brian, David	Coronavirus RNA replication	National Institutes of Health	06/01/08–05/31/13	$352,193	$349,008
Cekanova, Maria	Proposal for establishing primary canine cancer cell lines to study interfering RNA (siRNA) of anti-apoptotic genes	Fort Dodge Animal Health Global Research	04/01/09–03/31/10	$23,000	$21,171
	New staging techniques & evaluation of therapies for oral squamous cell carcinomas	Winn Feline Foundation	02/18/10–04/01/11	$15,000	$0
Dhar, Madhu	P-type ATPases, insulin signaling, protein trafficking	American Diabetes Association	01/01/10–12/31/10	$45,000	$15,830
Frank, Nicholas	Endotoxemia as a predisposing factor for laminitis	Grayson Jockey Club Research Foundation	04/01/10–03/31/11	$41,490	$1,670
	Effects of SmartControl IR on insulin sensitivity in obese insulin-resistant horses	SmartPak Equine	06/01/07–05/31/10	$25,982	$0
	Effects of clinical endotoxemia on glucose metabolism in horses	American College of Veterinary Internal Medicine	01/01/09–12/31/09	$12,440	$3,058
	Levothyroxine as a treatment for equine metabolic syndrome	Lloyd, Inc.	04/01/08–03/31/10	*	$6,912
	Levothyroxine as a treatment for equine metabolic syndrome	Grayson Jockey Club Research Foundation	04/01/08–09/30/09	*	$0

Investigator	*Project Title*	*Funding Agency*	*Project Period*	*2010 Receipts*	*2010 Expenditures*
Kania, Stephen	Characterization of staphylococci isolated from bears in the Great Smoky Mountains National Park	Discover Life in America, Inc.	04/01/10–03/31/11	$5,000	$2,156
	Bacteriophage in methicillin-resistant Staphylococcus from canine skin infections	Morris Animal Foundation	06/01/10–08/31/10	$4,000	$1,550
	Reverse transcription free microarray analysis	Sci-Tec	10/01/07–09/30/09	$20,000	$8,202
	Genomic sequencing of methicillin-resistant *Staphylococcus pseudintermedius* from canine pyoderma	Morris Animal Foundation	06/01/09–08/31/09	$4,000	$2,081
	Bioluminescent assay for gene expression analysis	Private industry	05/01/08–04/30/10	*	$22,661
Oliver, Stephen	Tennessee Quality Milk Initiative	Fort Dodge Animal Health Global Research	10/01/07–12/31/12	$30,000	$0
	Efficacy and field safety of Spectramast LC for intramammary treatment of clinical mastitis due to *Staphylococcus aureus* or *Streptococcus uberis*	Pfizer Animal Health	08/05/08–08/09/09	$13,039	$4,738
	Efficacy of two experimental post-milking teat disinfectants as evaluated in a positive control natural exposure study in dairy cows	DeLaval	02/09/09–03/31/09	$79,442	$60,942
	Confidential	Private industry	02/18/10–02/17/11	$1,050,000	$439,867
	Tennessee Quality Milk Initiative Research	Private industry	01/01/09–12/31/14	$30,000	$0
	Molecular mechanisms associated with *Streptococcus uberis* mastitis in dairy cows	USDA	09/01/07–08/31/10	$375,000	$123,519

Investigator	*Project Title*	*Funding Agency*	*Project Period*	*2010 Receipts*	*2010 Expenditures*
Rouse, Barry	Mechanisms in herpetic keratitis	National Institutes of Health	01/01/08–12/31/12	$354,580	$490,738
	T-regulatory cells in herpes simplex virus immunity and immunopathology	National Institutes of Health	02/01/06–01/31/11	$307,176	$391,325
Schuller, Hildegard	The GABA-B receptor is a novel drug target for pancreatic cancer	National Institutes of Health	05/01/10–04/30/13	$272,655	$248,160
	Modulation of cancer prevention by social stress	National Institutes of Health	09/30/09–08/31/11	$500,000	$435,578
	GABA-BR-mediated prevention of pancreatic cancer	National Institutes of Health	09/29/09–03/31/14	$294,088	$160,819
	Estrogen enhances the carcinogenic effects of the nicotine derivative NNK	National Lung Cancer Partnership	01/31/08–01/30/10	$50,000	$44,085
Wang, Hwa-Chain Robert	Carcinogenesis cellular model for identifying preventive agents	National Institutes of Health	09/01/07–08/31/10	$72,500	$74,974
	Green tea catechins in precancerous prevention	National Institutes of Health	09/01/08–08/31/10	$190,598	$73,787
Xu, Xuemin	The role of the new zeta cleavage in ABeta formation	National Institutes of Health	04/15/07–03/31/12	$288,392	$248,799
	Vascular risk factors in Alzheimer's disease	American Health Assistance Foundation	04/01/09–03/31/12	$133,333	$77,848
	Determine the role of the long Abeta-46 in Alzheimer's disease development	Alzheimer's Association	10/01/05–09/30/09	*	$22,149
Total				**$5,039,087**	**$3,597,130**

*No-cost extension granted, resulting in no new funds in the current year. Expenditure amounts are from carry-over from the previous year.

CENTERS OF EXCELLENCE/CENTERS OF EMPHASIS
ACTUAL, PROPOSED, AND REQUESTED BUDGET

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

	FY 2009-10 Actual			FY 2010-11 Proposed			FY 2011-12 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures	279,018	558,037	837,055	294,257	588,513	882,770	261,050	522,100	783,150
Salaries									
Faculty	45,852	91,704	137,555	56,304	112,607	168,911	59,119	118,238	177,357
Other Professional	28,847	57,695	86,542	29,103	58,205	87,308	30,558	61,116	91,673
Clerical/ Supporting	31,039	62,078	93,116	26,867	53,733	80,600	28,210	56,420	84,630
Assistantships	26,007	52,013	78,020	20,317	40,635	60,952	21,333	42,666	64,000
Total Salaries	131,745	263,489	395,234	132,590	265,181	397,771	139,220	278,440	417,660
Fringe Benefits	29,918	59,836	89,754	16,375	32,749	49,124	17,193	34,387	51,580
Total Personnel	161,663	323,325	484,988	148,965	297,930	446,895	156,413	312,827	469,240
Non-Personnel									
Travel	6,229	12,458	18,687	5,750	11,500	17,250	6,038	12,075	18,113
Software	1,342	2,683	4,025			0			0
Books & Journals			0			0			0
Other Supplies	59,217	118,433	177,650	116,959	233,918	350,877	63,337	126,675	190,012
Equipment	27,703	55,406	83,109	10,550	21,100	31,650	11,078	22,155	33,233
Maintenance	14,031	28,061	42,092	10,083	20,167	30,250	10,588	21,175	31,763
Scholarships	8,647	17,294	25,942	6,333	12,665	18,998	6,649	13,299	19,948
Consultants						0			0
Renovation						0			0
Other (Specify)	0	0				0			0
Ins, Cont & Sp Svc,			49,921	6,083	12,167	18,250	6,388	12,775	19,163
Media/Comm	188	375	563	533	1,067	1,600	560	1,120	1,680
Rentals, Comp Svc			3,300			0			0
Total Non-Personnel	117,356	234,711	405,288	156,292	312,583	468,875	104,637	209,273	313,910
GRAND TOTAL	279,018	558,037	890,276	305,257	610,513	915,770	261,050	522,100	783,150
Revenue									
New State Appropriation		591,200	591,200		555,602	555,602		522,100	522,100
Carryover State Appropriation		74,795	74,795		54,911	54,911			0
New Matching Funds	269,250		269,250	277,801		277,801	261,050		261,050
Carryover from Previous Matching Funds	37,398		37,398	27,456		27,456			0
Total Revenue	306,648	665,995	972,643	305,257	610,513	915,770	261,050	522,100	783,150