University of Missouri Veterinary Medical Diagnostic Laboratory (VMDL) Annual Report – 2020

Table of Contents

Summary Page 1
Introduction Page 2
VMDL Mission Statement Page 2
VMDL Advisory Board Page 2
VMDL Organizational Structure Page 3
Diagnostic Service Activities Page 4 – 8
National Programs Page 8 – 9
Teaching Activities Page 10 – 12
National and State Leadership Activities Page 12
Scholarly Activities Page 12 – 18
Extension, Outreach and Engagement Activities Page 18
Major Professional Meetings and Trainings Page 19

Summary
The University of Missouri Veterinary Medical Diagnostic Laboratory (VMDL) is Missouri’s only full service for all animal species diagnostic lab and only lab accredited by the American Association of Veterinary Laboratory Diagnosticians (AAVLD). In 2020, the VMDL retained the status of National Animal Health Laboratory Network (NAHLN) Level 1 Lab, FDA Veterinary Laboratory Response Network (FDA Vet-LRN) Tier 1 Lab, and National Poultry Improvement Plan (NPIP) Certification. The VMDL processed approximately 52,036 accessions and performed more than 142,744 diagnostic tests, which represents a 0.7% increase in accessions and 14.56% decrease in lab tests from 2019 to 2020. The VMDL provided diagnostic service to veterinarians and owners from 105 MO counties/independent cities and 43 US states and Canadian provinces. In 2020, the VMDL faculty taught (or co-taught) 37 courses and 18 clinical/diagnostic rounds. The VMDL faculty led and participated in 21 extramurally funded projects, including 10 new projects. The VMDL faculty published 33 peer-reviewed research and clinical papers, presented 13 conference posters and oral presentations, served on many prestigious national, state and university committees, attended important international, national and state conferences and trainings, and participated in various outreach and engagement activities.
**Introduction**

The MU VMDL is a full service veterinary diagnostic laboratory and it is Missouri’s only laboratory accredited by the American Association of Veterinary Laboratory Diagnosticians (AAVLD). The faculty and staff of VMDL are committed to excellence in diagnostic service, teaching, and research. The VMDL provides relevant, timely, and cost-effective diagnostic services to its clients and maintains a positive learning environment for the students.

The 2020 VMDL Annual Report summarizes diagnostic testing data, grants, publications, abstracts, and leadership activities from Jan 1, 2020 to Dec 31, 2020. To monitor caseload, data from 2016 to 2019 are also included in the report.

**VMDL Mission Statement**

To provide appropriate and timely diagnostic support to veterinary practitioners, livestock and poultry interests, companion animal interests, wildlife conservationists, and state-federal regulatory officials.

To monitor domestic animals, indigenous wildlife, and zoo animals for diseases that are a threat to livestock health and public health.

To support the teaching and service missions of the College of Veterinary Medicine.

To create new knowledge through fundamental and translational research.

**The VMDL Advisory Board**

**Mission Statement**

To advise VMDL management on policies, long-term developmental strategies, and collaborations with relevant university, private, state, national and international organizations.

**VMDL Advisory Board Membership**

The Advisory Board consists of 12 members representing the State Veterinarian’s office, commodity groups, small animal practice, large animal practice, and the Veterinary Health Center.

**VMDL Advisory Board Members**

Steve Strubberg, DVM, Missouri State Veterinarian
Terry Gosch, DVM, USDA Area Veterinarian in Charge
Sherri Russell, DVM, Missouri Wildlife Veterinarian
Clark Fobian, DVM, Sedalia, MO, Past President AVMA
Bruce Addison, MS, President, Addison Biological Laboratory, Inc.
Tony Martin, DVM, Director of Animal Health Division, MFA, Inc.
Veterinary Medical Diagnostic Laboratory
Veterinary Health Center
University of Missouri

Don Nikodim, Executive Vice President, Missouri Pork Association
Chuck Massengill, DVM, Missouri Cattlemen’s Association
David Wilson, DVM, MS, ACVS, MU VHC Director
John Middleton, DVM, PhD, ACVIM MU VHC Food Animal Service
Philip Johnson, BVSc, MS, MRCVS, ACVIM, MU VHC Equine Service

**VMDL Organizational Structure**

**VMDL Section Heads/Managers**

Anatomical Pathology – Dr. Gayle Johnson
Avian Diagnostics – Dr. Dan Shaw/Dr. Mike Zinn
Business Office – Mr. Kirk Thompson
Client Service – Dr. Lauren Delaney
Clinical Pathology – Dr. Angela Royal/ Ms. Cheryl Rojas
Director’s Office – Ms. Geri Hegstad
Histology – Dr. Dae-Young Kim/Ms. Candace Kassel
Microbiology – Dr. Tamara Gull/Mr. Jesse Bowman
Molecular Diagnostics – Dr. Solomon (Wole) Odemuyiwa/Ms. Debra Sharp
Quality Assurance – Ms. Susan Martin/Mr. Brian Nodine
Sample Receiving – Dr. Lauren Delaney
Serology/Immunology – Dr. Michael Zhang
Toxicology/Analytical Chemistry – Dr. Tim Evans/Dr. Xiangwei Du/Mr. Ben Landers

**VMDL Diagnostic Program Coordinators**
Anatomical Pathology Residency Program – Dr. Kei Kuroki
Clinical Pathology Residency Program – Dr. Angela Royal
Clinical and Diagnostic Microbiology – Dr. Tamara Gull
Equine Diagnostic Investigations – Dr. Fred Williams III
Food Animal Diagnostic Investigations – Dr. Tim Evans
Neuropathology and Oncopathology – Dr. Gayle Johnson
Small Animal Internal Medicine Pathology – Dr. Dae-Young Kim

**VMDL Client Outreach Programs**
Outreach Section has been established to address clients’ needs and concerns.
Online Portal is available for clients to check results and charges in real-time.
FedEx Express Prepaid Stamps enables inexpensive next day delivery.
Columbia Area Sample Courier service is available.
After-hours Sample Drop-off refrigerator is available at the VHC Small Animal Emergency Clinic.
Food Animal Field Investigations
VMDL Exhibitor presence at various veterinary and livestock meetings including booth at Missouri State Fair
VMDL Attendance at Regional VMA Meetings

**Diagnostic Service Activities**

**Table 1. Five Year VMDL (Main Lab and Clinical Pathology) Accessions***

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Accessions</th>
<th>Main Lab</th>
<th>Clin Path</th>
<th>MO &amp; Others/Total</th>
<th>VHC/Total</th>
<th>VHC/Main Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>48,617</td>
<td>30,032</td>
<td>18,585</td>
<td>26,293 (54%)</td>
<td>22,324 (46%)</td>
<td>3,879 (13%)</td>
</tr>
<tr>
<td>2017</td>
<td>45,680</td>
<td>25,598</td>
<td>20,082</td>
<td>22,631 (50%)</td>
<td>23,049 (50%)</td>
<td>3,873 (15%)</td>
</tr>
<tr>
<td>2018</td>
<td>48,538</td>
<td>27,719</td>
<td>20,819</td>
<td>24,339 (50%)</td>
<td>24,202 (50%)</td>
<td>4,156 (15%)</td>
</tr>
<tr>
<td>2019</td>
<td>51,668</td>
<td>26,933</td>
<td>24,675</td>
<td>23,417 (45%)</td>
<td>28,251 (55%)</td>
<td>4,309 (16%)</td>
</tr>
<tr>
<td><strong>2020</strong></td>
<td><strong>52,036</strong></td>
<td><strong>27,028</strong></td>
<td><strong>25,008</strong></td>
<td><strong>24,049 (46%)</strong></td>
<td><strong>27,987 (54%)</strong></td>
<td><strong>4,235 (16%)</strong></td>
</tr>
</tbody>
</table>

*A Main Lab accession may include multiple tests for multiple samples whereas each Clinical
Pathology accession represents one test performed on one sample. Approximately 95% clinical pathology accessions came from the VHC. From 2019 to 2020, total accessions increased 7.1%.

Table 2. Five Year VMDL (Main Lab and Clin Path) Tests by Animal Species*

<table>
<thead>
<tr>
<th>Species</th>
<th>Avian</th>
<th>Bovine</th>
<th>Canine</th>
<th>Caprine</th>
<th>Equine</th>
<th>Feline</th>
<th>Wild/Exotic</th>
<th>Non-Animal</th>
<th>Ovine</th>
<th>Porcine</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>8,954</td>
<td>19,345</td>
<td>42,979</td>
<td>1,633</td>
<td>9,483</td>
<td>6,891</td>
<td>6,277</td>
<td>4,784</td>
<td>643</td>
<td>6,022</td>
<td>107,011</td>
</tr>
<tr>
<td>2017</td>
<td>10,298</td>
<td>17,693</td>
<td>44,570</td>
<td>2,270</td>
<td>9,156</td>
<td>7,517</td>
<td>15,657</td>
<td>4,590</td>
<td>568</td>
<td>3,557</td>
<td>115,876</td>
</tr>
<tr>
<td>2018</td>
<td>8,773</td>
<td>19,128</td>
<td>46,191</td>
<td>1,331</td>
<td>10,263</td>
<td>7,558</td>
<td>30,050</td>
<td>2,728</td>
<td>537</td>
<td>2,607</td>
<td>129,166</td>
</tr>
<tr>
<td>2019</td>
<td>4,118</td>
<td>15,878</td>
<td>64,204</td>
<td>1,778</td>
<td>10,140</td>
<td>9,975</td>
<td>44,882</td>
<td>1,790</td>
<td>1,414</td>
<td>3,715</td>
<td>157,894</td>
</tr>
<tr>
<td>2020</td>
<td>4,141</td>
<td>16,488</td>
<td>68,169</td>
<td>1,743</td>
<td>9,161</td>
<td>10,253</td>
<td>24,673</td>
<td>2,574</td>
<td>774</td>
<td>4,768</td>
<td>142,744</td>
</tr>
</tbody>
</table>

Figure 1. Distribution of Diagnostic Tests by Animal Species
Table 3. Five Year VMDL (Main Lab and Clin Path) Tests by Section*

<table>
<thead>
<tr>
<th>Year</th>
<th>Avian Dx.</th>
<th>Ana Path</th>
<th>Histo/ IHC</th>
<th>Clin Path</th>
<th>Micro</th>
<th>Molecular Dx.</th>
<th>Serology/Immuno</th>
<th>Tox/Ana Chem</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>5,375</td>
<td>11,289</td>
<td>19,773</td>
<td>26,011</td>
<td>17,160</td>
<td>9,982</td>
<td>13,066</td>
<td>4,355</td>
<td>N/A</td>
<td>107,011</td>
</tr>
<tr>
<td>2017</td>
<td>5,415</td>
<td>11,352</td>
<td>29,850</td>
<td>28,249</td>
<td>16,727</td>
<td>10,911</td>
<td>21,634</td>
<td>4,610</td>
<td>N/A</td>
<td>128,748</td>
</tr>
<tr>
<td>2018</td>
<td>4,411</td>
<td>12,065</td>
<td>28,966</td>
<td>29,126</td>
<td>15,246</td>
<td>9,872</td>
<td>38,515</td>
<td>2,838</td>
<td>N/A</td>
<td>141,039</td>
</tr>
<tr>
<td>2019</td>
<td>1,587</td>
<td>12,154</td>
<td>41,117</td>
<td>31,992</td>
<td>13,589</td>
<td>8,449</td>
<td>46,646</td>
<td>2,360</td>
<td>9,193</td>
<td>167,087</td>
</tr>
<tr>
<td>2020</td>
<td>1,815</td>
<td>11,996</td>
<td>43,405</td>
<td>35,184</td>
<td>13,558</td>
<td>7,624</td>
<td>26,452</td>
<td>2,610</td>
<td>100</td>
<td>142,744</td>
</tr>
</tbody>
</table>

*The number of diagnostic tests decreased 14.56% from 2019 to 2020.

Table 4. Distribution of VMDL Accessions in 105 MO Counties/Independent City

<table>
<thead>
<tr>
<th>County</th>
<th>#ACCN*</th>
<th>County</th>
<th>#ACCN</th>
<th>County</th>
<th>#ACCN</th>
<th>County</th>
<th>#ACCN</th>
<th>County</th>
<th>#ACCN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boone</td>
<td>33,018</td>
<td>Webster</td>
<td>169</td>
<td>Scott</td>
<td>88</td>
<td>Carroll</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Louis County</td>
<td>1,422</td>
<td>Nodaway</td>
<td>165</td>
<td>Osage</td>
<td>86</td>
<td>Stoddard</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Charles</td>
<td>733</td>
<td>Taney</td>
<td>157</td>
<td>Grundy</td>
<td>80</td>
<td>Maries</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greene</td>
<td>717</td>
<td>Howell</td>
<td>153</td>
<td>Clay</td>
<td>77</td>
<td>Andrew</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jackson</td>
<td>626</td>
<td>Marion</td>
<td>147</td>
<td>Dunklin</td>
<td>73</td>
<td>Benton</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cole</td>
<td>590</td>
<td>Moniteau</td>
<td>147</td>
<td>Laclede</td>
<td>72</td>
<td>Perry</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Callaway</td>
<td>567</td>
<td>Buchanan</td>
<td>137</td>
<td>Shelby</td>
<td>66</td>
<td>Atchison</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Franklin</td>
<td>504</td>
<td>Barry</td>
<td>136</td>
<td>Wright</td>
<td>66</td>
<td>St. Clair</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnson</td>
<td>462</td>
<td>Ray</td>
<td>136</td>
<td>Macon</td>
<td>62</td>
<td>Mississippi</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>390</td>
<td>Saline</td>
<td>132</td>
<td>Pulaski</td>
<td>62</td>
<td>Dent</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jefferson</td>
<td>373</td>
<td>Randolph</td>
<td>126</td>
<td>Henry</td>
<td>53</td>
<td>Sullivan</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Specified</td>
<td>350</td>
<td>Pettis</td>
<td>125</td>
<td>Morgan</td>
<td>48</td>
<td>Chariton</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camden</td>
<td>322</td>
<td>McDonald</td>
<td>121</td>
<td>Platte</td>
<td>48</td>
<td>DeKalb</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Louis City</td>
<td>306</td>
<td>Miller</td>
<td>119</td>
<td>Ste. Genevieve</td>
<td>47</td>
<td>Clark</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phelps</td>
<td>279</td>
<td>Howard</td>
<td>113</td>
<td>Knox</td>
<td>46</td>
<td>Harrison</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cape Girardeau</td>
<td>254</td>
<td>Lawrence</td>
<td>111</td>
<td>Cedar</td>
<td>44</td>
<td>Ozark</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cass</td>
<td>245</td>
<td>Polk</td>
<td>111</td>
<td>Bollinger</td>
<td>43</td>
<td>Shannon</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newton</td>
<td>239</td>
<td>Putnam</td>
<td>111</td>
<td>Vernon</td>
<td>42</td>
<td>Boone</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lincoln</td>
<td>235</td>
<td>Oregon</td>
<td>109</td>
<td>Crawford</td>
<td>40</td>
<td>Clinton</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasconade</td>
<td>215</td>
<td>Texas</td>
<td>109</td>
<td>Adair</td>
<td>37</td>
<td>Scotland</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monroe</td>
<td>209</td>
<td>Bates</td>
<td>107</td>
<td>Lewis</td>
<td>37</td>
<td>Gentry</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lafayette</td>
<td>207</td>
<td>Cooper</td>
<td>104</td>
<td>Linn</td>
<td>37</td>
<td>Dade</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jasper</td>
<td>194</td>
<td>Barton</td>
<td>101</td>
<td>Dallas</td>
<td>34</td>
<td>Daviess</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Francois</td>
<td>194</td>
<td>Warren</td>
<td>97</td>
<td>Madison</td>
<td>33</td>
<td>Douglas</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butler</td>
<td>193</td>
<td>Pike</td>
<td>93</td>
<td>Caldwell</td>
<td>31</td>
<td>Holt</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livingston</td>
<td>172</td>
<td>Audrain</td>
<td>88</td>
<td>Montgomery</td>
<td>31</td>
<td>Reynolds</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5. Distribution of VMDL Accessions in 43 Non-MO States

<table>
<thead>
<tr>
<th>State/Country</th>
<th># Accession</th>
<th>State/Country</th>
<th># Accession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>1,014</td>
<td>Indiana</td>
<td>13</td>
</tr>
<tr>
<td>Arkansas</td>
<td>839</td>
<td>Michigan</td>
<td>13</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>423</td>
<td>Texas</td>
<td>8</td>
</tr>
<tr>
<td>Florida</td>
<td>396</td>
<td>New Mexico</td>
<td>7</td>
</tr>
<tr>
<td>North Carolina</td>
<td>299</td>
<td>Alabama</td>
<td>6</td>
</tr>
<tr>
<td>Kansas</td>
<td>243</td>
<td>Maryland</td>
<td>6</td>
</tr>
<tr>
<td>Iowa</td>
<td>144</td>
<td>Washington</td>
<td>6</td>
</tr>
<tr>
<td>California</td>
<td>136</td>
<td>Kentucky</td>
<td>5</td>
</tr>
<tr>
<td>Minnesota</td>
<td>113</td>
<td>Wyoming</td>
<td>5</td>
</tr>
<tr>
<td>Montana</td>
<td>63</td>
<td>Georgia</td>
<td>4</td>
</tr>
<tr>
<td>New York</td>
<td>49</td>
<td>Nevada</td>
<td>4</td>
</tr>
<tr>
<td>New Jersey</td>
<td>40</td>
<td>South Dakota</td>
<td>4</td>
</tr>
<tr>
<td>Virginia</td>
<td>35</td>
<td>Wisconsin</td>
<td>4</td>
</tr>
<tr>
<td>South Carolina</td>
<td>27</td>
<td>Colorado</td>
<td>3</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>25</td>
<td>New Hampshire</td>
<td>3</td>
</tr>
<tr>
<td>Manitoba</td>
<td>23</td>
<td>Oregon</td>
<td>2</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>23</td>
<td>British Columbia</td>
<td>1</td>
</tr>
<tr>
<td>Arizona</td>
<td>22</td>
<td>Idaho</td>
<td>1</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>22</td>
<td>Ontario</td>
<td>1</td>
</tr>
<tr>
<td>Tennessee</td>
<td>18</td>
<td>Rhode Island</td>
<td>1</td>
</tr>
<tr>
<td>Nebraska</td>
<td>17</td>
<td>Saskatchewan</td>
<td>1</td>
</tr>
<tr>
<td>Ohio</td>
<td>16</td>
<td>Indiana</td>
<td>13</td>
</tr>
</tbody>
</table>

**External Proficiency Tests**

**NAHNLN Data Transmission**
- ASF Electronic Messaging Competency
- CSF Electronic Messaging Competency
- FMD Electronic Messaging Competency
- IAV-A Electronic Messaging Competency
- IAV-S Electronic Messaging Competency
- Pseudorabies Electronic Messaging Competency

**Clinical Pathology**
- Chemistry-Routine
Hematology
Microscopy
Urinalysis

**Histology**
Chronic Wasting Disease IHC

**Microbiology**
Contagious Equine Metritis (CEM) Culture
*Listeria* and *Salmonella* in Raw Dog Food
*Salmonella* Group D Culture and Serology - National Poultry Improvement Plan (NPIP)

**Molecular Diagnostics**
Avian Influenza Virus (IAV-A) qRT-PCR
Avian Paramyxovirus (APMV)-1/Exotic New Castle Virus qRT-PCR
African Swine Fever (ASF) qPCR
Classical Swine Fever Virus (CSFV) qRT-PCR
Foot-and-Mouth Disease Virus (FMDV) qRT-PCR
Swine Influenza Virus (SIV) qRT-PCR

**Serology**
Bluetongue Serology
Bovine Leukemia Virus (BLV) Serology
Brucellosis Serology
Chronic Wasting Disease (CWD) ELISA
Equine Infectious Anemia (EIA)
Johne’s ELISA
Pseudorabies Virus (PRV) gB & gl ELISA

**Toxicology**
Aflatoxin in Feedstuffs HPLC
Aflatoxin M1 in Tissues HPLC
Deoxynivalenol (DON) in Feedstuffs HPLC
Fumonisin in Feedstuffs HPLC

**VMDL Participation in National Diagnostic Programs**
Figure 3. Level I Lab of National Animal Health Laboratory Network (NAHLN)
Figure 4. Tier I Member of FDA Veterinary Laboratory Investigation and Response Network (Vet-LIRN)
### Teaching Activities

#### Didactic and Laboratory Courses (N = 37; Bold: Coordinated by VMDL Faculty)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 140/2140</td>
<td>Companion Animals</td>
</tr>
<tr>
<td>AS 325/4977</td>
<td>Horse Production</td>
</tr>
<tr>
<td><strong>BioMed 3200</strong></td>
<td><strong>Comparative Hematology</strong></td>
</tr>
<tr>
<td>BioMED 3310</td>
<td>Biomedical Pathophysiology Online</td>
</tr>
<tr>
<td><strong>BioMed 4100</strong></td>
<td><strong>Veterinary Clinical Chemistry, Online</strong></td>
</tr>
<tr>
<td>BioMed 4110/V_PBIO 7110</td>
<td>Veterinary Cytology</td>
</tr>
<tr>
<td><strong>BioMED 4120</strong></td>
<td><strong>Principles of Toxicology Online (Undergraduate Level)</strong></td>
</tr>
<tr>
<td>LAB_AN 9437</td>
<td>Lab Animal Pathology</td>
</tr>
<tr>
<td>MMI 8050</td>
<td>Mechanisms of Microbial Pathogenesis</td>
</tr>
<tr>
<td><strong>P_Health 8150</strong></td>
<td><strong>Human Health and the Environment</strong></td>
</tr>
<tr>
<td>V_BSCI 5507</td>
<td>Veterinary Pharmacology</td>
</tr>
<tr>
<td>V_BSCI 5508</td>
<td>Veterinary Pharmacology</td>
</tr>
<tr>
<td><strong>V_BSCI 5509</strong></td>
<td><strong>Veterinary Toxicology</strong></td>
</tr>
<tr>
<td>V_M_S 6400</td>
<td>Food Animal Medicine &amp; Surgery I</td>
</tr>
<tr>
<td>V_M_S 6420</td>
<td>Equine Medicine and Surgery I</td>
</tr>
<tr>
<td><strong>V_M_S 6987</strong></td>
<td><strong>Problem-Based Learning Clinic Preparation</strong></td>
</tr>
<tr>
<td>V_M_S 6996</td>
<td>Advanced Dermatology</td>
</tr>
<tr>
<td>V_M_S 8036</td>
<td>Advanced Physiology of Dog and Cat</td>
</tr>
<tr>
<td>V_M_S 8401</td>
<td>Topics in Veterinary Clinical Sciences</td>
</tr>
<tr>
<td>V_M_S 8402</td>
<td>Seminar in Veterinary Clinical Sciences</td>
</tr>
<tr>
<td>V_M_S 8402 B</td>
<td>Seminar in Veterinary Clinical Sciences</td>
</tr>
<tr>
<td><strong>V_M_S 8402 D</strong></td>
<td><strong>Clinicopathologic Case Conference (CPC)</strong></td>
</tr>
<tr>
<td>V_M_S 8415</td>
<td>Advanced Veterinary Neurology</td>
</tr>
<tr>
<td>V_M_S 8485</td>
<td>Problems in Veterinary Clinical Science</td>
</tr>
<tr>
<td>V_PBIO 5552</td>
<td>Veterinary Bacteriology 1</td>
</tr>
<tr>
<td>V_PBIO 5553</td>
<td>Veterinary Bacteriology 2</td>
</tr>
<tr>
<td><strong>V_PBIO 5554</strong></td>
<td><strong>Veterinary Virology</strong></td>
</tr>
<tr>
<td>V_PBIO 5575</td>
<td>General Veterinary Pathology</td>
</tr>
<tr>
<td>V_PBIO 5576</td>
<td>Veterinary Systemic and Special Pathology I</td>
</tr>
</tbody>
</table>
Veterinary Systemic and Special Pathology II
Veterinary Clinical Pathology
Diagnostic Pathology and Special Species Medicine I
Diagnostic Pathology and Special Species Medicine II
Principles of Toxicology Online (Graduate Level)
Advanced Clinical Pathology
Advanced Microscopy in Veterinary Clinical Pathology
Area Veterinary Pathobiology Dissertation Research

Clinical and Diagnostic Rounds and Seminars (N = 18)

Chemistry Rounds
Comparative Orthopaedic Laboratory (COL) journal club
Cytology Rounds
Dermatology Rounds
Equine Journal Club
Food for Thought Rounds
Food Animal/ Equine Clinical Case Rounds
Food Animal Journal Club
Gross Pathology Rounds
Hematology Rounds
Human Health and the Environment
Image Review
Joint Pathology Center Wednesday Slide Conference
Mentoring International Students
Mentoring Pre-Vet Students (Including Pre-Vet Scholars)
Mentoring Veterinary Professional Students at VET Orientation for VM-1s
Neurology Rounds
Ophthalmic Pathology Rounds
Slide Treats
VMDL-Food Animal Monthly Rounds

Residency Training Programs
Anatomical Pathology
Clinical Pathology
Clinical and Diagnostic Microbiology

International Programs

1. Agencia de Regulación y Control de la Bioseguridad y Cuarentena para Galápagos or Agency for Biosafety and Quarantine Regulation and Control for the Galápagos (ABG) – Building diagnostic capacity and collaborative research

National and State Leadership Activities

National and State Leadership

1. Evans T. Co-Chair AAVLD Toxicology Committee
2. Evans T. ABVT Student Award Committee and Education Committee member
3. Evans T. Veterinary Education Assessment Examination Question Reviewer
5. Gull T. ACVM Board of Governors, ACVM Examination Committee, ACVIM Examination Committee.
7. Royal A. Member of ACVP Certifying Exam Assembly and Administration Group (Clinical Pathology).
8. Zhang S. AAVLD President, Member of AAVLD Bacteriology/Mycology Subcommittee, Antimicrobial Susceptibility Subcommittee, Quality Assurance Committee, Government Relations Committee, Strategic Planning Committee, and Workforce Development Committee.
9. Zhang S. Missouri Biosecurity Working Group

Scholarly Activities

Grants and Contracts

New Grants and Contracts

1. 2020-2020. Lyons B, Reinero C, Ericsson A, Gull T. Examination of the spatial and temporal dynamics of microbiota on select surfaces in a small animal intensive care unit. MU Clinician-Scientist Grant. $8,000.
2. 2020-2021. Gull T (PI), Kittana H, Odemuyiwa S, Calcutt M. Multi-locus sequence typing of divergent Mannheimia isolates and molecular and serological detection of leukotoxin from cases with and without disease. USDA AHFF. $8,000.
3. 2020-2021. Jeffery Bryan (PI, 35%), Dae Kim (Co-I, 20%), Jimmy Lattimer (Co-I, 10%), Charles Maitz (Co-I, 30%), Sarah Schlink (Co-I, 5%). Evaluation of Eye90™ Radioembolic
Microspheres radiopacity and delivery in healthy rabbits. ABK Biomedical Inc. $48,659.


6. 2020-2021. **Zhang S (PI), Evans T (Co-PI), Johnson GC (Co-PI), Gull T (Co-PI), Zhang MZ (Co-PI), Odemuyiwa S (Co-PI)**. Maintaining FDA Vet-LIRN Tier I Lab. NIH 1U18FD006670-01. $39,900 (Direct: $30,000).

7. 2020-2021. **Zhang S (PI), Gull T (Co-PI)**. Prototype reporting and veterinarian and animal owner educational materials for cases of antimicrobial resistant bacteria of public health importance in companion animals. KSU-FDA/ Vet-LIRN. $7,500


9. 2020-2022. **Shen Z (PI)**. United front to develop harmonized NGS training and procedures to increase the capabilities and capacity of NAHLN laboratories in response to antimicrobial resistance (AMR). UGA-USDA (AP20VSD&B00c018). $81,311 (Direct: $73,919, Indirect: $7,392).


**Existing Active Grants**


5. 2018-2023. Lucy M (PI), **Evans TJ** (Co-I, 5% shared credit), **Gull T** (Co-I, 5% shared credit). Uterine microbiome: Functional significance in establishing the uterine program postpartum. NIH (1R01HD092254-01A1), $1.6 million (Direct: $720,000, Indirect: $880,000).


11. 2019-2022. Kevin Wells (PI), Kim DY (Co-PI, 5% effort). Swine somatic cell genome editing center. NIH office of the director. $1,129,562.00

Peer Reviewed Publications

Published


In Press and Submitted:


Scientific Presentations


7. Odemuyiwa SO. The next pandemic will still come from animals. Webinar presentation on the


**Extension/Outreach/Engagement Presentations**

1. Ierardi R and Delaney L. Diagnostic Lab Report for data period 2019-11-01 through 2020-04-30. Academy of Veterinary Consultants (AVC), 7/01/2020


3. Williams III F. Rabies seminar for high school students at the Center Project. 1/16/20.

4. Williams III F. Presentation on zoo animal and wildlife pathology for the Zewclub and Comparative Pathology clubs, 4/21/20

5. Williams III F. CL Davis Foundation lunch seminar on animal abortion for pathologists, residents, and various students, 8/21/20

6. Williams III F. Pathology review for the VM-4's, 9/22/2020 and 9/23/2020

7. Williams III F. Necropsy Review for veterinary students, 9/30/20, 10/3/20, and 10/10/20

8. Royal A. Microscopy cases presented for MU Student Chapter of the ACVP, 9/17/20

9. Royal A and DeNew K. ASVCP Online Rounds, 11/24/20

Major Annual Professional Meetings and Trainings

1. American Association of Veterinary Laboratory Diagnosticians (AAVLD) Annual Meeting
2. American College of Veterinary Internal Medicine (ACVIM) Annual Meeting
3. American College of Veterinary Microbiologists (ACVM) Annual Meeting
4. Combined Annual Meetings of the American College of Veterinary Pathologists (ACVP) and American Society for Veterinary Clinical Pathology (ASVCP)
5. American Veterinary Medical Association (AVMA) Annual Meeting
6. Midwest Association of Veterinary Pathologists Annual Meeting
7. Missouri Veterinary Medical Association (MVMA) Annual Meeting and District Meetings
8. Missouri Biosecurity Working Group Quarterly Meetings
9. Missouri Captive Wild Animal Health Meetings
10. US Animal Health and AAVLD Government Relations Meeting
11. Vet-LIRN (Veterinary Laboratory Investigation and Response Network) Monthly Conference Calls
12. Conference for Research Workers in Animal Diseases (CRWAD) Annual Meeting