CENTER OF EXCELLENCE
in
Livestock Diseases & Human Health

2020 Annual Report
# Table of Contents

About the Institute .......................................................................................................................... 5
Letter from the Dean ......................................................................................................................... 7
Summary of Accomplishments ........................................................................................................ 8

## Program Report

- Introduction .................................................................................................................................. 11
- Personnel ....................................................................................................................................... 11
- Funding and Expenditures ............................................................................................................ 12
- Allocation of Funding .................................................................................................................... 13
- Start-Up Funds ............................................................................................................................... 13
- Infrastructure and Supplies ........................................................................................................... 14-15
- UTCVM Research Day ................................................................................................................ 16-17
- Dissemination of Research .......................................................................................................... 18
- Popular Press and Media .............................................................................................................. 19
- Summer Student Research Program ............................................................................................ 20-23
- Three-Minute Thesis ................................................................................................................... 24
- Five-Year Benchmark Data .......................................................................................................... 26
- Benchmark Summary (2016-2020) .............................................................................................. 27
- Future Plans: Looking Forward .................................................................................................. 28

## Faculty Reports

- Dr. David Anderson ....................................................................................................................... 30
- Dr. Marc Caldwell ......................................................................................................................... 31
- Dr. Vermont Punongba Dia ........................................................................................................... 32
- Dr. Stephen Kania ......................................................................................................................... 33
- Dr. Andrea Lear ............................................................................................................................. 34
- Dr. Chika Okafor .......................................................................................................................... 35
- Dr. Liesel Schneider ....................................................................................................................... 36
- Dr. Hwa-Chain Robert Wang ...................................................................................................... 37

## Publications and Presentations

- .................................................................................................................................................. 38-48

## Research Funded Externally

- .................................................................................................................................................. 50

## Research Funded Internally

- .................................................................................................................................................. 51

## Actual, Proposed, and Requested Budget

- .................................................................................................................................................. 52-53
About the Institute

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

AgResearch is an integral partner in teaching programs throughout the Institute. AgResearch faculty conduct world-class research programs in a variety of areas including crop breeding and genetics, soil conservation, no-till crop production, cattle reproduction, wood product development, and numerous other areas. AgResearch is also a key funding source for graduate assistantships and research endeavors graduate students participate in during their degree programs. The internship program of AgResearch offers undergraduate students unparalleled field experience. The unit’s ten branch research facilities serve as field laboratories for faculty and students, allow the public to evaluate research trials, and allow the public to experience gardens and arboretums.

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

The College of Veterinary Medicine (CVM) is one of only thirty veterinary colleges in the nation. The central mission of the College is educating Doctor of Veterinary Medicine (DVM) students seeking a career in one of the many aspects of the profession ranging from clinical practice to research. The College also serves the public in providing referral medical services to pet owners, zoos, and the livestock industry through the UTCVM Veterinary Medical Center. In addition, the college protects public health, enhances medical knowledge through research and education of graduate students, and generates economic benefits to the state and nation. Outreach programs engage an array of citizens and their animals in learning programs that explore the human-animal bond and promote wellbeing.

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

Dr. David E. Anderson
Associate Dean for Research and Graduate Studies

Dr. Stephen A. Kania
Assistant Dean for Research and Graduate Studies

Dr. James P. Thompson
Dean, College of Veterinary Medicine

Dr. Tim L. Cross
Senior Vice President/Senior Vice Chancellor,
University of Tennessee Institute of Agriculture

OUR MISSION

1. To promote interdisciplinary activities designed to improve the quality of human life through better animal health.

2. To expand livestock disease research capabilities.

3. To identify and characterize animal diseases that are similar to human disease.

4. To develop new strategies for the diagnosis, treatment, and prevention of disease.
Letter from the Dean

I am pleased to present the 2020 annual report for the Center of Excellence in Livestock Diseases and Human Health, based in the College of Veterinary Medicine, UT Institute of Agriculture at the University of Tennessee, Knoxville. This report provides a comprehensive overview of the utilization of funds to support the Center missions to promote interdisciplinary activities designed to improve the quality of human life through advances in animal health; to expand livestock disease research capabilities; to identify and characterize animal diseases that are similar to human disease; and to develop new strategies for the diagnosis, treatment, and prevention of disease.

Within this report, research and productivity of thirteen COE faculty are highlighted: eight faculty received COE seed grants and five faculty received start-up funding from COE during FY20. These faculty members have made significant advancements to grow research strengths including infectious disease and immunology, regenerative and rehabilitative medicine, and prevention and treatment of infectious and non-infectious livestock diseases that affect agricultural productivity.

Metrics used to assess annual return on investment show extramural funding remains strong despite a smaller number of extramural grant awards. In FY20, the ratio of research funding and research expenditures to state appropriation for the Center was 4.6:1 and 2.2:1, respectively. The lower ROI ratio for research expenditures is associated with transitions in research faculty, with extended searches to replace research intensive faculty who retired or left the College, and pandemic restrictions on research activities during the last quarter of the year.

Center faculty continue to garner national and international recognition for their research with significant scholarship increases in calendar year 2019. During CY19, Center faculty published fifty-nine peer-reviewed articles and four book chapters, and authored 105 abstracts, posters, and program presentations. In addition, COE faculty made three new invention disclosures and had one patent filed.

Despite increased fiscal challenges faced by our Center faculty, we are incredibly proud of their efforts and continued successes. The College has successfully recruited four new faculty with significant research assignments. We anticipate these faculty will have an immediate impact on research, awards, and productivity. We hope you enjoy this summary presentation of Center activities and accomplishments.

Dr. James P. Thompson, Dean
UT College of Veterinary Medicine
Summary of Accomplishments

The Center of Excellence in Livestock Diseases and Human Health continues to serve its mission to promote interdisciplinary activities designed to improve the quality of human life through better animal health, to expand livestock disease research capabilities, to identify and characterize animal diseases that are similar to human disease, and to develop new strategies for the diagnosis, treatment, and prevention of disease. The Center of Excellence plays a vital role in advancing human and animal health by supporting faculty, students, research infrastructure, and the acquisition of state-of-the-art research equipment. Faculty and students play a vital role in discovering new knowledge regarding the interrelationships among humans, animals, and the environment. To this end, the One Health Initiative was established in 2019 under the direction of Dr. Debra Miller. Dr. Miller is Professor and Director of the Center for Wildlife Health in the University of Tennessee Institute of Agriculture and now serves as the founding director of the One Health Initiative. Dr. Miller is in an ideal position to lead the OHI as she has a split appointment between the College of Veterinary Medicine and the Department of Forestry, Wildlife and Fisheries. In this role, she will serve to foster multidisciplinary research with institutional, national, and international collaborations.

Multiple faculty who were supported by Center of Excellence (COE) funding were successful in seeking extramural funding to advance their research. In FY20, COE faculty were awarded $3,632,232 in extramural funding. These funds were awarded, primarily, from federal granting agencies. Dr. David Anderson received funding as a sub-award with the University of Arkansas ($2.9M) in joint grants submitted to the Department of Defense, Army JWMRP, and PRORP programs. Dr. Anderson also received $25,935 from the National Science Foundation as part of a collaborative grant with Dr. Dustin Crouch, biomedical engineer in the College of Engineering at the University of Tennessee, Knoxville. Dr. Barry Rouse received three grants through the National Institutes of Health (NIH) to continue his studies on viral pathogenesis with special emphasis on eye diseases. Dr. Rouse received a total of $632,460 through NIH grant awards. Dr. Stephen Kania received a total of $57,876 in industry funding from Boehringer Ingelheim Animal Health (BIAH). One grant from BIAH totaling $42,000 was awarded to evaluate a vaccine for the treatment of methicillin-resistant *Staphylococcus pyoderma* in dogs. Another grant from the Boehringer Ingelheim Veterinary Scholars Program totaling $15,876 was secured to support summer research experience programs for professional students in the College of Veterinary Medicine.

In 2019, Center of Excellence faculty remained actively engaged through publications and presentations to local, national, and international audiences. The thirteen Center faculty accounted for fifty-nine peer-reviewed research articles, four book chapters, and 105 presentations/posters/abstracts. Scholarly productivity metrics show that COE faculty published an average of 4.5 journal articles per faculty member and participated in an average of 8.1 scientific presentations, posters, and abstracts.

Overall, research expenditures by Center of Excellence faculty decreased in FY20. The College of Veterinary Medicine experienced the loss of some tenure-track faculty through retirements and job relocations, which likely had a negative impact on research expenditures. Research expenditures were substantially affected by the COVID-19 pandemic as a result of research laboratories being shut down or significantly limited during the period from March through June 2020. Throughout most of the second half of FY20, live animal and in-person research was severely restricted. Exramural funding during FY20 totaled $3,632,232 resulting in a FY20 return on investment based on new research awards of 4.6:1.
### FY20 Sources of COE Faculty Research Funding

<table>
<thead>
<tr>
<th>Source</th>
<th>2020 (13 Faculty)</th>
<th>2019 (12 Faculty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal/State</td>
<td>93%</td>
<td>93%</td>
</tr>
<tr>
<td>Industry</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Internal</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Total:** 100%

**External Grant Funding:**
- 2020: $3,632,232
- 2019: $2,027,793

**Internal Funding:**
- 2020: $207,077
- 2019: $1,654,883

**Research Expenditures:**
- 2020: $1,153,173.32
- 2019: $1,654,883

**Return on Investment:**
- 2020: 4.6:1
- 2019: 3.2:1

---

1. Publications and presentations based on the 2019 calendar year; research monies based on the FY20.
2. Publications and presentations based on the 2019 calendar year; research monies based on FY20.
PROGRAM
REPORT
Introduction

The Center of Excellence (COE) in Livestock Diseases and Human Health was founded in 1984. The Center of Excellence serves a critical role in the Institute of Agriculture and the University of Tennessee, Knoxville to serve the missions of research, education, and service to the state of Tennessee and national/international communities. Faculty participating in the Center of Excellence programs meet these responsibilities by conducting original research for the purpose of discovering new knowledge and disseminating that knowledge to stakeholders. This includes training undergraduate, professional, and graduate students in the fine arts of evaluation and interpretation of research, so that these students can gain the knowledge and skills to become the next generation of scientists and scholars. Faculty also serve through collaborations with scientists throughout the nation and global community and dissemination of discoveries through publications, presentations, and outreach activities with stakeholders.

The COE faculty have research strengths in several areas that are enhanced through interdisciplinary and multidisciplinary collaboration in the pursuit of extramurally funded research.

Areas of research emphasis with COE faculty include:

- Infectious disease and immunology
- Regenerative and rehabilitative medicine
- Genomics
- One Health
- Translational models for animal and human disease

All of these research areas intertwine for the purpose of advancing human and animal health and supporting agriculture. Resources available to the Center of Excellence are utilized to promote research through startup packages for new faculty. In addition, these resources are utilized to fund seed grants to support faculty extramural grant submissions and purchase equipment to expand research capabilities and improve competitiveness for extramural funding. Summer research student programs and the annual Research Day conference in which results of COE activities are presented to faculty, students, and the community are also supported by resources available to the Center of Excellence.

Personnel

Dr. David E. Anderson
Director of the Center of Excellence

Dr. Stephen A. Kania
Director of Center of Excellence student programs

Dr. Madhu Dhar
Chair of Research Committee

Kim Rutherford
Oversees submissions of faculty proposals for funds

Amanda Hand
Annual report production
## Funding and Expenditures

### Research Funded Externally, FY20

<table>
<thead>
<tr>
<th>Lead Investigator</th>
<th>Federal/State</th>
<th>Industry</th>
<th>University</th>
<th>Foundation/Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. David Anderson</td>
<td>$2,941,896.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$2,941,896.00</td>
</tr>
<tr>
<td>Dr. Stephen Kania</td>
<td>-</td>
<td>$57,876.00</td>
<td>-</td>
<td>-</td>
<td>$57,876.00</td>
</tr>
<tr>
<td>Dr. Barry Rouse</td>
<td>$632,460.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$632,460.00</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$3,574,356.00</strong></td>
<td><strong>$57,876.00</strong></td>
<td>-</td>
<td>-</td>
<td><strong>$3,632,232.00</strong></td>
</tr>
</tbody>
</table>

### Research Expenditures, FY20

<table>
<thead>
<tr>
<th>Lead Investigator</th>
<th>Federal/State</th>
<th>Industry</th>
<th>University</th>
<th>Foundation/Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. David Anderson</td>
<td>$491,477.18</td>
<td>$70,343.39</td>
<td>$9,236.62</td>
<td>-</td>
<td>$571,057.19</td>
</tr>
<tr>
<td>Dr. Marc Caldwell</td>
<td>$8,558.62</td>
<td>$207.70</td>
<td>$3,977.90</td>
<td>-</td>
<td>$12,744.22</td>
</tr>
<tr>
<td>Dr. Vermont Punongba Dia</td>
<td>-</td>
<td>-</td>
<td>$20,109.04</td>
<td>-</td>
<td>$20,109.04</td>
</tr>
<tr>
<td>Dr. Stephen Kania</td>
<td>$7,894.95</td>
<td>$22,173.97</td>
<td>$11,099.76</td>
<td>-</td>
<td>$41,168.68</td>
</tr>
<tr>
<td>Dr. Andrea Lear</td>
<td>$2,011.73</td>
<td>-</td>
<td>$10,914.30</td>
<td>-</td>
<td>$12,926.03</td>
</tr>
<tr>
<td>Dr. Chika Okafor</td>
<td>$5,542.65</td>
<td>-</td>
<td>$16,710.00</td>
<td>-</td>
<td>$22,252.65</td>
</tr>
<tr>
<td>Dr. Barry Rouse</td>
<td>$391,685.61</td>
<td>$6,868.83</td>
<td>$13,508.00</td>
<td>-</td>
<td>$412,062.44</td>
</tr>
<tr>
<td>Dr. Liesel Schneider</td>
<td>$30,601.62</td>
<td>-</td>
<td>$12,346.15</td>
<td>-</td>
<td>$42,947.77</td>
</tr>
<tr>
<td>Dr. Hwa-Chain Robert Wang</td>
<td>$7,120.61</td>
<td>-</td>
<td>$31,115.88</td>
<td>-</td>
<td>$38,236.49</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$944,892.97</strong></td>
<td><strong>$99,593.89</strong></td>
<td><strong>$129,017.65</strong></td>
<td>-</td>
<td><strong>$1,173,504.51</strong></td>
</tr>
</tbody>
</table>
Allocation of Funding

Allocation of funding within the Center of Excellence (COE) in Livestock Diseases and Human Health promotes research for faculty and students in order to advance knowledge in animal and human health. Funding supports a variety of activities including faculty startup packages associated with the recruitment of new faculty and seed grants for faculty to develop necessary data to support extramural grant submissions and foster new collaborative research initiatives. This funding also works to ensure students are engaged in research with faculty and have the necessary resources to achieve their goals. Purchasing new equipment to advance and expand research capabilities of COE faculty and updating laboratories to ensure facilities are modern and sufficient for the recruitment and continued success of COE faculty is also accounted for in the allocation of COE funding.

Center of Excellence faculty include tenure-track faculty at all stages of career development. Startup funds are assigned to newly hired tenure-track assistant professors to ensure they have sufficient resources to establish a research program and develop data and publications that will contribute to their competitiveness as principal investigators on extramural grant submissions. Other Center of Excellence funds used to promote faculty research are awarded annually through the Center’s call for research proposals, which occurs each spring. The UTCVM research committee reviews each proposal and makes recommendations to the Associate Dean for Research regarding which proposals are best aligned with the objectives of the Center of Excellence and are most likely to contribute to the faculties’ ability to successfully compete for extramural funding. A number of special requests occur during the year with respect to COE faculty needs and operations of their laboratories. The Associate Dean for Research addressed these requests on a case-by-case basis.

Start-Up Funds

The Center provided $41,333 in start-up funds for six junior faculty members to secure additional funding in 2019. The junior faculty members’ research areas are described below:

- **Dr. Jonathan Abbott**  
  Small Animal Clinical Sciences  
  $5,000

- **Dr. Alejandro Esteller-Vico**  
  Biomedical & Diagnostic Sciences  
  $9,000

- **Dr. Stephanie Kleine**  
  Small Animal Clinical Sciences  
  $5,000

- **Dr. Andrea Lear**  
  Large Animal Clinical Sciences  
  $12,333

- **Dr. Denae LoBato**  
  Biomedical & Diagnostic Sciences  
  $5,833
Infrastructure and Supplies

Center of Excellence funds support research infrastructure in the UT College of Veterinary Medicine and the UT Institute of Agriculture and include the purchase of equipment, maintenance of shared essential research equipment, and other needs for support in shared laboratories. Requests for funds are evaluated by the research advisory committee. This committee reviews funding requests and recommends supporting or denying requests based on justification. The committee ensures the request being evaluated does not represent a redundant request relative to existing resources. The committee also considers the number of faculty who are likely to benefit from the resources and equipment of the request.

Equipment

During FY20, the Center of Excellence funded several research equipment requests. A Vicon motion capture system was purchased to use in kinetic analysis of motion. This system greatly advances the faculty research and enables the performance of clinical trials the college did not previously have the capabilities to execute. The Center contributed toward the purchase of a MALDiTOF analytical unit for the bacteriology laboratory. This equipment is a matrix assisted laser desorption and ionization time-of-flight mass spectrometer and provides rapid, efficient, and species-specific identification of bacteria and fungi. The MALDiTOF is the current industry standard, which also has the benefit of

The Instron 5567 electromechanical testing machine has enabled faculty and graduate students to enhance their research. Data has been used in publications as well as preliminary data in support of multiple extramural grant submissions.

The high-speed cameras of the Vicon motion capture system track markers placed on the animal, allowing researchers to perform complex gait analysis.
increasing biosafety and decreasing biohazard waste. This unit enables identifications of new or poorly characterized organisms which may not otherwise be recognized. The MALDiTOF significantly enhances our discovery efforts for research in infectious disease. Also, the Center shared in the purchase of a Moleculight camera with the UTCVM Small Animal Clinical Sciences and Large Animal Clinical Sciences departments. This is a state-of-the-art wound imaging and bacterial fluorescent camera that recently has been introduced to human medicine. This camera will greatly accelerate animal models research and clinical trials research in the assessment of wound healing and bacterial contamination and growth.

**Supplemental Funding**

Spanning his entire time as a professor at the University of Tennessee, Distinguished Professor Dr. Barry Rouse has received continuous funding from the National Institutes of Health (NIH) since 1978. Dr. Rouse has often held more than one NIH Research Project Grant (RO1) award simultaneously and recently received yet another renewal to continue research exploring the fundamental mechanisms of immunopathology of herpes virus corneal disease. As a result, this NIH RO1 grant, first awarded in 1984, has been renewed repeatedly for well over thirty years, which is a major accomplishment.

**Travel**

During FY20, the Center of Excellence provided $7,172.46 to support travel expenses of faculty and students. These funds were used to partially offset the expenses incurred to participate in national and international meetings. Faculty traveling to national scientific meetings included:

- Dr. Cheryl Greenacre traveled to middle Tennessee sampling turkeys for toxoplasmosis testing
- Dr. Remi Grześkowiak presented his PhD work to the American College of Veterinary Surgeons
- Dr. Stephen Kania traveled with Comparative & Experimental Medicine (CEM) students to the National Veterinary Student Symposium, hosted by Tufts University
- Dr. Agricola Odoi traveled to Florida to work with the Florida Department of Health and meet with research collaborators
- Dr. Kyle Snowden presented research at the American College of Veterinary Surgeons
- Dr. Richard Gerhold traveled to Berlin, Germany to present the results of his research at the fifth international meeting on apicomplexan parasites in farm animals
UTCVM Research Day

The Center was a major sponsor of the University of Tennessee College of Veterinary Medicine Research Day. This event is designed to serve as a venue for students and new investigators to gain experience in showcasing their research while also providing potential collaboration and networking opportunities. This year, eighteen graduate students and six veterinary students delivered oral presentations. An additional ten presentations were delivered by residents, post-docs, and faculty members. These presenters include Drs. Elizabeth Anglin, Engin Berber, Austin Bow, Natalie Chow, Michelle Dennis, Luca Giori, Silke Hecht, Rebecca Rifkin, Peter Sojka, and Deepak Sumbria. Student presentations were scored based on their performance. The winners of Research Day are highlighted below.

2020 UTCVM Research Day Awards - Presentation Award Winners

Graduate Student Category

1st Place – Dr. Ashley Reeves Wilmoth, Comparative & Experimental Medicine

Presentation: Assisted Reproductive Techniques in Free-Ranging Ocelot and Bobcat Populations in South Texas

Mentor: Dr. Debra Miller

Travel award: $500.00

(Left) Ultra-rapid freezing (URF) technique of semen pellets over liquid nitrogen. (Upper right) Assessment of motility of spermatozoa under phase contrast microscopy. (Lower Right) Ultrasonography of a female ocelot under the influence of anesthetic compounds for determination of pregnancy status.
2nd Place – Dr. Anastasia Towe, Comparative & Experimental Medicine
*Presentation:* Batrachochytrium salamandrivorans lesions in larval Northern two-lined salamanders (*Eurycea bislineata*)
*Mentors:* Drs. Debra Miller and Matthew Gray
*Travel award:* $300.00

3rd Place – Dr. Jane Woodrow, Comparative & Experimental Medicine
*Presentation:* Analysis of Bronchoalveolar Lavage Reveals Mast Cell Chymase Dysregulation and IFN-gamma as Possible Indicators of Equine Asthma Categories
*Mentors:* Drs. Barry Rouse and Elizabeth Lennon
*Travel award:* $200.00

**Veterinary Student Category**

1st Place – Blake Andrews, Class of 2022
*Presentation:* Symmetric dimethylarginine (SDMA) in captive tigers (*Panthera tigris*)
*Mentors:* Drs. Andrew Cushing and Mee-Ja Sula
*Travel award:* $500.00

2nd Place – Emily Kent, Class of 2023
*Presentation:* Control of *Salmonella* Dublin in a Dairy Herd
*Mentors:* Drs. Andrea Lear and Chika Okafor
*Travel award:* $300.00

3rd Place – Allison Andrews, Class of 2023
*Presentation:* Epidemiology of Bovine Anaplasmosis in TN Cattle
*Mentors:* Drs. Brian Whitlock and Chika Okafor
*Travel award:* $200.00

**Phi Zeta Award for Excellence in Animal Health Research**

Kassandra Downing, Class of 2022
*Presentation:* Effects of local gentamicin delivery on tissue-implant interfaces
*Mentor:* Dr. David Anderson
*Cash award:* $250.00
Dissemination of Research

Center of Excellence faculty are strongly encouraged faculty to disseminate their research discoveries through publications, presentations at scientific meetings, presentations of posters, and participation in scientific meetings. A complete list of faculty publications and presentations is included in this annual report for the calendar year 2019. The thirteen funded faculty members of the Center of Excellence had a total of sixty-three publications. Fifty-nine of these publications were peer-reviewed scientific articles, and four of these publications were book chapters. In addition to these published works, Center of Excellence faculty were represented in 105 presentations including oral presentations, abstracts, and posters. Presentations occurred locally, and at the state, national, and international levels. Above, you will see a world map indicating the locations of meetings at which faculty presented their work. In addition to these scholarly works, three invention disclosures were filed with the University of Tennessee Research Foundation in 2019, and one patent was filed for an invention designed to improve the precision and efficiency of end-to-end intestinal anastomosis.
Popular Press and Media

Faculty receiving support from the Center of Excellence in Livestock Diseases and Human Health participate in a wide range of outreach and education activities. Many of these activities involve presentation of research to professional audiences at scientific and continuing education meetings. In addition to faculty speaking engagements, the UTCVM issues press releases to state, regional, and national media on a regular basis, resulting in numerous television, radio, and print features. These are effective means by which activities related to research conducted through the Center of Excellence are communicated to stakeholders and the public at large.

A premier example of community engagement is the recurring, biweekly television spot, Channel 10’s “Live at Five at Four” news show, on local NBC affiliate WBIR. The college also manages a Facebook page, VOLVet Connect alumni e-newsletter, and VOLVet News, a quarterly newsletter for referring veterinarians. Facebook page administrators post clinical and research information for users. As of October 2020, the UTCVM Facebook page had 13,130 “likes” from individuals. Also, an alumni Facebook page maintains connectedness with UTCVM alumni and this page has 1,400 “likes” as of October 2020. Furthermore, a farm animal and equine hospital page generated 2,022 “likes,” and the Equine Performance and Rehabilitation Center resulted in 1,248 “likes” during the same time period. VOLVet Connect contains items of note aimed at DVM alumni, including UTCVM research news, continuing education, network opportunities, and a Comparative and Experimental Medicine graduate student research focus feature. UTCVM is active on Twitter (4,465 followers), has a YouTube channel with 903 subscribers, and has a Pinterest presence with 5,100 monthly viewers. The college’s Instagram account has 2,112 followers. VOLVet Vision is a yearly magazine that explores the research, teaching, and outreach services of UTCVM. This year, the magazine highlighted the Class of 1979 and forty years of graduating veterinarians in Tennessee. The issue also covered the college’s simulation program, global outreach programs, as well as some of the changes in delivering education due to COVID-19.

In May, Dr. Michael Jones was featured in “Eagle Power,” a documentary about eagles that aired on NOVA, the most-watched prime time science series on American television, reaching an average of five million viewers weekly.

In these ways, the faculty representing the Center of Excellence in Livestock Diseases and Human Health can communicate newly discovered knowledge, promote research and education, and guide application of these discoveries.

[External link: https://www.pbs.org/wgbh/nova/video/eagle-power/]
Summer Student Research

In efforts to foster interest in biomedical research careers and enhance appreciation for scientific investigation, inquiry, and the acquisition of new knowledge, the Center once again provided opportunities for veterinary students to conduct research at UTCVM.

Twenty-one students participated in laboratory and field research and attended weekly professional development seminars, during which guest speakers addressed topics such as career opportunities in research, compliance issues in laboratory animal care, data visualization, science writing, scientific presentations, and the grant proposal process. Near the end of the ten-week program, the students presented their research findings to their colleagues and to UTCVM faculty and staff. Three students presented at the 2020 National Veterinary Student Symposium.

The Center fully funded nineteen student stipends for the Summer Student Research Program. A grant from Boehringer Ingelheim funded two students (Courtney Marquette and Kassandra Downing). Dr. Stephen Kania, a Center faculty member, coordinated the program alongside Dr. Linda Frank. Eleven UTCVM veterinary students who gained research experience in the summer program are currently enrolled in the college’s DVM/PhD program.

To maximize student opportunities, the program is open to both Center and non-Center faculty. During FY20, five Center faculty members participated in the program. The Center continues to encourage the participation of its faculty in mentoring DVM students.

Kassandra Downing, UTCVM Class of 2022, working on her summer project, Effects of local gentamicin delivery on tissue-implant interfaces. Kassandra was awarded the Phi Zeta Award for Excellence in Animal Health Research based on this work.
<table>
<thead>
<tr>
<th>Name</th>
<th>Location, Year</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Allie Andrews**   | White House, TN, 2nd year | BS in Agriculture from Austin Peay State University  
Faculty Mentors: Dr. Chika Okafor, & Dr. Brian Whitlock  
Summer Project: Determining the Seroprevalence of Bovine Anaplasmosis in TN Cattle  
Career Interests: Mixed animal general practice |
| **Blake Andrews**   | Spring Hill, TN, 3rd year | BS in Agriculture from the University of Georgia  
Faculty Mentors: Dr. Andrew Cushing, & Dr. Mee-Ja Sula  
Summer Project: Symmetric dimethylarginine (SDMA) in captive tigers  
Career Interests: Anatomic pathology; academia |
| **Samantha Barbero**| Massapequa Park, NY, 2nd year | BS in Marketing from Long Island University  
Faculty Mentors: Dr. Silke Hecht, & Dr. Connie Fazio  
Summer Project: Investigation of Nasal Lesions resulting in Cribriform Plate Destruction  
Career Interests: Radiology |
| **Kelsey Carrier**  | Louisville, KY, 2nd year | BS in Biology and Biochemistry minor from Bellamine University  
Faculty Mentors: Dr. Melissa Kennedy, Dr. Debra Miller, Dr. Ashley Reeves, & Niloofar Khajeh Kazerooni  
Summer Project: General health monitoring and disease surveillance of free ranging bobcat (Lynx rufus) and ocelot (Leopardus pardalis)  
Career Interests: Exotic animal medicine |
| **Alec Daniels**    | Rockwood, TN, 3rd year | BS in Biological Sciences from the University of Georgia  
Faculty Mentor: Dr. Pierre-Yves Mulon  
Summer Project: Mechanical study of suture material and the effects of surgeon fatigue  
Career Interests: Small Animal medicine, pathology |
| **Kassandra Downing**| Yucaipa, CA, 3rd year | BS in Biology from Augusta University  
Faculty Mentors: Dr. David Anderson, Dr. Madhu Dhar, & Dr. Lori Cole  
Summer Project: Effects of local gentamicin delivery on tissue-implant interfaces  
Career Interests: Laboratory animal medicine |
| **Erin Duble**      | Chattanooga, TN, 3rd year | BS in Biology from Grove City College  
Faculty Mentor: Dr. Liza Köster  
Summer Project: Usefulness of pulmonary arterial end-diastolic forward flow (EDFF) in predicting right ventricle remodeling in precapillary pulmonary hypertension and pulmonic stenosis in dogs  
Career Interests: Small animal emergency and critical care |
| **Hannah Durick**   | Franklin, TN, 3rd year | BS in Anthropology from the University of Tennessee  
BA in International Development from the University of Tennessee  
MS in Biogeography from Texas A&M University  
Faculty Mentors: Dr. Melissa Kennedy, & Dr. Becky Trout Fryxell  
Summer Project: First steps to understanding the epidemiology of ticks and tick-borne agents in northwestern Zimbabwe  
Career Interests: Residency in Zoological Medicine |
| **Emma Ellis**      | Harriman, TN, 2nd year | BS in Animal Science from the University of Tennessee  
BA in Theology/Philosophy from Hardin-Simmons University  
Faculty Mentor: Dr. Cassie Lux  
Summer Project: Looking Back - A Summer of Retrospective Studies: “Comparison of outcome between cystoscopic-assisted cystotomy & open cystotomy” and “Evaluating infectious complications of total ear canal ablation”  
Career Interests: Small animal medicine |
Chandler Hawk  
Friendsville, TN | 2nd year  
BS in Marketing with collateral in Entrepreneurship from the University of Tennessee  
**Faculty Mentor:** Dr. Elizabeth Collar  
**Summer Project:** Investigation of Lumbosacral Bone Density in Quarter Horses  
**Career Interests:** Mixed animal general practice or small animal emergency and critical care

Emily Kent  
Parma, OH | 2nd year  
BS in Animal Science and Biology from the University of Findlay  
**Faculty Mentors:** Dr. Andrea Lear, & Dr. Chika Okafor  
**Summer Project:** Control of Salmonella Dublin in a Dairy Herd  
**Career Interests:** Zoological/exotic animal medicine

Brian LaMendola  
Jacksonville, FL | 3rd year  
BS in Zoology from the University of Florida  
**Faculty Mentor:** Dr. Rick Gerhold  
**Summer Project:** A Retrospective Study on Elk Morbidity and Mortality in Tennessee  
**Career Interests:** Veterinary pathology

Zachary Lembersky  
Knoxville, TN | 2nd year  
BS in Neuroscience and Behavioral Biology from Emory University  
**Faculty Mentor:** Dr. Adrien-Maxence Hespel  
**Summer Project:** Development of a Novel Objective Assessment for Sacro-Iliac Luxation on Radiograph  
**Career Interests:** Surgical residency

Courtney Marquette  
Cleveland, OH | 2nd year  
BS in Biology from the University of South Carolina  
**Faculty Mentor:** Dr. Debra Miller  
**Summer Project:** Investigating the impact of climate change on leatherback sea turtle hatching development  
**Career Interests:** Small animal and wildlife medicine

Nicholas Millis  
Knoxville, TN | 2nd year  
BS in Biochemistry Cellular and Molecular Biology from the University of Tennessee  
**Faculty Mentor:** Dr. Agricola Odoi  
**Summer Project:** Patterns and predictors of antimicrobial and multidrug resistance among *Staphylococcus* ssp. isolated from canine specimens submitted to UTCVM  
**Career Interests:** Veterinary surgery or emergency and critical care

Mary-Ables Ray  
Jonesborough, TN | 3rd year  
BS in Biology from Georgetown College  
**Faculty Mentor:** Dr. Phil Jones  
**Summer Project:** Effect of adding dexmedetomidine to bupivacaine solution on the duration of nerve blocks in horses  
**Career Interests:** Equine private practice internship; ambulatory equine practitioner

Leann Shaw  
Norco, CA | 3rd year  
BS in Biology from the University of Tennessee Riverside  
MS in Veterinary Biomedical Science from Lincoln Memorial University  
**Faculty Mentor:** Dr. Darryl Millis  
**Summer Project:** Effect of Therapeutic Taping on Gait and Selected Exercises in Dogs  
**Career Interests:** Small animal surgery; orthopedic surgery

Sayge Smith  
Knoxville, TN | 3rd year  
BS in Animal Science from the University of Tennessee  
**Faculty Mentor:** Dr. Stephanie Kleine  
**Summer Project:** Effects of Acepromazine and Butorphanol on Propofol Induction Dose in Dogs  
**Career Interests:** Avian and exotic companion mammal specialist
**Robert Stilz**  
**Signal Mountain, TN | 2nd year**  
**BS in Animal Science/Pre-veterinary Medicine from Berry College**  
**Faculty Mentor:** Dr. Marcy Souza  
**Summer Project:** Pharmacokinetics and Egg Residues of Oral Meloxicam in Bantam Cochin Chickens  
**Career Interests:** Veterinary public health, zoonotic disease, One Health

**Mary Winemiller**  
**Sarasota, FL | 2nd year**  
**BS in Biology from the University of South Florida**  
**Faculty Mentor:** Dr. Becky Trout Fryxell  
**Summer Project:** Reexamining the Ecology of the Most Prevalent Ticks in Eastern Tennessee via Surveillance of the Invasive Asian Longhorned Tick  
**Career Interests:** Wildlife medicine, research, public health, conservation medicine

**Bonnie Wakefield**  
**Fayetteville, TN | 2nd year**  
**BS in Biology from Sewanee: The University of the South**  
**Faculty Mentors:** Dr. Zennithson Ng, Dr. Julia Albright, & Dr. Liza Köster  
**Summer Project:** Effect of the veterinary visit on heart rate variability in dogs  
**Career Interests:** Rural general practice; mixed animal medicine

---

Leann Shaw, UTCVM Class of 2022, demonstrating skin marker placement on a German Shepherd utilized for three-dimensional motion capture to analyze kinematic gait alterations secondary to the application of kinesiology tape.
Three Minute Thesis

In April 2019, the final competition for the third annual University of Tennessee Three Minute Thesis (3MT) was held as a part of the University of Tennessee’s Graduate and Professional Student Appreciation Week with the twelve winners of the semi-final competitions. The competition challenges master’s and doctoral students to communicate their unique thesis or dissertation to an audience unfamiliar with the subject. Competitors have three minutes to explain their research using only one slide or photo. The College of Veterinary Medicine’s Comparative and Experimental Medicine program had two participants in the competition, and one became the overall winner!

**Overall Three Minute Thesis Winner**

**Caroline Billings-Ziemba**

DVM-PhD Candidate, College of Veterinary Medicine and CEM PhD program

*Presentation:* Bone Regeneration: The Future of Fracture Repair

*Advisor:* Dr. David Anderson

Caroline said after working internships in the medical device field, she knew she’d found her niche.

“You can use the skill sets of being a veterinarian and also a researcher to impact a huge patient population of both animals and humans.”

*An outstanding presentation was also delivered by:*  

**Rachael Wolters**

DVM-PhD candidate, College of Veterinary Medicine and CEM PhD program

*Presentation:* Epidemiological Analysis of Antimicrobial Resistance of Mastitis Cases in South African Dairy Herds

*Advisor:* Dr. Agricola Odoi

*Dr. Caroline Billings-Ziemba (right) with the other winners of the 3MT competition in April of 2019.*
Five-Year Benchmark Data

Scholarly productivity among COE faculty remains strong. Total publications, publications per faculty member, presentations nationally and internationally, and presentations per faculty member increased in calendar year 2019 compared to calendar year 2018. Faculty published fifty-nine peer-reviewed journal articles, four book chapters. Faculty also participated in and created 105 presentations, posters, and published abstracts.

Although the total number of grant awards received in FY20 decrease as compared to previous years, there was a significant increase in the total value of awards received. Grant proposals were most often made to federal and state agencies, with a smaller number of proposals being submitted to industries and foundations. Awards were most often secured from federal and state agencies, and fewer industry awards were secured. The external grant awards amounted to over $3.6 million in FY20, which is a significant increase compared to the past three years. Research expenditures declined slightly from the previous year, partly as a result of shutting down research laboratories in the last four months of FY20 as a result of the COVID-19 pandemic.

Center of Excellence faculty continue to be strongly engaged in the mentoring of graduate and professional students in research. The Summer Student Research Experience Program engaged twenty-one veterinary students in laboratory and field research projects. Faculty across multiple disciplines mentored students throughout the Summer Student Research Experience Program.

Research Funding by Source: FY16-FY20

<table>
<thead>
<tr>
<th></th>
<th>Federal/State</th>
<th>Industry</th>
<th>Internal</th>
<th>Foundation/Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY16</td>
<td>$3,652,672.00</td>
<td>$928,591.00</td>
<td>$17,200.00</td>
<td>$31,000.00</td>
</tr>
<tr>
<td>FY17</td>
<td>$575,610.00</td>
<td>$7,438.00</td>
<td>$-</td>
<td>$47,532.00</td>
</tr>
<tr>
<td>FY18</td>
<td>$1,199,153.00</td>
<td>$124,430.00</td>
<td>$546,430.00</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>FY19</td>
<td>$1,907,177.00</td>
<td>$37,766.00</td>
<td>$35,768.00</td>
<td>$47,082.00</td>
</tr>
<tr>
<td>FY20</td>
<td>$3,574,356.00</td>
<td>$57,876.00</td>
<td>$207,077.00</td>
<td>$-</td>
</tr>
</tbody>
</table>
Benchmark Summary

Despite the challenges experienced by Center of Excellence faculty during FY20, extramural funding success was strong relative to the total amount of funds awarded. During FY20, COE faculty submitted twenty-seven proposals and the number of successful awards totaled sixteen. The value of awards for FY20 from federal and state sources totaled $3,632,232. This represents a two- to three-fold increase in extramural awards funding as compared with FY19, FY18, and FY17. Data from FY20 is skewed because of a single large grant of approximately $2.6 million.

### Proposals and Awards FY20

<table>
<thead>
<tr>
<th>Source</th>
<th>Proposals COE Faculty</th>
<th>Awards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal/State</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Industry</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Foundation</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Internal</td>
<td>14</td>
<td>8</td>
</tr>
</tbody>
</table>

### Awards FY16-20

<table>
<thead>
<tr>
<th>Year</th>
<th>Federal/State</th>
<th>Industry</th>
<th>Internal</th>
<th>Foundation/Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY20</td>
<td>$3,574,356.00</td>
<td>$57,876.00</td>
<td>$207,077.00</td>
<td>$-</td>
</tr>
<tr>
<td>FY19</td>
<td>$1,907,177.00</td>
<td>$37,766.00</td>
<td>$35,768.00</td>
<td>$47,082.00</td>
</tr>
<tr>
<td>FY18</td>
<td>$1,199,153.00</td>
<td>$124,430.00</td>
<td>$546,430.00</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>FY17</td>
<td>$575,610.00</td>
<td>$7,438.00</td>
<td>$-</td>
<td>$47,532.00</td>
</tr>
<tr>
<td>FY16</td>
<td>$3,652,672.00</td>
<td>$928,591.00</td>
<td>$17,200.00</td>
<td>$31,000.00</td>
</tr>
</tbody>
</table>
Future Plans: Looking Forward

The Center of Excellence in Livestock Diseases and Human Health (COE) continues to invest in its faculty, students, research, and infrastructure to support its mission. The Center faculty are dedicated to the continued development of interdisciplinary and multidisciplinary activities designed to promote the quality of human and animal life, expand research capacities for livestock research, explore commonalities between animal diseases and human diseases that have mutual benefit for the advancement of both, and develop new strategies for the diagnosis, treatment, and prevention of disease. Two important programs established at the university exemplify the Center’s mission: the Genomics Center for the Advancement of Agriculture and the One Health Initiative.

FY20 was a year of transition and turbulence for the COE. The COVID-19 pandemic resulted in significant limitations in graduate education and research. Many laboratories shut down completely for more than four months. Although some laboratory groups continued to work, research efforts were significantly curtailed, which led to significant reductions in research expenditures during the fiscal year. The effect of the pandemic on research activities continues to be felt in FY21. Most laboratories and research groups have returned to work under restrictions of the COVID-19 disease prevention strategies. Also, FY20 included multiple retirements and relocations of research faculty, as well as multiple protracted faculty searches in core areas of research for the COE. Several new research-oriented faculty have been hired with great expectations for increasing extramural-supported research, training of graduate students and veterinary students, scholarly activities, and the graduate curriculum and programs. These faculty will have key roles in dissemination of new knowledge to stakeholders including scientists, practitioners, producers, and the public.

New faculty hires support the growing areas of focus in the COE including infectious disease and immunology and regenerative and rehabilitation medicine. Dr. Elizabeth Collar is a new research faculty member whose focus is musculoskeletal disorders. Her expertise is complementary to the regenerative and rehabilitation medicine focus. Drs. Sreekmari Rajeev and Michelle Dennis are newly hired research faculty with expertise in infectious disease and pathologic basis of disease. Dr. Rajeev will focus her research on leptospirosis, a debilitating and potentially fatal bacterial disease of people and animals. Dr. Dennis’s present research involves aquatic wildlife focusing on species of ecological and economic importance. These faculty members support the growing strength in the COE’s focus in infectious disease and immunology. In January 2021, Dr. Neelakanta and Dr. Sultana will join the college as infectious disease experts. These faculty are well-established and will immediately begin work on current R01 awards from NIH in the areas of vector-borne disease. An additional search is ongoing for an infectious disease virologist and immunologist. These faculty bring great strengths to the COE, and it is our expectation that grant submissions, grant awards, and research expenditures will significantly increase in FY21.

During FY20, the COE worked collaboratively with AgResearch to secure a contract with Hanover Research. Hanover specializes in assisting faculty in identifying grant mechanisms that are most likely to advance their work. This organization also aids researchers in refining the structure of their grants to maximize their competitiveness for awards. This initial year of the contract was successful in assisting multiple faculty, and the contract has been extended for another year. Several faculty have already requested support from Hanover in the development of their federal grant proposals.
FACULTY RESEARCH SUMMARIES
Dr. David Anderson

PROFESSOR, ASSOCIATE DEAN FOR RESEARCH & GRADUATE STUDIES
UTCVM RESEARCH ADMINISTRATION AND LARGE ANIMAL CLINICAL SCIENCES

About Dr. Anderson

MS
Kansas State University

DVM
North Carolina State University

Supported by:
Department of Defense, National Institutes of Health, National Science Foundation, Food & Drug Administration, & the Center of Excellence

Collaborators:
Drs. Madhu Dhar, Dustin Crouch, Pierre-Yves Mulon, Stephen Kanla, Silke Hecht, & Sherry Cox

Collaborators:
Rebecca Rifkin, Remi Grzeškowiak, Alisha Pedersen, & Caroline Billings-Ziema

Publications:
9 in 2019

Book Chapters:
1 in 2019

Presentations:
20 in 2019

Invention Disclosures:
3 in 2019

Patents Filed:
1 in 2019

COE SEED FUND RESEARCH:
Determination of the mechanisms associated with Staphylococcus aureus isolated from cases of hypertrophic osteomyelitis

Dr. Anderson’s research focuses around tissue regeneration and the use of regenerative technologies to restore form and function to injured structures in the body. To advance this work, he worked with a large team of collaborators to discover new knowledge, mentor graduate students and early career faculty, and disseminate that knowledge via publications and presentations. Dr. Anderson has had a long collaborative relationship with the Center for Integrative Nanotechnology Sciences at the University of Arkansas at Little Rock, which is under the direction of Dr. Alexandru Biris. This collaboration has resulted in successful awards from the Department of Defense through the Army military research programs. In 2019, collaborators received two federal grants worth over $6 million to advance bone regeneration technology. In recent years, a new collaboration with Dr. Dustin Crouch, biomedical engineer in the College of Engineering at the University of Tennessee, is focusing on restoring injured warriors and citizens who have suffered amputations to a more normal function and quality of life. A common complication in clinical patients is infection, and Dr. Anderson’s team received a Center of Excellence grant in 2019 to study the mechanisms associated with osteomyelitis associated with Staphylococcus aureus. Specifically, this grant is designed to conduct a genomic analysis of Staphylococcus aureus and explore the mechanisms by which this bacteria gains entry into bone cells and causes changes in cell function. Dr. Anderson’s work is translational in nature and works with animals to improve the health and well-being of people.
Dr. Marc Caldwell
ASSOCIATE PROFESSOR
UTCVM LARGE ANIMAL CLINICAL SCIENCES

Dr. Caldwell’s research focuses on immunology and infectious disease of livestock and the potential use of these species for translational research to humans. In his current COE research, Dr. Caldwell and his team proposed studying the effect of ethyl pyruvate on inflammatory responses and white blood cell function in neonatal calves. Bacterial infections of the bloodstream, and especially toxins being spread systematically through the bloodstream, are important causes of inflammatory response syndrome, which is often associated with multiple organ failure in humans and animals. This research hopes to discover a new treatment for the control of overwhelming inflammatory responses to these bacterial toxins. Ethyl pyruvate is a small-molecule inhibitor that might be useful in the treatment of systemic inflammatory disease. Ethyl pyruvate may work through the inhibition of transcriptional regulators of the inflammatory response. This has the potential to significantly advance the field of immunology, infectious disease, and inflammatory disorders.
Dr. Dia's research focus includes evaluation of health-promoting properties of food constituents, utilizing food processing coproducts as sources of novel food ingredients, and determining the mechanisms by which bioactive peptides and phenolics prevent and manage diseases. His current COE funded research is focused on finding a treatment for inflammatory bowel disease. Inflammatory bowel disease is extremely common in humans and animals, and Dr. Dia’s team proposed to study a bioactive peptide, Lunasin. Inflammatory bowel disease in people in the United States results in over two million physician visits, nearly 200,000 hospitalizations, and over $30 billion in annual healthcare costs. Lunacin is a peptide, isolated from soybeans, that has been proposed to have some type of anti-inflammatory property.
Dr. Stephen Kania
PROFESSOR, ASSISTANT DEAN FOR RESEARCH & GRADUATE STUDIES
UTCVM RESEARCH ADMINISTRATION AND BIOMEDICAL AND DIAGNOSTIC SCIENCES

Dr. Kania’s research focuses on genetic characterization, antimicrobial resistance, and methods to treat and prevent staphylococcal infections. His research occupies a niche at the interface between immunology, molecular microbiology, and bacteriology. The approaches used by his research group include genome sequencing, transcriptome analysis, mass spectrometry analysis, identification of bacterial proteins involved in immune dysfunction, and production of attenuated recombinant virulence proteins using synthetic genes. Protein function is determined using recombinant proteins, phenotypic assays, and attenuated recombinant proteins. This work has culminated with a six-component vaccine for *Staphylococcus pseudintermedius*, which is currently in a clinical trial. The goal of his present research is to develop a chimeric protein composed of important components of all six proteins to create a more cost-efficient vaccine for dogs. This research will also help serve as a model for human vaccines.

**COE SEED FUND RESEARCH:**
Chimeric Attenuated Virulence Factor Vaccine for *Staphylococcus pseudintermedius* Canine Pyoderma

**About Dr. Kania**

- **MS**
  Washington State University
- **PhD**
  University of Florida
- **Supported by:**
  American Kennel Club
  Canine Health Foundation,
  Boehringer-Ingelheim, &
  the Center of Excellence
- **Collaborators:**
  Drs. Marc Caldwell
  & Chika Okafor
- **Publications:**
  14 in 2019
- **Presentations:**
  3 in 2019
- **Honors in 2019:**
  Zoetis Award for Veterinary Research Excellence
Dr. Andrea Lear
ASSISTANT PROFESSOR
UTCVM LARGE ANIMAL CLINICAL SCIENCES

About Dr. Lear

PhD
University of Tennessee

MS
Colorado State University

DVM
Auburn University

Supported by:
United States Department of Agriculture, National Institute of Food and Agriculture, & the Center of Excellence

Presentations:
12 in 2019

Honors in 2019:
Zoetis Distinguished Veterinary Teacher Award
Large Animal Clinician of the Year
University of Tennessee College of Veterinary Medicine
Charles and Julie K. Wharton Faculty Development Award

COE SEED FUND RESEARCH:
Viral Trojan Horse: Does exosome formation mediate BVDV transmission to susceptible cells?

Dr. Lear’s research focuses on understanding the impact of viral infection and inflammation during times of pregnancy. This includes alteration of maternal-fetal interactions, placental immunology, and neonatal outcomes such as epigenetics. Dr. Lear utilizes pregnant ruminants models to understand these effects for both livestock and human health and well-being.
Dr. Chika Okafor
ASSISTANT PROFESSOR
UTCVM BIOMEDICAL AND DIAGNOSTIC SCIENCES

Dr. Okafor’s research focuses on the use of antimicrobials in animals and concerns regarding development of antimicrobial drug resistance by microorganisms. Many Tennessee cattle producers believe the FDA’s Veterinary Feed Directive might lead to the overuse of injectable antimicrobials in animals and increased antibiotic residues in animal products. This overuse may lead to development of antimicrobial resistance in bacteria and increase risk of exposure in consumers. The prevalence of antibiotic residues in foods of animal origin and the effects of consumer cooking on antibiotic residues are unknown. Anecdotally, cattle producers believe products sold at farmers’ markets are more likely to contain antibiotic residues due to minimal regulatory oversight. This research will determine the safety of animal products from farmers’ markets and the effects of consumer food preparation on antibiotic residues.
Diagnosis of bovine respiratory disease (BRD) in cattle is largely based upon visual observation of clinical signs. Recognition of developing disease early on in the course of the disease will allow for timely treatment, less reliance on antibiotics, and optimum recovery rates. Biosensors can be used to record activity and location of cattle, and based upon these data, early disease detection is possible. Dr. Schneider’s current research aims to monitor behavioral changes in stocker calves associated with BRD using a novel biosensor collar. Also, the research studies monitor the nasopharyngeal microbiome for illness associations. Accelerometer and global positioning system data is collected from stocker cattle on a commercial operation in Tennessee. Biomarkers and nasopharyngeal samples are collected periodically throughout the study to determine correlations between behavior and physiological parameters. Development of novel techniques for earlier BRD diagnosis aid the beef industry through improved clinical outcomes and antimicrobial stewardship.
Advancing Bladder Cancer Treatment

Urothelial carcinoma, also known as bladder cancer, accounts for more than ninety percent of urinary bladder cancer cases. The incidence of these cancers has been increasing for the past ten years in the US, reaching 80,470 new cases and an estimated 17,670 deaths in 2019. Conventional surgical treatment, chemotherapy, and immunotherapy are effective short-term treatments, but more than 50% of bladder cases recur and progress to life-threatening, advanced muscle-invasive cancer. Dr. Wang has developed a new approach using a combination drug regimen for control of metastasis of these cancer cells; he is currently testing the approach. Using a triple combination of the FDA-approved anticancer agents (gemcitabine, romidepsin, and cisplatin) may be effective in controlling bladder cancer cells. He hopes to demonstrate the efficacy of this rationalized Gem+Rom+Cis regimen in the control of Urothelial carcinoma metastasis in vivo using mouse models of bladder cancer.
PUBLICATIONS AND PRESENTATIONS
Dr. Jonathan Abbott

PUBLICATIONS


BOOKS & BOOK CHAPTERS


PRESENTATIONS


Management of Canine Heat Failure - Feline Cardiomyopathies: An Update, Dec 3, 2019, UTCVM Henton Veterinary Conference, Knoxville, TN.

Dr. David Anderson

PUBLICATIONS


BOOKS & BOOK CHAPTERS

PRESENTATIONS

C-section in small ruminants under field conditions. UTCVM VPAC July 2019.


Laura Freeman, Pierre-Yves Mulon, Remigiusz Grześkowiak, Alisha Pedersen, Rachel Clark, David Anderson. Comparison of acute load to failure testing of goat femoral neck fractures, ex vivo, repaired using 4.0-mm solid, cannulated, or enhanced cannulated cancellous bone screws. CEM Research Day, UTCVM, Knoxville, TN. Sept. 30, 2019. 3rd Place Award veterinary student category. https://vetmed.tennessee.edu/research/Pages/CEM_Research_Symposium.aspx.

Remigiusz M. Grześkowiak, Rebecca E. Rifkin, Bailey Jackson, Pierre-Yves Mulon, Austin J. Bow, Reza Seddighi, Thomas Doherty, Silke Hecht, Shaun E. Bourdo, Madhu S. Dhar, H. Steve Adair, Alexandru S. Biris, David E. Anderson. Assessment of a 3D Hydrophilic Polyurethane Scaffold containing nano-HA and bone particles, with or without BMP2 or mesenchymal stem cells, on Bone Regeneration and Neovascularization of massive (> 5cm) segmental defects. CEM Research Day, UTCVM, Knoxville, TN. Sept. 30, 2019. 1st Place Award graduate student category.

Steven D. Newby, Christopher Forsyth, David Anderson and Madhu Dhar. 3D printed Low Oxygen Graphene- Poly Lactic-co-Glycolic Acid (PLGA) nanoengineered scaffold will create an environment suitable for mesenchymal stem cell proliferation and differentiation for osteogenesis and angiogenesis for orthopedic repair. CEM Research Day, UTCVM, Knoxville, TN. Sept. 30, 2019.


INVENTION DISCLOSURES

Electrospun Poly-caprolactone Neuralwrap Surface Coated with Graphene Oxide. Steiner, Anderson, Harper
Novel Delivery System for Topical Treatment. K. Tobias
Development of a Serological Assay to Detect Parelaphostrongylus Tenius Infection in Animals Gerhold, Kania, Richards.

PATENTS/PATENT APPLICATIONS

Biodegradable Intraluminal Small Intestinal Anastomotic Guide. Filed 7/12/19.

Dr. Marc Caldwell

PUBLICATIONS


BOOKS & BOOK CHAPTERS


PRESENTATIONS


Dr. Vermont Punongba Dia

PUBLICATIONS


PRESENTATIONS


Outstanding Undergraduate Research Mentoring Award, Herbert College of Agriculture The University of Tennessee, Knoxville, 59th Annual Awards Recognition Program and Reception, April 3, 2019.

Dr. Alejandro Esteller-Vico

PUBLICATIONS


PRESENTATIONS

Bluegrass Equine Reproduction Symposium. Lexington KY; October 24-25 2019; Interpretation of progestin and estrogen measurements in cyclic and pregnant mares.

Dr. Stephen Kania

PUBLICATIONS

Dehghanpir, Shannon; Bemis, David; Kania, Stephen; Sakaguchi, Kanako; Langohr, Ingeborg; Gaunt, Stephen; Grooters, Amy; Pucheu-Haston, Cherie “What is Your Diagnosis? Dermal Nodules in a Dog”. Veterinary Clinical Pathology 2019;1–3. DOI: 10.1111/vcp.12723n.


Michael McEntire, Edward C. Ramsay, Stephen Kania, Peter Prestia, Eman Anis, Andrew Cushing, and Rebecca P. Wilkes. Tiger (panthera tigris) and domestic cat (felis catus) immune responses to canarypox-vectored canine distemper vaccination. (Accepted and in press).


Raizer, Nicola; Gedon, Natalie; Kania, Stephen; Kuehnle, Harald; Kuehnle, Christoph; Mueller, Ralf. Effect of an essential fatty acid spot-on on the prevention and treatment of equine pastern dermatitis. Veterinary Dermatology. (Submitted).

Brittany A. Coppinger, Stephen Kania, Jeffrey R. Lucas, Kathryn E. Sieving, Todd M. Freeberg. Experimental manipulation of mixed-species flocks reveals heterospecific audience effects on calling. (Submitted to Behavior).


Vincent Perreten, Stephen A. Kania and David Bemis. Staphylococcus ursi sp. nov., a new member of the ‘Staphylococcus intermedius Group’ isolated from healthy black bears.

PRESENTATIONS


HONORS

2019 Zoetis Award for Veterinary Research Excellence. University of Tennessee College of Veterinary Medicine, September 24, 2019.

Dr. Stephanie Kleine

PUBLICATIONS


PRESENTATIONS

Klein, Stephanie. Correlation of synovial fluid leptin with body condition scores in the healthy and osteoarthritis canine stifle. Presented at: Orthopedic Research Society Conference; Feb 2-5, 2019; Austin, TX.
**Dr. Andrea Lear**

**PRESENTATIONS**


Wright M, Needleman A, Schaffer J, Videla R, Lear AS (2019). “Clinical trial to determine efficacy of copper oxide wire particle administration to decrease gastrointestinal nematode concentrations in adult alpacas.” Conference of Research Workers in Animal Diseases, Chicago IL. “Winner of Best Student Presentation, awarded by Veterinary Parasitologists”.


**HONORS**

2019 Zoetis Distinguished Veterinary Teacher Award. University of Tennessee College of Veterinary Medicine, July 30, 2019.

2019 Large Animal Clinician of the Year. University of Tennessee College of Veterinary Medicine, May 10, 2019.

2019 Charles and Julie K. Wharton Faculty Development Award.

**Dr. Denae LoBato**

**PUBLICATIONS**


**PRESENTATIONS**

Translating the Liberal Arts to a Career in Science. Pathology, Research, and Teaching: A Romance. Invited talk given to the undergraduate students at Hollins University, Roanoke, VA. March 2019.

Dr. Chika Okafor

PUBLICATIONS


PRESENTATIONS


Okafor, C.C. (2019). Antibiotic use in food animals and deceptive labelling practices. An invited lecture by Jiah Toms to the employees of UT Institute of Public Services at 1610 University Ave, Knoxville, TN 37921 on September 18. (In addition to employees in attendance, others zoomed from across the state).

Okafor, C.C. (2019). Antibiotic use in food animals and effects on One Health. An invited lecture by the Department Head/ Director of Public Health at UT, Dr. Kathy Brown, to the graduate students in the Public Health Program at the UT Health and Physical Education and Recreation Building on January 24. (A total of 30 students attended).


AAVMC workshop of instructors teaching Antimicrobial Resistance topics to veterinary students with the objective of improving subject contents and delivery] Workshop at AAVMC headquarters in Washington, DC 20005 on June 13, 2019.

[Kansas State University-sponsored invitation to the K-State annual symposium on Anaplasmosis due to my numerous works on the disease. In the symposium, we explored areas on inter-institutional collaborations] Symposium at Hilton Garden Inn Manhattan KS, May 20, 2019.

[An American Association of Veterinary Medical Colleges (AAVMC) and Association of Public and Land-grant Universities (APLU) summit on Gene Editing in Livestock: Looking to the Future for academic researchers actively working in the area of gene editing of livestock to describe the current state of the science and consider ways to provide science-based evidence that will impact public policy development, including perspectives on safety considerations for human consumption and the impact that applying such technology will have on the future of food security] Summit at AAVMC headquarters in Washington, DC 20005 September 24-25, 2019.
Dr. Barry Rouse

PUBLICATIONS


PRESENTATIONS

Invited Seminar. Georgia State University. 16 April 2019.
Invited Seminar. Emory University. Atlanta, Georgia. 28 February 2019.

Dr. Leisel Schneider

PUBLICATIONS


PRESENTATIONS

Published Abstracts (* indicates presenting author, † indicates student under supervision of Schneider)


Dr. Hwa-Chain Robert Wang

PUBLICATIONS


**Presentations**


Hwa-Chain R. Wang. Invited Speaker: Writing a Scientific Manuscript; fully sponsored by Guangdong Ocean University, China; 12/1/2019.


Hwa-Chain R. Wang. Invited Speaker: Writing a Scientific Manuscript; sponsored by Sichuan Agricultural University, China; 12/13/2019.

## Research Funded Externally

<table>
<thead>
<tr>
<th>Lead Investigator</th>
<th>Proposal Title</th>
<th>Sponsor</th>
<th>Amount Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. David Anderson</td>
<td>CAREER: Muscle-Driven Endoprostheses for Restoring Natural Sensorimotor Function</td>
<td>US - NSF - National Science Foundation</td>
<td>$25,935.00</td>
</tr>
<tr>
<td></td>
<td>Advanced Development and Validation of a Nanomaterial-Based Scaffold for Simultaneous Bone Regeneration and Antimicrobial Drug Delivery</td>
<td>Department of Defense, Army PRORP sub-award from University of Arkansas</td>
<td>$249,496.00</td>
</tr>
<tr>
<td></td>
<td>Advanced Development and Testing of a Nanomaterial-Based Scaffold for Bone Regeneration and Drug Delivery</td>
<td>Department of Defense, Army JMRP sub-award from University of Arkansas</td>
<td>$2,666,465.00</td>
</tr>
<tr>
<td>Dr. Stephen Kania</td>
<td>Evaluation of a Therapeutic Vaccine for the treatment of Methicillin Resistant <em>Staphylococcus Pyoderma</em> in Dogs</td>
<td>Boehringer Ingelheim Animal Health USA Inc.</td>
<td>$42,000.00</td>
</tr>
<tr>
<td></td>
<td>2020 Boehringer Ingelheim Veterinary Scholars Program (BIVSP)</td>
<td>Boehringer Ingelheim Animal Health USA Inc.</td>
<td>$15,876.00</td>
</tr>
<tr>
<td>Dr. Barry Rouse</td>
<td>Impact of metabolic regulation on viral neuro-virulence</td>
<td>HHS - NIH - National Institutes of Health</td>
<td>$183,750.00</td>
</tr>
<tr>
<td></td>
<td>Mechanisms of Herpetic Keratitis</td>
<td>HHS - NIH - NEI - National Eye Institute</td>
<td>$44,872.00</td>
</tr>
<tr>
<td></td>
<td>Mechanisms of Herpetic Keratitis</td>
<td>HHS - NIH - NEI - National Eye Institute</td>
<td>$403,838.00</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>TOTAL</strong></td>
<td><strong>$3,632,232.00</strong></td>
</tr>
</tbody>
</table>


### Research Funded Internally

<table>
<thead>
<tr>
<th>Lead Investigator</th>
<th>Proposal Title</th>
<th>Amount Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. David Anderson</td>
<td>Determination of the mechanisms associated with <em>Staphylococcus aureus</em></td>
<td>$20,500</td>
</tr>
<tr>
<td></td>
<td>isolated from cases of hypertrophic osteomyelitis</td>
<td></td>
</tr>
<tr>
<td>Dr. Marc Caldwell</td>
<td>Effect of ethyl pyruvate on the inflammatory response and neutrophil</td>
<td>$29,995</td>
</tr>
<tr>
<td></td>
<td>function in neonatal calves</td>
<td></td>
</tr>
<tr>
<td>Dr. Vermont Punongba Dia</td>
<td>Management of colitis by lunasin-enriched material in mouse model</td>
<td>$26,780</td>
</tr>
<tr>
<td>Dr. Stephen Kania Dia</td>
<td>Chimeric Attenuated Virulence Factor Vaccine for <em>Staphylococcus</em></td>
<td>$15,000</td>
</tr>
<tr>
<td></td>
<td><em>pseudintermedius</em> Canine Pyoderma</td>
<td></td>
</tr>
<tr>
<td>Dr. Andrea Lear</td>
<td>Viral Trojan Horse: Does exosome formation mediate BVDV transmission to</td>
<td>$15,000</td>
</tr>
<tr>
<td></td>
<td>susceptible cells?</td>
<td></td>
</tr>
<tr>
<td>Dr. Chika Okafor</td>
<td>Prevalence of antibiotic residues in selected foods of animal origin at</td>
<td>$30,000</td>
</tr>
<tr>
<td></td>
<td>farmers’ markets in East Tennessee</td>
<td></td>
</tr>
<tr>
<td>Dr. Leisel Schneider</td>
<td>Implementation of a novel biosensor for early respiratory disease detection in</td>
<td>$30,000</td>
</tr>
<tr>
<td></td>
<td>beef stocker cattle</td>
<td></td>
</tr>
<tr>
<td>Dr. Hwa-Chain Robert Wang</td>
<td>A metastatic tumor animal model for anticancer therapeutics</td>
<td>$30,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>$197,275</td>
</tr>
</tbody>
</table>

2019 Regenerative and Rehabilitation Medicine team. Back row, left to right: Austin Bow, Steven Newby, David Anderson, Steve Adair. Middle row left to right: Monica Rawson, Remi Grześkowiak, Rebecca Rifkin, Tena Ursini. Bottom row left to right: Madhu Dhar, Elizabeth Croy, Richard Steiner.
Actual and Proposed Budget

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>FY20 Actual</th>
<th></th>
<th></th>
<th>FY21 Proposed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Matching</td>
<td>Appropr.</td>
<td>Total</td>
<td>Matching</td>
<td>Appropr.</td>
<td>Total</td>
</tr>
<tr>
<td>Expenditures</td>
<td>$136,133</td>
<td>$260,748</td>
<td>$396,881</td>
<td>$933,921</td>
<td>$1,867,842</td>
<td>$2,801,763</td>
</tr>
<tr>
<td>Salaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>$6,784</td>
<td>$13,568</td>
<td>$20,351</td>
<td>$95,117</td>
<td>$190,234</td>
<td>$285,351</td>
</tr>
<tr>
<td>Other Professional</td>
<td>$835</td>
<td>$1,669</td>
<td>$2,504</td>
<td>$835</td>
<td>$1,669</td>
<td>$2,504</td>
</tr>
<tr>
<td>Clerical/ Supporting</td>
<td>$23,429</td>
<td>$46,858</td>
<td>$70,287</td>
<td>$23,429</td>
<td>$46,858</td>
<td>$70,287</td>
</tr>
<tr>
<td>Assistantships</td>
<td>$1,517</td>
<td>$3,033</td>
<td>$4,550</td>
<td>$0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Total Salaries</td>
<td>$32,565</td>
<td>$65,128</td>
<td>$97,692</td>
<td>$119,381</td>
<td>$238,761</td>
<td>$358,142</td>
</tr>
<tr>
<td>Longevity (Excluded from Salaries)</td>
<td>$178</td>
<td>$355</td>
<td>$533</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fringe Benefits</td>
<td>$5,622</td>
<td>$11,244</td>
<td>$16,866</td>
<td>$23,922</td>
<td>$47,844</td>
<td>$71,766</td>
</tr>
<tr>
<td>Total Personnel</td>
<td>$38,365</td>
<td>$76,727</td>
<td>$115,091</td>
<td>$143,303</td>
<td>$286,605</td>
<td>$429,908</td>
</tr>
<tr>
<td>Non-Personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>$2,391</td>
<td>$4,781</td>
<td>$7,172</td>
<td>$2,391</td>
<td>$4,781</td>
<td>$7,172</td>
</tr>
<tr>
<td>Software</td>
<td>$153</td>
<td>$306</td>
<td>$459</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Books &amp; Journals</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other Supplies</td>
<td>$30,517</td>
<td>$61,034</td>
<td>$91,551</td>
<td>$85,017</td>
<td>$170,034</td>
<td>$255,051</td>
</tr>
<tr>
<td>Equipment</td>
<td>$23,611</td>
<td>$47,222</td>
<td>$70,833</td>
<td>$377,611</td>
<td>$755,222</td>
<td>$1,132,833</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$0</td>
<td>$0</td>
<td>-</td>
<td>$0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Scholarships</td>
<td>$7,081</td>
<td>$3,541</td>
<td>$10,622</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Consultants</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Renovation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>$166,667</td>
<td>$333,333</td>
<td>$500,000</td>
</tr>
<tr>
<td>Other (Specify):</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rentals/Entertainment</td>
<td>$599</td>
<td>$300</td>
<td>$899</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Printing/Publications/Postage</td>
<td>$2,236</td>
<td>$4,472</td>
<td>$6,708</td>
<td>$0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Professional Services/Memberships</td>
<td>$5,557</td>
<td>$11,113</td>
<td>$16,670</td>
<td>$0</td>
<td>$0</td>
<td>-</td>
</tr>
<tr>
<td>Contract &amp; Special Services</td>
<td>$25,600</td>
<td>$51,199</td>
<td>$76,799</td>
<td>$158,933</td>
<td>$317,866</td>
<td>$476,799</td>
</tr>
<tr>
<td>Gasoline &amp; Diesel</td>
<td>$26</td>
<td>$51</td>
<td>$77</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Non-Personnel</td>
<td>$97,771</td>
<td>$184,019</td>
<td>$281,790</td>
<td>$790,619</td>
<td>$1,581,236</td>
<td>$2,371,855</td>
</tr>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>$136,134</td>
<td>$260,747</td>
<td>$396,881</td>
<td>$933,922</td>
<td>$1,867,841</td>
<td>$2,801,763</td>
</tr>
</tbody>
</table>

Revenue

<table>
<thead>
<tr>
<th>Revenue</th>
<th>FY20 Actual</th>
<th></th>
<th></th>
<th>FY21 Proposed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New State Appropriation</td>
<td>-</td>
<td>$524,064</td>
<td>$524,064</td>
<td>-</td>
<td>$525,079</td>
<td>$525,079</td>
</tr>
<tr>
<td>Carryover State Appropriation</td>
<td>-</td>
<td>$1,153,145</td>
<td>$1,153,145</td>
<td>-</td>
<td>$1,412,621</td>
<td>$1,413,129</td>
</tr>
<tr>
<td>New Matching Funds</td>
<td>$262,031</td>
<td>-</td>
<td>$262,031</td>
<td>$262,540</td>
<td>-</td>
<td>$262,540</td>
</tr>
<tr>
<td>Carryover from Previous Year</td>
<td>$576,573</td>
<td>-</td>
<td>$576,573</td>
<td>$706,310</td>
<td>-</td>
<td>$706,565</td>
</tr>
<tr>
<td>Matching Funds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL REVENUE</td>
<td>$838,604</td>
<td>$1,677,209</td>
<td>$2,515,813</td>
<td>$968,850</td>
<td>$1,937,700</td>
<td>$2,907,313</td>
</tr>
</tbody>
</table>
## Requested Budget

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>FY22 Requested</th>
<th>Matching</th>
<th>Appropr.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>$99,873</td>
<td>$199,746</td>
<td></td>
<td>$299,619</td>
</tr>
<tr>
<td>Other Professional</td>
<td>$876</td>
<td>$1,753</td>
<td></td>
<td>$2,629</td>
</tr>
<tr>
<td>Clerical/ Supporting</td>
<td>$24,600</td>
<td>$49,201</td>
<td></td>
<td>$73,801</td>
</tr>
<tr>
<td>Assistantships</td>
<td>$0</td>
<td>$0</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td><strong>Total Salaries</strong></td>
<td>$125,349</td>
<td>$250,700</td>
<td></td>
<td>$376,049</td>
</tr>
<tr>
<td>Longevity (Excluded from Salaries)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fringe Benefits</td>
<td>$25,118</td>
<td>$50,236</td>
<td></td>
<td>$75,354</td>
</tr>
<tr>
<td><strong>Total Personnel</strong></td>
<td>$150,467</td>
<td>$300,936</td>
<td></td>
<td>$451,403</td>
</tr>
<tr>
<td><strong>Non-Personnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>$4,781</td>
<td>$9,563</td>
<td></td>
<td>$14,344</td>
</tr>
<tr>
<td>Software</td>
<td>-</td>
<td>-</td>
<td></td>
<td>$918</td>
</tr>
<tr>
<td>Books &amp; Journals</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Other Supplies</td>
<td>$52,841</td>
<td>$105,681</td>
<td></td>
<td>$158,522</td>
</tr>
<tr>
<td>Equipment</td>
<td>$39,130</td>
<td>$78,259</td>
<td></td>
<td>$117,389</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$0</td>
<td>$0</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Scholarships</td>
<td>-</td>
<td>-</td>
<td></td>
<td>$21,244</td>
</tr>
<tr>
<td>Consultants</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Renovation</td>
<td>$0</td>
<td>$0</td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td><strong>Other (Specify):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rentals/Entertainment</td>
<td>-</td>
<td>-</td>
<td></td>
<td>$1,798</td>
</tr>
<tr>
<td>Printing/Publications/Postage</td>
<td>$1,118</td>
<td>$2,236</td>
<td></td>
<td>$3,354</td>
</tr>
<tr>
<td>Professional Services/Memberships</td>
<td>$11,113</td>
<td>$22,227</td>
<td></td>
<td>$33,340</td>
</tr>
<tr>
<td>Contract &amp; Special Services</td>
<td>$43,107</td>
<td>$86,214</td>
<td></td>
<td>$129,321</td>
</tr>
<tr>
<td>Gasoline &amp; Diesel</td>
<td>-</td>
<td>-</td>
<td></td>
<td>$154</td>
</tr>
<tr>
<td><strong>Total Non-Personnel</strong></td>
<td>$152,090</td>
<td>$304,180</td>
<td></td>
<td>$480,384</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>$302,557</td>
<td>$605,116</td>
<td></td>
<td>$931,787</td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New State Appropriation</td>
<td>-</td>
<td>$551,333</td>
<td></td>
<td>$551,333</td>
</tr>
<tr>
<td>Carryover State Appropriation</td>
<td>-</td>
<td>$69,858</td>
<td></td>
<td>$69,858</td>
</tr>
<tr>
<td>New Matching Funds</td>
<td>$275,667</td>
<td>-</td>
<td></td>
<td>$275,667</td>
</tr>
<tr>
<td>Carryover from Previous Year</td>
<td>$34,929</td>
<td>-</td>
<td></td>
<td>$34,929</td>
</tr>
<tr>
<td>Matching Funds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL REVENUE</strong></td>
<td>$310,596</td>
<td>$621,191</td>
<td></td>
<td>$931,787</td>
</tr>
</tbody>
</table>
The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment and admission without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, gender identity, age, physical or mental disability, genetic information, veteran status, and parental status.