

University of Missouri Veterinary Medical Diagnostic Laboratory (VMDL) Annual Report – 2018

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Summary

The University of Missouri Veterinary Medical Diagnostic Laboratory (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 VMDL is a Level I Lab of the National Animal Health Laboratory Network (NAHLN) and Tier I Lab of the FDA Veterinary Laboratory Response Network (FDA Vet-LRN). In 2018, the VMDL processed approximately 48,555 accessions and performed 129,166 diagnostic tests. In a 5-year period from 2014 to 2018, case accessions increased 14.33%. The VMDL diagnostic service was utilized by veterinarians and owners from 110 MO counties/independent cities and 48 US states and Canadian provinces. In 2018, the VMDL faculty taught (or co-taught) 36 courses and 16 clinical/diagnostic rounds. The VMDL faculty and staff completed 4 extramurally funded projects and received funding for 11 new projects. The VMDL faculty and staff published 32 peer-reviewed papers and 5 book chapters, presented 26 conference posters and presentations, served on many prestigious national and university committees, and attended 9 international, national and state conferences and trainings.

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. We strive to provide relevant, timely, and cost-effective diagnostic services to our clients and create a positive learning environment for our students.

The 2018 Veterinary Medical Diagnostic Laboratory (VMDL) Annual Report summarizes diagnostic testing data, grants, publications, abstracts, and leadership activities from Jan 1, 2018 to Dec 30, 2018. To monitor caseload, data from 2014 to 2017 are also included in this 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 mission 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

Taylor Woods, DVM, Missouri Acting State Veterinarian

Sherri Russell, DVM, Missouri Wildlife Veterinarian

Bruce Addison, President, Addison Biological Laboratory, Inc.

Philip Johnson, BVSc, MS, MRCVS, ACVIM MU VHC Equine Service

Tony Martin, DVM, Director of Animal Health Division, MFA, Inc.

Chuck Massengill, DVM, Missouri Cattlemen's Association

John Middleton, DVM, PhD, ACVIM MU VHC Food Animal Service

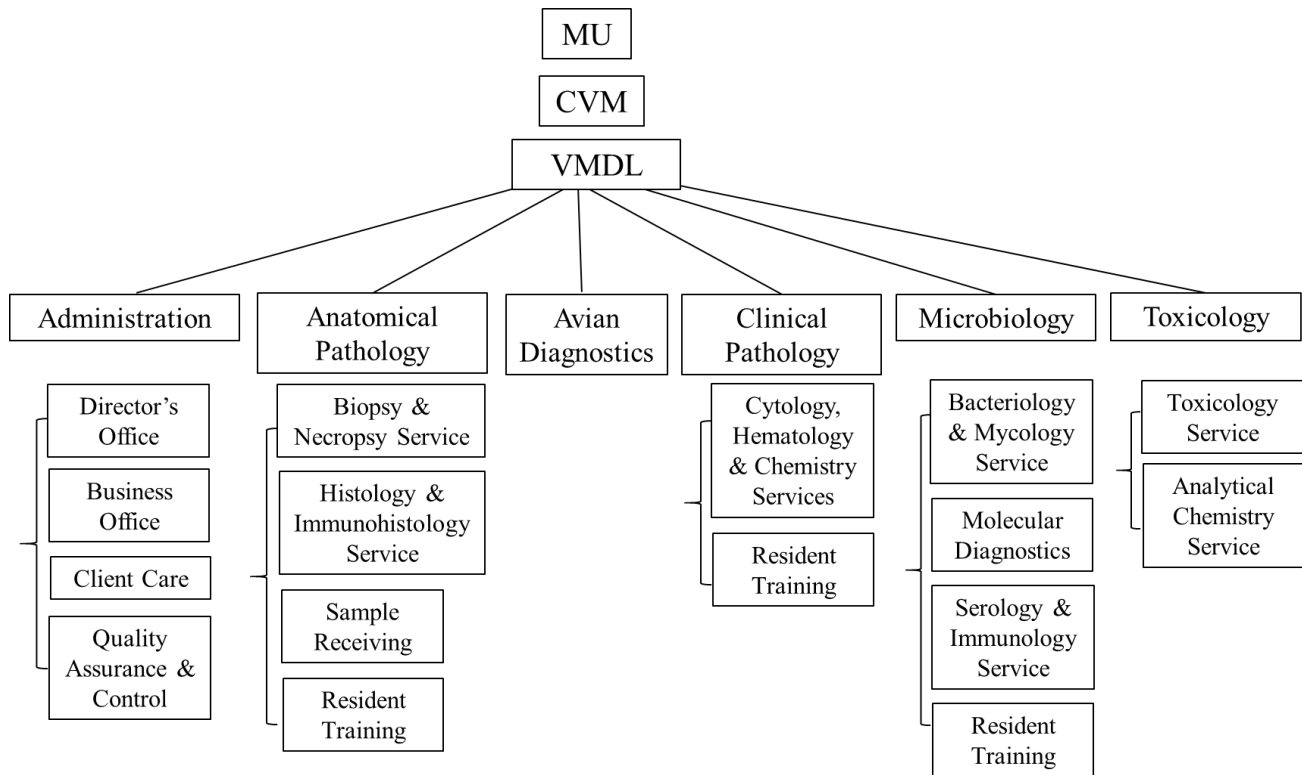
Don Nikodim, Executive Vice President, Missouri Pork Association

Steve Patterson, DVM, Bethel, MO

Steve Strubberg, DVM, Hermann, MO

David Wilson, DVM, MS, ACVS, MU VHC Director

VMDL Organizational Structure



VMDL Section Heads/Managers

Anatomical Pathology – Dr. Gayle Johnson

Avian Diagnostics – Dr. Dan Shaw

Business Office – Mr. Mike Wimmenauer

Client Care and Outreach – 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
 Sample Receiving – Ms. Geri Hegstad
 Serology/Immunology – Dr. Mike Zhang
 Toxicology – Dr. Tim Evans/Dr. George Rottinghaus

VMDL Diagnostic Program Coordinators

Anatomical Pathology Residency Program – Dr. Kei Kuroki
 Clinical Pathology Residency Program – Dr. Charles Wiedmeyer
 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.
 Afterhours Sample Drop-off refrigerator is available at the VHC Small Animal Emergency Clinic.

VMDL Service Activities

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

Year	VMDL Total Accessions	VMDL Main Lab	VMDL Clin Path	Source (%) and Type		
				MO-US /Total	VHC/Total	VHC/Main Lab
2014	42,471	29,193	13,278	25,863 (61%)	16,608 (39%)	3,330 (11%)
2015	48,848	32,195	16,653	28,266 (58%)	20,582 (42%)	3,929 (14%)
2016	48,617	30,032	18,585	26,293 (54%)	22,324 (46%)	3,879 (18%)
2017	45,680	25,598	20,082	22,631 (50%)	23,049 (50%)	3,873 (15%)
2018	48,538	27,719	20,819	24339 (50%)	24,202 (50%)	4,156 (18%)

*A Main Lab accession may include multiple tests for multiple samples whereas each Clinical Pathology accession represents one test performed on one sample.

Accessions increased 14.33% from 2014 to 2018.

More than 95% of clinical pathology accessions came from VHC.

Up to 18% of Main Lab accessions came from VHC.

The Necropsy Lab provided support for 5 research projects.

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

Year/ Species	Avian	Bovine	Canine	Caprine	Equine	Feline	Wild Exotic	Non- Animal	Ovine	Porcine	Total
2014	5,856	20,898	48,698	1,995	13,588	5,854	7,373	4,741	564	7,468	1,17,035
2015	8,306	18,579	42,595	1,609	11,217	7,067	7,005	4,196	579	5,280	1,06,433
2016	8,954	19,345	42,979	1,633	9,483	6,891	6,277	4,784	643	6,022	1,07,011
2017	10,298	17,693	44,570	2,270	9,156	7,517	15,657	4,590	568	3,557	1,15,876
2018	8,773	19,128	46,191	1,331	10,263	7,558	30,050	2,728	537	2,607	1,29,166

Figure 1. Distribution of Diagnostic Tests by Animal Species

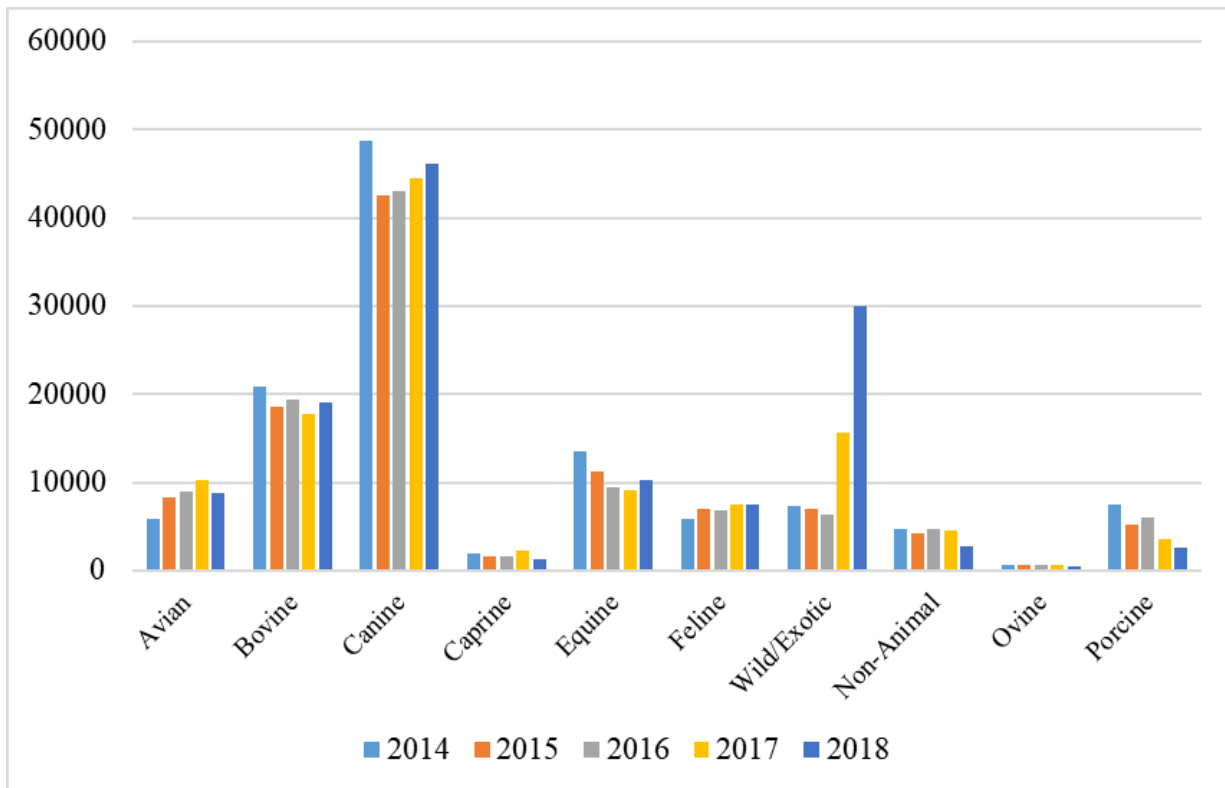


Table 3. Five Year VMDL (Main Lab and Clin Path) Tests by Section

Year	Avian	Ana Path	Histo/IHC	Clin Path	Micro	PCR/Vir	Sero	Tox	Total
2014	2111	9,190	30,130	19,107	14,771	10,018	26,832	4,876	11,7035
2015	4374	10,620	22,526	23,242	16,373	10,372	14,520	4,406	10,6433
2016	5375	11,289	19,773	26,011	17,160	9,982	13,066	4,355	10,7011
2017	5415	11,352	16,978	28,249	16,727	10,911	21,634	4,610	11,5876
2018	4411	12,065	16,978	29,126	15,246	9,872	38,515	2,838	12,9051

Table 4. Distribution of VMDL Accessions in 110 MO Counties/Independent City

County	# Accession	County	# Accession	County	# Accession
Adair	46	Moniteau	112	Osage	75
Andrew	29	Monroe	165	Ozark	11
Atchison	22	Montgomery	45	Perry	11
Audrain	1	Morgan	60	Pettis	187
Audrain	92	Gasconade	184	Phelps	244
Barry	175	Gentry	5	Pike	67
Barton	36	Greene	925	Platte	20
Bates	88	Grundy	130	Polk	130
Benton	7	Harrison	3	Pulaski	84
Bollinger	18	Henry	63	Putnam	117
Boone	29,768	Hickory	1	Ralls	2
Buchanan	184	Howard	115	Randolph	99
Butler	170	Howell	217	Ray	217
Caldwell	18	Jackson	606	Ripley	3
Callaway	4	Jasper	214	Saint Charles	805
Callaway	585	Jefferson	325	Saint Clair	30
Camden	267	Johnson	411	Saint Francois	166
Cape Girardeau	294	Knox	25	Saint Louis	1598
Carroll	57	Laclede	36	Saint Louis City	251
Cass	203	Lafayette	206	Sainte Genevieve	38
Cedar	55	Lawrence	74	Saline	181
Chariton	10	Lewis	13	Schuyler	3
Christian	312	Lincoln	231	Scotland	47
Clark	11	Linn	56	Scott	83
Clay	111	Livingston	121	Shannon	8

Clinton	3	Macon	59	Shelby	102
Cole	537	Madison	50	Stoddard	16
Cooper	147	Maries	18	Stone	62
Crawford	49	Marion	113	Sullivan	3
Dade	3	Mcdonald	37	Taney	50
Dallas	55	Mercer	1	Texas	111
Daviess	1	Miller	117	Vernon	42
Dekalb	19	Mississippi	16	Warren	87
Dent	33	Newton	194	Washington	9
Douglas	3	Nodaway	95	Wayne	1
Dunklin	76	Not Specified	924	Webster	151
Franklin	442	Oregon	66	Wright	64

Table 5. Distribution of VMDL Accessions in 48 Non-MO States

State/Country	# Accession	State/Country	# Accession
Alaska	1	New Hampshire	1
Alberta	2	New Mexico	4
Arizona	5	New York	10
Arkansas	557	North Carolina	224
British Columbia	4	North Dakota	19
California	96	Ohio	15
Colorado	2	Oklahoma	371
Connecticut	1	Ontario	2
Florida	363	Oregon	15
Georgia	6	Pennsylvania	30
Idaho	2	Puerto Rico	17
Illinois	675	Rhode Island	4
Indiana	16	Saskatchewan	1
Iowa	126	South Carolina	15
Kansas	370	South Dakota	20
Kentucky	12	Tennessee	2
Maine	1	Texas	22
Manitoba	8	Utah	24
Maryland	1	Vermont	3
Massachusetts	11	Virginia	27
Michigan	16	Washington	2
Minnesota	201	West Virginia	1
Montana	17	Wisconsin	14
Nebraska	18	Wyoming	5

External Proficiency Tests

Clinical Pathology

Chemistry-Routine
Hematology
Microscopy
Urinalysis

Histology

Chronic Wasting Disease IHC

Microbiology

AAVLD Inter-laboratory Bacteriology Quality Assurance Survey
Contagious Equine Metritis (CEM) Culture
Johne's Direct Fecal PCR & Liquid Culture
Salmonella Group D Culture and Serology - National Poultry Improvement Plan (NPIP)

Molecular Diagnostics

Avian Influenza Virus (AIV) RT-PCR
Avian Paramyxovirus (APMV)-1/Exotic New Castle Virus RT-PCR
Classical Swine Fever Virus (CSFV) RT-PCR
Foot-and-Mouth Disease Virus (FMDV) RT-PCR
Swine Influenza Virus (SIV) RT-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 & gI ELISA

Toxicology

Aflatoxin HPLC
Deoxynivalenol (DON) HPLC
Fumonisin HPLC

VMDL Participation in National Diagnostic Programs

Figure 3. Level I Lab of National Animal Health Laboratory Network (NAHLN)

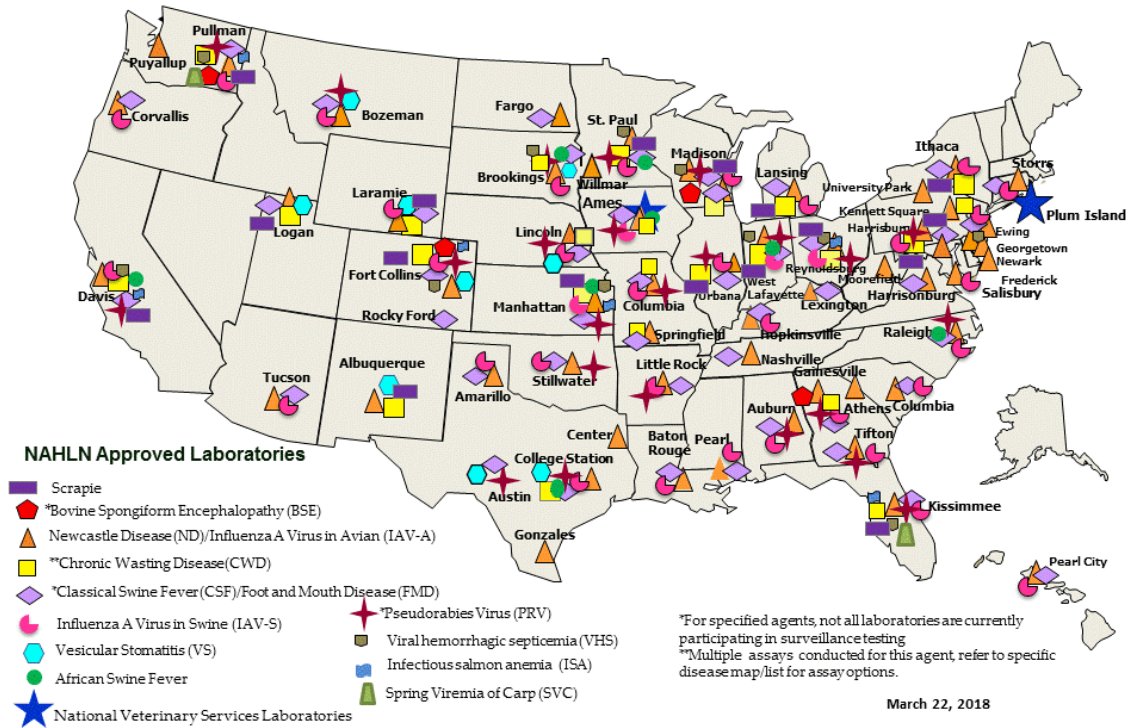
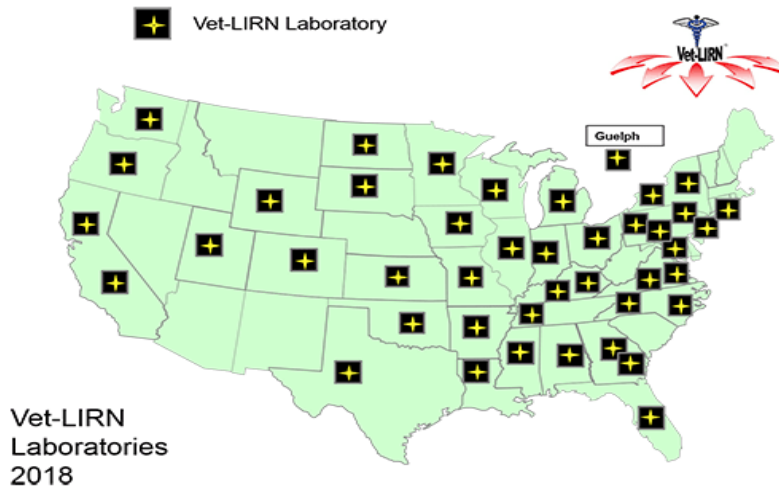


Figure 4. Tier I Member of FDA Veterinary Laboratory Investigation and Response Network (Vet-LIRN)

Network Laboratories



VMDL Faculty Teaching Activities

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

AS 140/2140	Companion Animals
AS 325/4977	Horse Production
BioMed 3200	Comparative Hematology
BioMED 3310	Biomedical Pathophysiology Online
BioMed 4100	Veterinary Clinical Chemistry, On-line
BioMed 4110/V_PBIO 7110	Veterinary Cytology
BioMED 4120	Principles of Toxicology On-line
LAB_AN 9437	Lab Animal Pathology
MMI 8050	Mechanisms of Microbial Pathogenesis
MICROB 9001	Topics in Microbiology
P Health 8001	Human Health and the Environment
V_BSCI 5506	Veterinary Cellular Biology
V_BSCI 5507	Veterinary Pharmacology
V_BSCI 5508	Veterinary Pharmacology
V_BSCI 5509	Veterinary Toxicology
V_M_S 6400	Food Animal Medicine & Surgery I
V_M_S 6420	Equine Medicine and Surgery I
V_M_S 6987	Problem-Based Learning Clinic Preparation
V_M_S 6996	Advanced Dermatology
V_M_S 8036	Advanced Physiology of Dog and Cat
V_M_S 8402	Seminar in Veterinary Clinical Sciences
V_M_S 8402 B	Seminar in Veterinary Clinical Sciences
V_M_S 8402 D	Clinicopathologic Case Conference (CPC)
V_M_S 8415	Advanced Veterinary Neurology
V_M_S 8485	Problems in Veterinary Clinical Science
V_PBIO 5552	Veterinary Bacteriology 1
V_PBIO 5553	Veterinary Bacteriology 2
V_PBIO 5554	Veterinary Virology
V_PBIO 5575	General Veterinary Pathology
V_PBIO 5576	Veterinary Systemic and Special Pathology I

V_PBIO 5577	Veterinary Systemic and Special Pathology II
V_PBIO 5578	Veterinary Clinical Pathology
V_PBIO 6647	Diagnostic Pathology and Special Species Medicine I
V_PBIO 6679	Diagnostic Pathology and Special Species Medicine II
V_PBIO 8434	Advanced Clinical Pathology
V_PBIO 8435	Advanced Microscopy in Veterinary Clinical Pathology
V_PBIO 9090	Area Veterinary Pathobiology Dissertation Research

Clinical and Diagnostic Rounds and Seminars (n=16)

Chemistry Rounds
Comparative Orthopaedic Laboratory (COL) journal club
Cytology Rounds
Dermatology Rounds
Food for Thought Rounds
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
Neurology Rounds
Ophthalmic Pathology Rounds
Slide treats
VMDL-Food Animal Monthly Rounds

Residency Training Programs

Anatomical Pathology Resident Training
Clinical Pathology Resident Training
Clinical and Diagnostic Microbiology

International Programs

1. Department of Food Science and Engineering (USP) at the University of Sao Paulo (USP), Pirassununga, São Paulo, Brazil – Collaborative training and research
2. 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

VMDL Faculty National and State Leadership Activities

National and State Leadership

1. Evans T. President, American Board of Veterinary Toxicology (ABVT)
2. Evans T. Member, American Board ABVT Student Award Committee
3. Evans T. Co-Chair, AAVLD Toxicology Committee
4. Evans T. Member, Veterinary Education Assessment (VEA) Review Committee
5. Gull T. ACVIM Credentials Committee.
6. Gull T. ACVM Board of Governors, ACVM Examination Committee, ACVIM Examination Committee.
7. Royal A. Member of ACVP Certifying Exam Committee, Proctor for ACVP Board Examination (Clinical Pathology).
8. Shaw D. Chair of Training Program Review Committee of American College of Poultry Veterinarians, 2018.
9. Shaw D. Program Chair for 2018 North Central Avian Disease Conference, Minneapolis, MN, 12-13 March 2018.
10. Wiedmeyer CE. Phi Zeta Veterinary Honor Society - National President.
11. Zhang S. Vice President of AAVLD, Co-Chair of AAVLD Membership Committee, Member of AAVLD Bacteriology/Mycology Subcommittee, Antimicrobial Susceptibility Subcommittee, Quality Assurance Committee, Government Relations Committee, Strategic Planning Committee, and Workforce Development Committee.
12. Zhang S. Missouri Biosecurity Working Group
13. Zhang S. Missouri Council on Captive Wild and Exotic Animals.
14. Zhang S. USDA NAHLN Antimicrobial Resistance Working Group, Technical Working Group.

VMDL Faculty Scholarly Activities

Grants and Contracts

New Grants and Contracts

1. **Evans TJ** (Co-I), **Gull T** (Co-I), Lucy M (PI). Uterine microbiome: Functional significance in establishing the uterine program postpartum. NIH (1R01HD092254-01A1), \$1.6 million (Direct: \$720,000, Indirect: \$880,000). 10% Shared Credit, 0.5% FTE. 07/01/2018 – 06/30/2023.

2. **Kim DY** (Co-PI), Middleton J (PI). Fetal Lamb Tracheal Occlusion, CHILDRENS MERCY HOSPITAL. Total: \$47,944. 15% Shared Credit, 1% FTE, March to September, 2018.
3. **Kuroki K** (Co-I), Cook JL (PI). Canine THA Study. ARTHREX, INC. \$110,517 (Direct \$76,855, Indirect \$33,662), 10% Shared Credit, 5% FTE, 06/20/18 – 06/19/19.
4. **Kuroki K** (Co-I), Cook JL (PI). Pivotal Anchor Study: Supplement VI. ARTHREX, INC., \$28,771 (Direct \$15,114, Indirect \$8,313), 20% Shared Credit, No FTE, 01/01/18 – 12/31/18.
5. **Kuroki K** (Co-I), Stannard JP (PI). A biologic joint replacement strategy to treat patients with post-traumatic osteoarthritis – Expansion. DOD (W81XWH1810430), \$1,989,044 (Direct \$1,302,402, Indirect \$686,642), 2% Shared Credit, 5% FTE, 01/09/18 – 08/31/21.
6. **Kuroki K** (Co-I), Cook JL (PI). Comparison of scaffolds for augmentation of partial rotator cuff tears in a canine model. ARTHREX, INC., \$348,872 (Direct: \$259,665, Indirect \$89,207), 15% Shared Credit, 1% FTE. 10/01/18-09/30/19.
7. **Rottinghaus GE**. Analytical Core Research Sample Testing. (\$210,000), 2018
8. **Zhang MZ** (Co-PI), Almasri M (PI). Smart Biosensing technology for Simultaneous Detection of Multiple Waterborne Pathogens in Drinking Water Sources, Black and Veatch. \$150,000 (No Indirect), 40% Shared Credit, 12/2017 – 06/2019.
9. **Zhang S** (PD). NAHLN Level 1 Lab Agreement. USDA (17-9419-0159), \$328,000 (Direct: \$29520, Indirect: \$3,280), 07/01/2018 – 06/30/2019.
10. **Zhang S** (PI). CVM Vet-LRN Vet Diagnostic Lab Program Supplement. FDA (A3U18FD005179-05S1), \$5,000. 09/01/2018 – 08/31/2019.
11. **Zhang S** (PI). Whole Genome Sequencing For the Detection of Antimicrobial Resistance Genes – CVM Vet LRN Capacity Development. FDA1U (18FD006460-01), \$119,350 (Direct: \$104,470, Indirect: \$14,880), 07/01/2018 – 06/30/2019.
12. **Zhang S** (PI), **Johnson GC** (Co-PI), **Evan, TJ** (Co-PI). CVM Vet-LRN Vet Diagnostic Lab Program. FDA (5U18FD005179-05). \$16,500 (Direct: \$15,500, Indirect: \$1,500), 09/01/2018 – 08/31/2019.
13. **Zhang MZ** (PD) and **Kim DK** (Co-PD). Chronic Wasting Disease Diagnosis and Surveillance. Missouri Department of Conservation, \$358,700, 07/01/2018 – 06/30/2019.

Existing Active

1. **Evans TJ** (Co-I). Online multi-leveled veterinary biomedical science and technology: undergraduate and graduate. 2020 Vision for Excellence, Mizzou Online. \$100,000. 0% to VMDL.
2. **Kuroki K** (Co-I), Hung C (PI) (Cook JL Consortium PI). Local Dexamethasone Delivery for Osteochondral Grafting. Musculoskeletal Transplant Foundation, \$102,368 (Direct \$85,307, Indirect \$17,061), 20% Shared Credit, 1% FTE, 02/01/16 – 01/31/18.
3. **Kuroki K** (Co-I), Hung C (PI) (Cook JL Consortium PI). NIH/NIAMS (5R01AR068133-03), \$239,810 (Direct \$156,228, Indirect \$83,582), 10% Shared Credit, 5% FTE, 05/16/16-04/30/18.

4. **Kuroki K** (Co-I), Lee CH (PI) (Cook JL Consortium PI). Seamless healing of avascular meniscus tears by stem cell recruitment. NIH/NIAMS (1R01AR071316-01A1), \$239,281 (Direct \$155,883, Indirect \$83,398), 5% Shared Credit, 2% FTE, 09/06/17 – 06/30/21.
5. **Wiedmeyer CE** (Co-I), Johnson PJ (PI), Martinez-Lemus, LA (Co-I). Role of an Endothelial Glycocalyx in Equine Health and Disease. USDA Animal Health Formula Funds, \$8,000, No indirect costs. 4% Shared Credit, 10/1/2017 – 09/30/2018.

Publications

Published

1. Abdullah A, Dastider SG, Jasim I, **Shen Z**, Yuksek N, **Zhang S**, Dweik M, and Almasri M. Microfluidic based impedance biosensor for pathogens detection in food products. Electrophoresis. doi: 10.1002/elps.201800405. 2018.
2. Amselle M, Bodeis-Jones S, Delmonte P, **Zhang S**, Davidson M, Gulland F, Chizhikov V, and Volokhov D. *Neisseria zalophi* sp. nov., isolated from oral cavity of California sea lions (*Zalophus californianus*). Archives of Microbiology. 200(5): 819-828, 2018.
3. An SJ, Kim DY, Ahn SM, Jung DI, Hwang TS, Lee HC, Lee JH, and Yu DH. Primary salivary gland adenocarcinoma in a dog. J. Vet. Clinics. 35(6): 308-310, 2018.
4. Balcomb CC, Angelos JA, Chigerwe M, Byrne BA, Lane VM, Wetzlich SF, Sahin O, Holler L, **Zhang S**, Tell LA. Comparative pharmacokinetics of two florfenicol formulations following extravascular administration in sheep. Am. J. Vet. Res. 79(1):107-114, 2018.
5. Beyer WN, **Casteel SW**, Friedrichs KR, Gramlich E, Houseright RA, Nichols JR, Karouna-Renier NK, **Kim DY**, Rangen KL, Rattner BA, and Schultz SL. Biomarker responses of *Peromyscus leucopus* exposed to lead and cadmium in the Southeast Missouri Lead Mining District. Environ Monit Assess. 190(2):104, 2018.
6. Brimmo OA, Bozynski CC, Cook CR, **Kuroki K**, Sherman SL, Pfeiffer FM, Stoker AM, Cook JL. Subchondroplasty for the treatment of post-traumatic bone marrow lesions of the medial femoral condyle in a pre-clinical canine model. J Orthop. Res. 36:2709-2717, 2018.
7. Buttrum L, Ledbetter L, Cherla R, Zhang Y, **Mitchell WJ**, Zhang G. Both Major Histocompatibility Complex Class I (MHC-I) and MHC-II Molecules Are Required, while MHC-I Appears To Play a Critical Role in Host Defense against Primary *Coxiella burnetii* Infection. Infect. Immun. 22;86(4), 2018.
8. **Fortin JS**, **Royal AB**, **Kuroki K**. Concurrent thoracic mesothelioma and thyroid c-cell adenoma with amyloid deposition in an aged horse. Vet. Med. Sci. 4:63-70, 2018.
9. **Fortin JS**, Shomper J, **Williams F**, and **Royal AB**. What is your diagnosis? Nasopharyngeal mass in a mixed breed dog. Vet. Clin. Pathol. 47: 320-321, 2018
10. Franco LT, Petta T, **Rottinghaus GE**, Bordin K, Gomes GA, Oliveira C. Co-occurrence of mycotoxins in maize food and maize-based feed from small-scale farms in Brazil: a pilot study. Mycotoxin Research <https://doi.org/10.1007/s12550-018-0331-4>, 2018.

11. Franklin SP, Stoker AM, Bozynski CC, **Kuroki K**, Clarke KM, Johnson JK, and Cook JL. Comparison of Platelet-Rich Plasma, Stromal Vascular Fraction (SVF), or SVF with an Injectable PLGA Nanofiber Scaffold for the Treatment of Osteochondral Injury in Dogs. *J. Knee Surg.* 31:686-697, 2018.
12. Gersoff WK, Bozynski CC, Cook CR, Pfeiffer FM, **Kuroki K**, and Cook JL. Evaluation of a Novel Degradable Synthetic Biomaterial Patch for Augmentation of Tendon Healing in a Large Animal Model. *J. Knee Surg.* doi:10.1055/s-0038-1646930, 2018.
13. Gosselin VB, **Kim DY**, Nagy DW, Shoemake BM, **Shaw DP**, **Royal AB**, **Evans TJ**, Middleton JR. Immune complex glomerulonephritis of suspected iatrogenic origin in five Japanese Black calves. *J. Vet. Med. Sci.* 80(5):823-828, 2018.
14. Gosselin VB, Dufourb S, **Zhang MZ**, Middleton JR. Sensitivity and specificity of a competitive ELISA using frozen-thawed milk or serum for the diagnosis of small ruminant lentivirus infection in goats using a Bayesian latent class model. *Small Ruminant Research* 167:29-31, 2018.
15. Grigby K, Kovarik CM, **Rottinghaus GE**, Booth FW. High and low nightly running behavior associates with nucleus accumbens N-Methyl-D-aspartate receptor (NMDAR) NR1 subunit expression and NMDAR functional differences. *Neuroscience Letters* 671:50-55, 2018.
16. Guess TM, Razu SS, **Kuroki K**, and Cook JL. Function of the anterior intermeniscal ligament. *J. Knee Surg.* 31:68-74, 2018.
17. Kenyon SL, Roberts CA, Kallenbach RL, Lory JA, Kerley MS, **Rottinghaus GE**, and Hill NS, and Ellersieck MR. Vertical distribution of ergot alkaloids in the vegetative canopy of tall fescue. *Crop Sci.* 58(2):925-931, 2018.
18. Lacey CA, **Mitchell WJ**, Dadelahi AS, and Skyberg JA. Caspases-1 and caspase-11 mediate pyroptosis, inflammation, and control of Brucella joint infection. *Infect Immun.* IAI.00361-18. doi:10.1128/IAI.00361-18, 2018.
19. **Landers BR**, Muraroli RA, Brand LM, Kobashigawa EH, Ledoux DR, **Kim DY**, **Evans TJ**, and **Rottinghaus GE**. Changes in porcine growth, biochemical parameters, histopathology, and melamine residue levels in tissues induced by consumption of melamine and cyanuric acid. *Animal Husbandry, Dairy, and Veterinary Science* 2(1):1-10, 2018.
20. Maitz CA, Brockman JD, **Yang M**, **Zhang S**, Stannard J, Volgas D, Gahl JM. Demonstration of the bactericidal effects of the boron neutron capture reaction. *Applied Radiation and Isotopes* 137:190-193, 2018.
21. Martin LM, Bukoski A, Whelchel D, **Evans T**, **Wiedmeyer CE**, and Johnson P. Pharmacokinetics of intravenous lithium chloride and agreement between two methods of lithium measurement in horses. *Equine Veterinary Journal* 50:4; 537-543, 2018
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25. **Royal AB** and Jochems B. What is your diagnosis? Tongue lesion in a Great Horned Owl. *Vet. Clin. Pathol.* 47: 505-506, 2018. doi:10.1111/vcp.12616
26. **Shen Z, Zhang MZ**, Stitch RW, **Mitchell WJ** and **Zhang S**. Development of a tickborne pathogens QPCR panel for detection of *Anaplasma*, *Ehrlichia*, *Rickettsia*, and Lyme Disease *Borrelia* for animal patients. *J. Microbiol. Meth.* 151:83-89, 2018.
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29. Stoker AM, Stannard JP, **Kuroki K**, Bozynski CC, Pfeiffer FM, and Cook JL. Validation of the Missouri Osteochondral Allograft Preservation System for the maintenance of osteochondral allograft quality during prolonged storage. *Am. J. Sports Med.* 46:58-65, 2018.
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32. **Yang M, Zhang C, Zhang MZ**, and **Zhang S**. Beta-defensin derived cationic antimicrobial peptides with potent killing activity against gram negative and gram positive bacteria. *BMC Microbiology* 18:54, 2018. doi:10.1186/s12866-018-1190-z

In Press:

1. Asokan V, Kerl ME, Harmon MR, **Evans TJ**. Novel route of exposure to organophosphates in small animals. *JVECC*. Accepted in 2018.
2. Collister JP, Nahey DB, **Wiedmeyer CE**, Banek CT, and Osborn JW. Lesion of OVLT markedly attenuates chronic deoxycorticosterone acetate (DOCA) salt hypertension in the rat. *Am J Physiol Regul Integr Comp Physiol*. Accepted in 2018.
3. **Johnson GC, Fales WH**, Shoemake BM, Adkins PR, Middleton JM, **Williams III F, Zinn M, Mitchell WJ**, and Calcutt MJ. An outbreak of *Mycoplasma mycoides* subspecies *capri* arthritis in young goats: a case study. *JDVI*. Accepted in 11/2018

4. Kenyon SL, Roberts CA, Kallenbach RL, Lory JA, Kerley MS, **Rottinghaus GE**. Ergovaline concentration of tall fescue as affected by limestone application. *Crop, Forage & Turfgrass Management*. Accepted in 2018.
5. Rodrigues RoO, Rodrigues RiO, Ledoux DR, **Rottinghaus GE**, Borutova R, Averkieva O, and McFadden TB. Toxy-Nil and UnikePlus reduce aflatoxin M1 levels in milk of lactating dairy cows fed aflatoxin B1. *Dairy Science* 2018. Accepted in 2018.

Submitted

1. Bax, E, Cochran, K, Mao, J, **Wiedmeyer, CE**, and Rosenfeld, C. Opposing Effects of S-equol Supplementation on Metabolic and Behavioral Parameters in Mice Fed a High Fat Diet. *Nutrition Research*. Submitted in 2018.
2. Fernandez, A and **Rottinghaus GE**. Carryover of dietary aflatoxin B1 to matrinxã (*Brycon cephalus*) fish tissues and effects on performance. *PLOS ONE*. Submitted in 2018.
3. Kenyon SL, Roberts CA, Kallenbach RL, Lory JA, Kerley MS, **Rottinghaus GE**, and Young CA. Comparison and diet preference of novel endophyte-infected tall fescue cultivars. *Crop Science*. Submitted in 2018.
4. Kolicheski A, Levine C, O'Brien DP, Wenger DA, Johnson GS, and **Johnson GC**. β -mannosidosis in mixed-breed sibling dogs has intermediate phenotype between β -mannosidosis in ruminants and in humans or mice. *Vet Pathology*. Submitted in 2018.
5. Li Y, Mahloch NW, Starkey NJE, Pena-Luna M, **Rottinghaus GE**, Fritsche KL, Besch-Williford C, and Lubahn DB. 3,3'-Diindolylmethane dose-dependently prevents advanced prostate cancer. *Cancer Research*. Submitted in 2018.
6. Moore SG, Ericsson AC, Behura SK, Lamberson WR, Smith MF, **Evans TJ**, McCabe MS, Pook SE, and Lucy MC. Concurrent and long-term effects of endometrial microbiota on the endometrial transcriptome in postpartum dairy cows. *Biology of Reproduction*. Submitted in 2018.
7. Ponzilacqua B, **Rottinghaus GE**, Landers BR, and Oliveria CAF. Effect of medicinal herb extracts and Brazilian traditional plants on in vitro mycotoxin detoxification. Submitted in 2018.
8. **Yang M, Zhang C, Hansen SA, Mitchell WJ, Zhang MZ, and Zhang S**. Antimicrobial efficacy of novel CAMPs against *P. aeruginosa* infection in a murine skin wound infection model. *J. Antimicrobial Chemotherapy*. Submitted in 2018.
9. **Zhang C, Yang M, Fales WH, Zhang MZ, Shaw DP, and Zhang S**. Serovar distribution and antimicrobial resistance profile of *Salmonella enterica* isolated from avian diagnostic samples between 2010 and 2016. *Avian Diseases*. Submitted in 2018.

Book Chapters

Published

1. **Evans TJ**, Rottinghaus GE, Landers BR. Mycotoxins. In Smith BP (ed): *Large Animal Internal Medicine*, 6th edition. St. Louis, Mosby. Submitted in 2018.
2. **Evans TJ**. Reproductive toxicity and endocrine disruption. In Gupta, RC (ed): *Veterinary*

Toxicology: Basic and Clinical Principles, 3rd edition, p 271. New York, Academic Press/Elsevier, Inc., 2018.

3. Gupta RC, **Evans TJ**, Nicholson SS. Ergot and fescue toxicosis. In Gupta, RC (ed): Veterinary Toxicology: Basic and Clinical Principles, 3rd edition, p 995. New York, Academic Press/Elsevier, Inc., 2018.
4. Mostrom, M, **Evans TJ**. Phytoestrogens. In Gupta, RC (ed): Veterinary Toxicology: Basic and Clinical Principles, 3rd edition, p 817. New York, Academic Press/Elsevier, Inc., 2018.
5. **Wiedmeyer CE** (100% Contribution) "Evaluation of hepatic function and injury" Clinical Chemistry of Laboratory Animals – 3rd Edition. Editors: Greg Travlos, Judith Prescott, David Kurtz.

In Press and Submitted

1. **Evans TJ**, Gupta RC. Tremorgenic mycotoxins. In Gupta, RC (ed): Veterinary Toxicology: Basic and Clinical Principles, 3rd edition, p 1033. New York, Academic Press/Elsevier, Inc., 2018 (Tentative).
2. **Whitney MS**, Coates JR: Cerebrospinal fluid analysis in the dog and cat, in Veterinary Cytology, Sharkey LC, Radin MJ, Seelig D, eds. Hoboken, New Jersey: John Wiley and Sons. (Final revisions submitted in 01/2018; in press).

Scientific Presentations

1. **Evans T**. How to determine what killed the horse. Missouri Veterinary Medical Association Annual Meeting, January 18 to 21, 2018, Columbia, MO.
2. **Evans T**. Ergot alkaloids: the animal side of things. MU Extension In-Service. February, 2018.
3. **Evans T**. The impact of mycotoxins on gut health. Equine Gut Health Conference, Texas A&M University, October 13, 2018, College Station, TX.
4. Bryan J and **Johnson GC**. F-18-FDG PET scan predicts regions of highest mitotic activity in high grade soft tissue sarcomas. Veterinary Cancer Society Conference, October 19, 2018, Louisville KY.
5. Coates JR, Muzur C, Swaayze E, **Johnson GC**, Vensteenkiste D, Bibi KF, Lim S, Bennett F, and Miller TM. Antisense oligonucleotide therapy targeting SOD1 for the treatment of canine degenerative myelopathy: a disease model of ALS. International symposium on ALS/MD, Dec 7-9 2018, Glasgow, Scotland.
6. Gooch, SA, Shoemake, CR, Han, X, and **Wiedmeyer, CE**. Cryopreservation of body cavity fluids for diagnostic cytology. National Veterinary Scholars Symposium, August 2 to 4, 2018, College Station, TX.
7. **Ierardi RA** and **Johnson GC**. Pineocytoma in an aged female mule. 61st AAVLD, Oct 20-22. Kansas City MO.
8. Kolicheski A, Levine C, O'Brien D, Johnson GS, and **Johnson GC**. Beta-mannosidosis in mixed-breed sibling dogs. American College of Veterinary Pathologists, Nov 3-5 2018, Washington DC.
9. **Kuroki K**. A canine case of intestinal echinococcosis in Missouri, USA. 61st AAVLD/USAHA Annual Meeting, Oct. 18-22, 2018, Kansas City, MO.

10. **Kuroki K.** Alveolar echinococcosis in a pet dog in Missouri. Abstract #D-27. 74th ACVP/ASVCP Concurrent Annual Meeting, Nov. 3-7, 2018, Washington DC.
11. **Kuroki K.** Histologic Evaluation of ACL and Synovium in dogs to delineate the roles of vascularity and synovitis in ACL degeneration. 18th Annual Comparative Orthopaedics Day, Apr 6, 2018, Columbia, MO.
12. Maitz CA, Brockman JD, **Shen Z, Zhang S,** Stannard J, Volgas D, and Gahl JM. Initial safety and efficacy of the boron neutron capture reaction in treating local infections on implanted medical devices. ACVR. October 14-19, 2018, Fort Worth, TX.
13. Mak CE, **Kim DY, Odemuyiwa SO,** and **Evans TJ** (Presenter). A retrospective study of the cause of spontaneous bovine abortions and stillbirths in Missouri between 2004 and 2015. 61st AAVLD. October 18 – 24, 2018, Kansas City, MO.
14. Mitchell NM, Pastrana-Negron A, Mohamed A, Reddy PG, and **Odemuyiwa SO.** 2018. Surveillance and characterization of equine Hepaciviridae in east Alabama herds. NSF Emerging Researchers National Conference in STEM, February 13, 2018, Washington, DC.
15. **Rothacker T, Royal AB, Kim DY,** and Bryan J. Coelomic fluid from a snake (neoplastic effusion; ovarian sex cord stromal tumor). ACVP/ASVCP Annual Meeting, November 3-7, 2018, Washington DC.
16. Shahzad S, Hoffman K, **Shen Z,** Straka K, Daugherty E, Thompson D, **Zhang MZ, Mitchell WJ, Zhang S,** and Stich RW. Detection of pathogens associated with different tick species collected from elk in Missouri. CRWAD, November 30-December 5, 2018, Chicago, IL.
17. **Shaw DP.** Appropriate samples for lab analysis. Layer Health Management School, St. May 14-15, 2018, Paul, MN.
18. **Shaw DP.** Appropriate samples for lab analysis. Broiler-Turkey Health Management School, May 14-15, 2018, St. Paul, MN.
19. **Shaw, DP.** Campylobacter infection and its impact on poultry. Merck Animal Health 2nd Commercial Layers and Egg Production Summit, December 11-12, 2018 Clearwater, FL.
20. **Shaw, DP.** Identification of egg layer diseases. Mid-America Organic Association, January 31, 2018, Independence, MO,
21. **Shen Z, Zhang MZ, Kim DY, Mitchell WJ,** and **Zhang S.** Development and validation of a Taqman real-time PCR for the detection of *Neospora caninum* in bovine abortion samples. AAVLD. October 18 -22, 2018. Kansas City, MO.
22. **Shoemake C** and **Royal AB.** BAL fluid from a dog (pneumocystosis). ACVP/ASVCP Annual Meeting, November 3-7, 2018, Washington DC.
23. Van Kan, T. and **Odemuyiwa, SO.** 2018. Monitoring for arboviruses in mid-Missouri by local tick sampling and viremia in domestic and wild animals. National Veterinary Scholars Symposium. August 2-4, 2018. Texas A&M University.
24. **Young C, Shen Z, Zhang S,** and **Zhang MZ.** A retrospective study of the prevalence of leptospirosis in Missouri animal populations. 61st AAVLD. October 18 -22, 2018, Kansas City, MO.

25. **Zhang C, Yang M, Gull T, Zhang MZ, Zhang S.** Serovar distribution and antimicrobial susceptibility of *Salmonella enterica* isolated from equine diagnostic specimens between 2010 and 2017. 61st AAVLD. October 18 -22, 2018, Kansas City, MO.

Extension/Outreach/Engagement Presentations

1. **Evans T.** Four visits to Columbia Public Schools in 2018 to talk about household items toxic to pets
2. **Evans T.** What killed the cow? Webster County Extension Meeting, Marshfield, MO. January, 2018.
3. **Evans T.** What killed the cow? Stone County Extension Meeting, Crane, MO. March, 2018
4. **Evans T.** Nitrate poisoning. Two Drought Survival Meetings during August of 2018.
5. **Evans T.** Four days of science presentations at Missouri State Fair, Sedalia, MO, September of 2018.
6. **Williams III, F.** Why do necropsies? Pre-vet Club. Vet School: Pre-vet Club. February, 2018, Columbia, MO
7. **Williams III, F.** Zoo Animal Pathology. Zew Club/Comparative Pathology Club. Adams Conference Center: Zew Club/Comparative Pathology Club. January, 2018. Columbia, MO
8. **Williams III, F.** Broken Hearts (Cardiac Pathology). Comparative Pathology Club. Columbia, MO: Comparative Pathology Club. February, 2018. Columbia, MO

Faculty Awards

1. Evans T. Harrison Kaplan Online Graduate Teaching Award
2. Wiedmeyer C. Golden Aesculapius Award for VM-2

Major Annual Professional Meetings and Trainings

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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. Missouri Veterinary Medical Association (MVMA) Annual Meeting and District Meetings
 7. Missouri Biosecurity Working Group Quarterly Meetings
 8. Missouri Captive Wild Animal Health Meetings
 9. US Animal Health and AAVLD Government Relations Meeting
 10. Vet-LIRN (Veterinary Laboratory Investigation and Response Network) Monthly Conference Calls
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