



ANNUAL REPORT

MONTANA DEPARTMENT OF LIVESTOCK
Montana Veterinary Diagnostic Laboratory

Mission Statement

To serve the State of Montana by providing high quality, accurate, financially accessible and timely veterinary diagnostic testing, results and consultation; to assist state animal health officials in the diagnosis, control, and prevention of animal disease; and to contribute to state and national efforts to protect both animal and public health.



FISCAL YEAR

July 1, 2019 through June 30, 2020

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Fig. 1—Sheep (Pexels.com)

Lab Director's Statement

The 2020 fiscal year was highlighted by a significant amount of change at the Montana Veterinary Diagnostic Lab (MVDL). These changes included the hiring of new professional veterinary and lab technician staff, equipment upgrades in multiple lab sections, adjustments to testing service fees, and the addition of flat rate shipping services for our clients through the United Parcel Service.

In September, 2019 we welcomed Dr. Jonathon Sago to the MVDL as our second board certified veterinary pathologist. Dr. Sago has been an excellent addition to our professional staff and provided a much needed increase in our pathology services operational throughput. Dr. Erika Schwarz joined the MVDL in April 2020 and assumed personnel management and technical oversight of our microbiology service areas which include the Microbiology, Molecular Diagnostics, Serology, and Virology lab sections. Dr. Schwarz has hit the ground running and has already made a significant positive impact on our service offerings.

Heading into FY2021, we are poised to expand on our diagnostic services. The diagnostic equipment we secured in FY2020 is expected to enable us to begin testing for Chronic Wasting Disease (CWD) on behalf of Montana Fish Wildlife and Parks during the fall hunting season. We are pleased to perform these testing services for Montana hunters going forward.

In FY2020, the MVDL experienced an approximate 3% decrease in overall testing numbers relative to 2019. A decrease in annual Brucella testing represented 86% of the decrease, likely a result of challenges associated with a transition in the primary screening assay for the Brucellosis surveillance program during the peak testing season. This report contains a summary of test data from all sections of the Montana Veterinary Diagnostic Laboratory with the exception of the milk laboratory section.

As we head into FY2021, we will continue to look at opportunities to further expand our services on behalf of Montana veterinarians. Central to that mission will be a focus on the quality and timeliness of our testing services as well as the usability of our client web portal for the purposes of electronic sample information submission and access to test reports. We would like to thank our clients for their continued business and look forward to serving your diagnostic testing needs in the future.

Sincerely,



Gregory Juda, PhD
Lab Director
Montana Veterinary Diagnostic Laboratory

DIAGNOSTIC LAB STAFF FY2020

Administration

Gregory Juda, PhD..... Lab Director
Steve Smith, DVM, DACVPLead Veterinary Pathologist
Jonathon Sago, DVM, DACVP Veterinary Pathologist
Erika Schwarz, DVM, MPH, PhD Veterinary Microbiologist

Administrative Support

Tess Moore..... Quality Manager
Cathy Ortega Front Office
Michelle Reynolds Front Office
Lauren Larios..... Pathology/Administrative Assistant

Clinical Pathology

Cecilia Esparza, CLSClinical Laboratory Technologist
Katie Arenas Technician

Histology

Dan Zou, PhD..... Technician

Microbiology

Kaylee Krantz..... Technician
Colleen Matzke, MS Technician

Milk Laboratory

Julie Armstrong Technician
Erin Burns Technician

Molecular Diagnostics

June Pounder, PhD Technician
Aracely Ospina-Lopez, MS Technician

Serology

Antonio Fuentes Sanchez Technician
Diana Durnal Technician

Virology

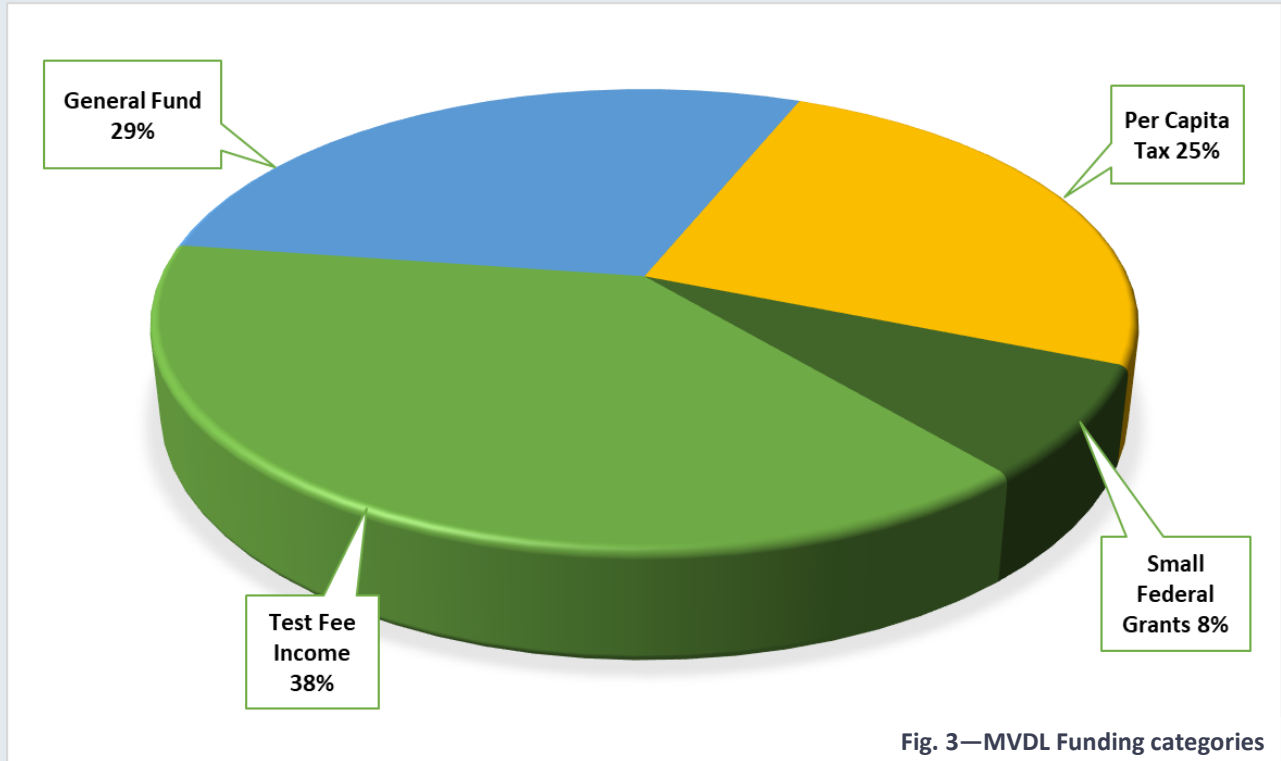
Sarah Horak..... Technician
Bryan Tegner Jacobson Technician

Fig. 2—Stacked Rocks (Pexels.com)

BUDGET AND FUNDING

Montana Veterinary Diagnostic Laboratory (MVDL) is funded by multiple sources including fee income from tests performed, Montana State General Funds, Montana State Special Revenue (livestock head tax), and federal grant funds. Fee income of approximately 50% is typical for state-run diagnostic test laboratories across the country.

Although a substantial portion of MVDL’s budget is supplied by fee income, the State of Montana, the livestock industry, and the National Animal Health Laboratory Network (NAHLN) are also significant contributors to funding annual lab operations and allow the laboratory to better fulfill our mission and serve Montana. The following graph and table detail the sources and amounts contributed to our operational budget for FY2020.



2020 Fiscal Year Lab Funding Sources	
Test Fee Income	\$1,185,113
General Fund	\$890,521
Per Capita Tax	\$770,373
Small Federal Grants	\$240,027
Total Operational Budget	\$3,086,033

NAHLN MEMBER LAB

Montana Veterinary Diagnostic Lab (MVDL) is a member of the National Animal Health Laboratory Network (NAHLN), a nationwide consortium of animal diagnostic labs coordinated by the US Department of Agriculture. The purpose of NAHLN is to support US animal agriculture by supporting early detection, rapid response, and appropriate recovery from high-consequence animal diseases.

As a member lab, the MVDL receives federal grant money on an annual basis to support the purchase of critical infrastructure including equipment, training, and/or supplies. This funding has been critical to MVDL operational capabilities via the purchase of equipment utilized within the Molecular Diagnostics and Pathology lab sections and most recently for chronic wasting disease testing. The MVDL has the capability to perform NAHLN testing for eight different high impact animal diseases including:

- ◆ Foot and Mouth Disease
- ◆ Classical Swine Fever
- ◆ Vesicular Stomatitis
- ◆ Avian Influenza (IAV-A)
- ◆ Swine Influenza (IAV-S)
- ◆ Pseudorabies
- ◆ Newcastle Disease (Avian Paramyxovirus)
- ◆ African Swine Fever

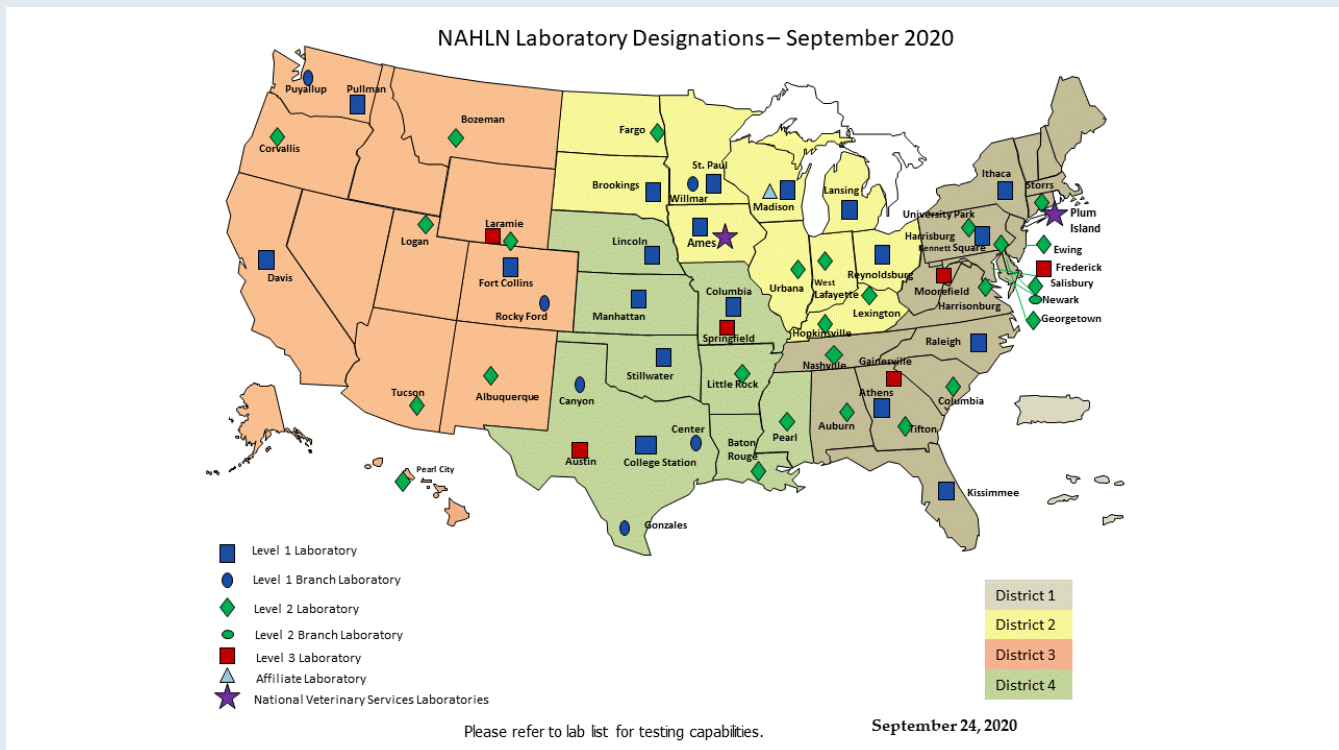
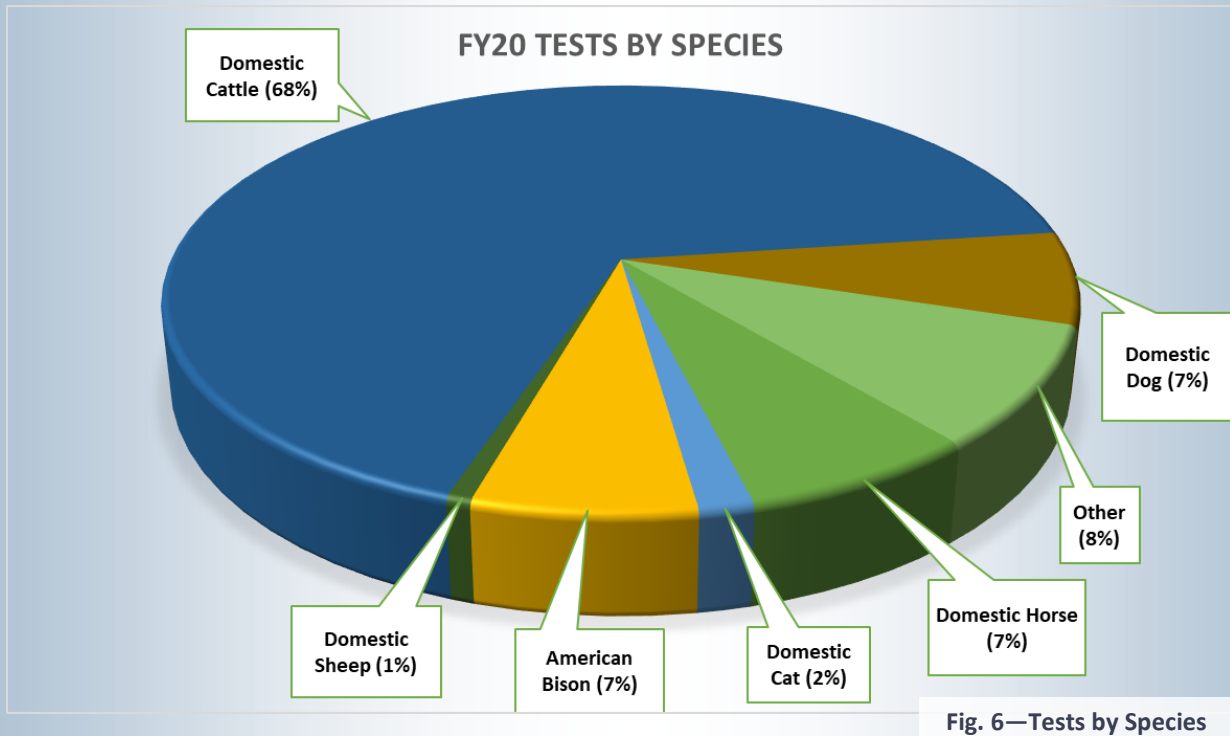
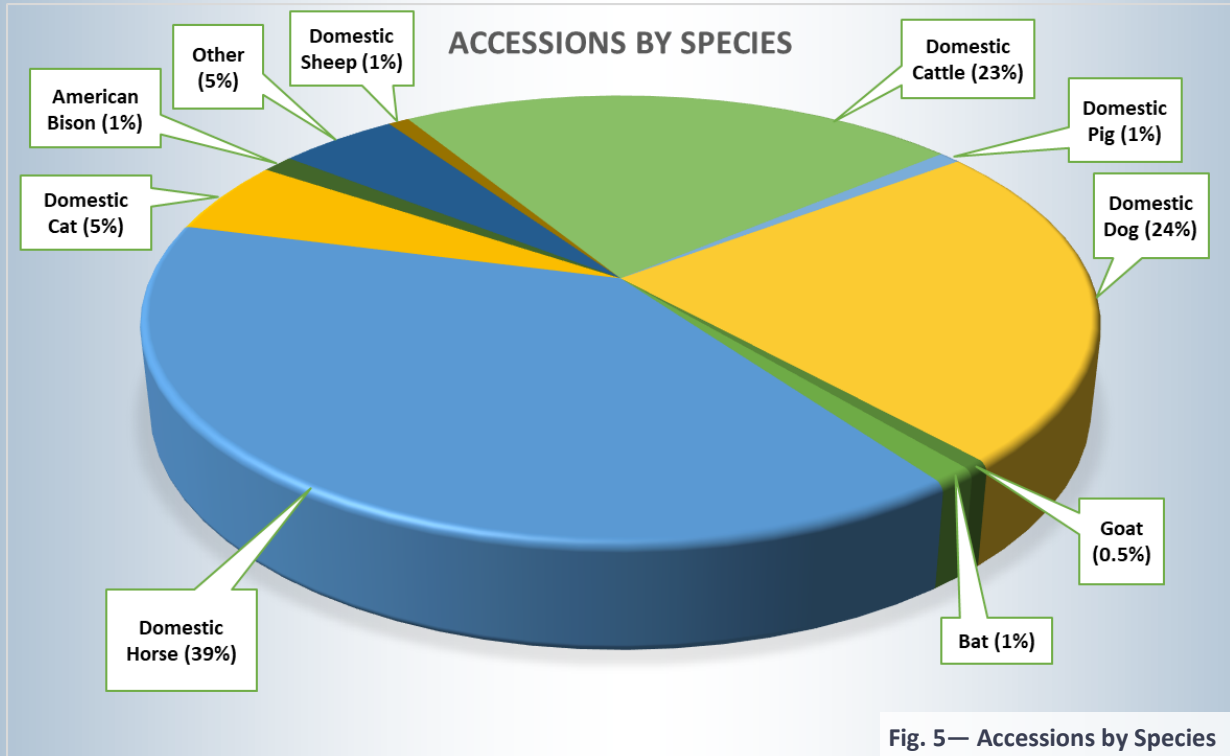


Fig. 4—NAHLN map (USDA)

ACCESSION AND TESTING DEMOGRAPHICS FY20

An accession is a specimen or group of specimens from either a single animal or a herd, belonging to one owner, from a single submitter. Accessions are sometimes referred to as cases. Multiple individual tests may be performed on a single accession or specimen. The following graphs represent the percentage of accessions and total tests performed by species with domestic cattle representing the highest percentage of our testing.



A C C E S S I O N A N D T E S T I N G D E M O G R A P H I C S

The Montana Veterinary Diagnostics Lab (MVDL) performed approximately 192,000 total diagnostic tests in FY2020, which is a slight decline relative to the total number of tests performed in the two years prior. An additional 1,943 tests were referred out to other laboratories for services that aren't currently offered by the MVDL.

FY2020 Total Number of Accessions and Test Data:

Species	Accessions	Tests
Domestic Cattle	3,811	129,930
Domestic Horse	6,564	13,815
Domestic Dog	3,962	13,444
Other	806	15,457
American Bison	212	12,887
Domestic Cat	897	3,169
Domestic Sheep	142	1,417
Goats	109	912
Domestic Pig	146	562
Bat	198	399
Total	16,847	191,992

Total Referrals Sent to Other Laboratories: 1,943

Historical Accessions and Testing Data:

	2018	2019	2020
Total Accessions	20,824	20,260	16,847
Total Tests	199,619	198,305	191,992

F Y 2 0 R A B I E S S U M M A R Y

One critical public health function of the Montana Veterinary Diagnostic Laboratory (MVDL) is rabies testing within the State of Montana. During Fiscal Year 2020, 17 bats and two skunks tested positive. The majority of rabies testing in bats and identification of positive samples occurs during warmer months, when bats are more active. Causes of an unsuitable test result typically involve lack of an appropriate anatomic test sample (brain stem and cerebellum) or decomposition of the tissue to be tested.

Species	Positive	Negative	Unsuitable	Total
Bat	17	175	15	207
Black Bear	0	1	0	1
Coyote	0	2	0	2
Domestic Cat	0	85	2	87
Domestic Cattle	0	10	4	14
Domestic Dog	0	132	0	132
Domestic Goat	0	3	0	3
Domestic Horse	0	4	0	4
Domestic Sheep	0	3	0	3
Fox	0	1	0	1
Mountain Lion	0	1	0	1
Mouse	0	1	0	1
Muskrat	0	3	1	4
Rabbit	0	1	0	1
Raccoon	0	19	2	21
Richardson's Ground Squirrel	0	2	0	2
Squirrel	0	1	0	1
Skunk	2	11	0	13
Vole	0	1	0	1
Total	19	456	24	499



Fig. 7—Bat (MT FWP)

FY20 BRUCELLA SUMMARY

Several of our highest volume tests are for *Brucella abortus*, and these also serve our public health mission. The following table represents the five highest volume *Brucella* tests performed by the Montana Veterinary Diagnostic Laboratory (MVDL). In FY2020, the MVDL performed 95,278 tests for *Brucella abortus* which represented approximately 50% of the MVDL’s total testing volume.

During the peak of the testing season (Oct-Dec) in FY20, the MVDL was forced to transition all screening testing from the rapid automated presumptive test (RAP) to the fluorescent polarization assay (FPA) due to a disruption in the supply chain for the RAP antigen. Despite this transition, the dedicated staff in the MVDL Serology Lab was able to maintain the testing operations that are essential to the United States Department of Agriculture (USDA) and the Department of Livestock’s brucellosis surveillance program.

Tests by Month	RAP	FPA	BAPA	CF	Card
July	450	77	978	45	49
August	455	86	908	55	22
September	4610	326	266	68	11
October	10,557	6,809	519	65	7
November	0	25,513	305	108	28
December	0	17,656	666	131	46
January	0	7,631	316	80	32
February	0	1,432	589	86	14
March	0	1,818	955	125	50
April	0	1,623	927	126	15
May	0	5,014	571	136	28
June	0	2,126	667	84	17
Total Tests	16,072	70,111	7,667	1,109	319

- * RAP: Rapid Automated Presumptive Test
- * FPA: Fluorescent Polarization Assay
- * BAPA: Buffered Acidified Plate Antigen Test
- * CF: Complement-Fixation Test
- * Card: Standard Card Test

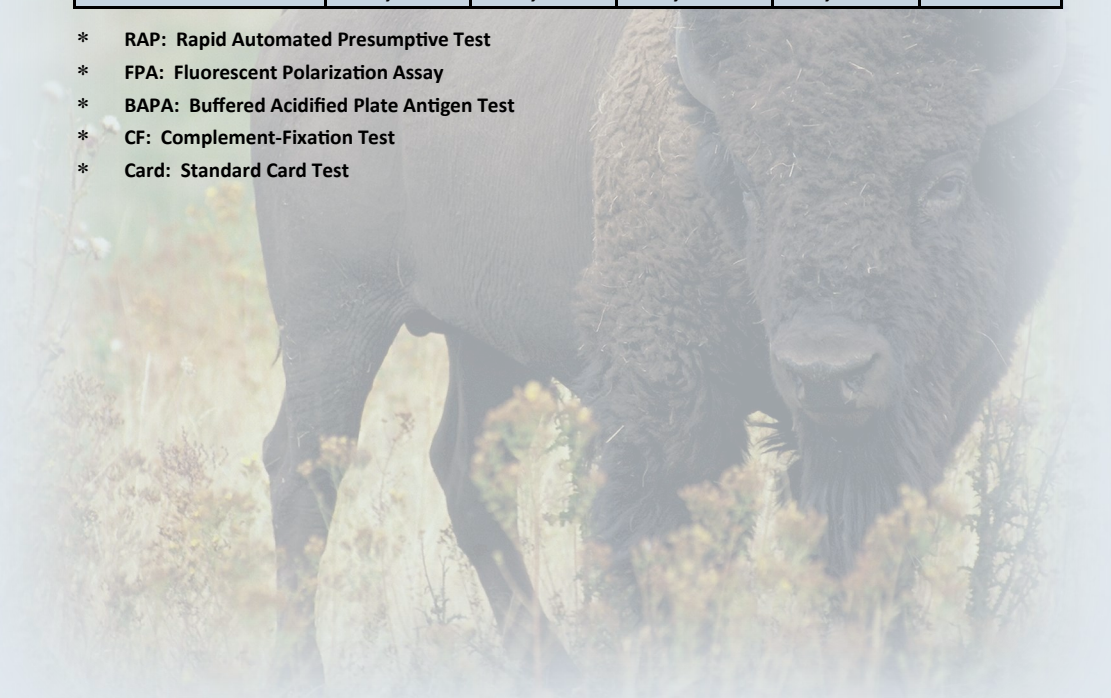


Fig. 8—Bison (Pexels.com)

P R O F I C I E N C Y T E S T I N G

Montana Veterinary Diagnostic Laboratory technicians perform routine proficiency testing as a means of maintaining compliance with applicable regulations and assuring the integrity of MVDL testing methods and personnel. The following table summarizes proficiency tests completed in FY2020.

FY2020 MVDL Proficiency Testing Participation	Section
African Swine Fever virus PCR	Molecular Diagnostics
Anaplasmosis cELISA	Clinical Serology
Antibiotic and Bacterial Enumeration	Milk Program
Avian Influenza virus PCR	Molecular Diagnostics
Avian Influenza virus AGID/ELISA	Clinical Serology
Bacterial Identification Terrestrial	Clinical Microbiology
Bluetongue Virus ELISA	Clinical Serology
Bovine Leukosis virus ELISA	Clinical Virology
Brucella canis Sero	Clinical Serology
Brucella ovis ELISA	Clinical Serology
Brucella abortus - SPT, BAPA, STT, CF, Riv, CARD, FPA	Clinical Serology
Chemistry Analysis	Clinical Pathology
Classical Swine Fever PCR	Molecular Diagnostics
Foot and Mouth Disease PCR	Molecular Diagnostics
Equine Infectious Anemia AGID	Clinical Serology
Electronic Messaging - FMD, PRV, ASF, CSF, IAV, VSV	Information Technology - VADDS
Endocrinology Analysis	Clinical Pathology
Feline Leukemia virus SNAP	Clinical Virology
Feline Coronavirus SNAP	Clinical Virology
Feline Immunodeficiency virus SNAP	Clinical Virology
Heartworm ELISA	Clinical Microbiology
Hematology Analysis	Clinical Pathology
Johnes ELISA	Clinical Serology
Johnes PCR, Direct, Individual	Molecular Diagnostics
Johnes PCR, Pooled	Molecular Diagnostics
Leptospira MAT	Clinical Virology
Parasitological Identification	Clinical Microbiology
Pseudorabies virus gB ELISA	Clinical Virology
Clinical Pathology Quality Control	Clinical Pathology
Rabies virus DFA	Clinical Virology
Salmonella PCR	Molecular Diagnostics
Salmonella Group D and Serotype	Clinical Microbiology
Urinalysis	Clinical Pathology
Urine Identification	Clinical Pathology
Vesicular Stomatitis virus PCR	Molecular Diagnostics
Vesicular Stomatitis virus CF	Clinical Serology
virulent Newcastle Disease virus PCR	Molecular Diagnostics



Fig. 9—AAVLD logo (AAVLD)



Fig. 10—VLA logo (VLA)

T E S T D A T A — S E R O L O G Y

Montana Veterinary Diagnostic Laboratory (MVDL) provides a comprehensive suite of serology test methods, the bulk of which serve to support the Brucellosis surveillance program managed by the Animal Health Bureau of the Department of Livestock and screening for Equine Infectious Anemia. The following table details the number of individual tests conducted in FY2019 and 2020 by test type.

Test Type	FY19	FY20
B. abortus FPA	7,299	69,681
B. abortus RAP	84,924	16,116
B. abortus BAPA	6,208	11,020
EIA AGID (total)	6,055	5,179
M. avium paratuberculosis ELISA	3,228	4,417
EIA ELISA (total)	1,641	1,723
Anaplasma cELISA	508	1,241
Brucella abortus/suis CF	1,137	1,090
Bluetongue ELISA	737	1,063
Salmonella Pullorum	75	735
B. ovis ELISA	685	594
B. abortus Card	566	328
EHD AGID	651	282
B. abortus STT (1:50)	254	174
CAE/OPP cELISA	79	174
Avian Influenza AGID	8	139
B. canis RSAT	121	101
B. abortus SPT (1:50)	190	18
B. abortus Rivanol	2	10
B. canis 2ME-RSAT	35	3
Total	114,403	114,088

T E S T D A T A — V I R O L O G Y

Montana Veterinary Diagnostic Laboratory (MVDL) provides a broad spectrum of virology related diagnostics. The following table details the number of individual tests conducted in FY2019 and FY2020 by test type.

Test Type	FY19	FY20
Bovine Viral Diarrhea Virus ELISA	1,793	2,052
Leptospira (5 Routine Serovars)	1,153	1,777
Bovine Herpesvirus 1 SN	725	1,069
Bovine Leukemia Virus ELISA	628	965
Bovine Viral Diarrhea Virus SN	548	956
Bovine Respiratory Syncytial Virus SN	354	847
Parainfluenza-3 HI	170	808
Rabies - Small Animal	478	472
Pseudorabies ELISA	215	252
Leptospira (7 Routine Serovars)	311	164
FeLV/FIV Combo Rapid Immunoassay (SNAP)	107	89
Bovine Viral Diarrhea Virus Isolation	66	78
Bovine Leukemia Virus AGID	79	59
Feline Infectious Peritonitis ELISA	43	52
Vesicular Stomatitis (Ind) SN	39	33
Vesicular Stomatitis (NJ) SN	39	33
Rabies - Large Animal	28	22
West Nile Virus IgM ELISA	66	17
Canine Distemper Virus Fluorescent Antibody	5	14
Leptospira Fluorescent Antibody	24	13
Canine Parvovirus Rapid Immunoassay (SNAP)	6	9
Feline Leukemia Virus Rapid Immunoassay (SNAP)	5	9
Leptospira Icterohaemorrhagiae MAT	-	9
Feline Panleukopenia Virus Fluorescent Antibody	3	4
Leptospira Grippotyphosa MAT	-	4
Leptospira Pomona MAT	-	4
Canine Parvovirus Fluorescent Antibody	4	3
Leptospira Canicola MAT	-	3

TEST DATA — VIROLOGY

Test Type	FY19	FY20
Bovine Herpesvirus 1 Fluorescent Antibody (IBR)	1	2
Canine Herpesvirus Fluorescent Antibody	-	2
Bovine Viral Diarrhea Virus Fluorescent Antibody	-	1
Leptospira Hardjo MAT	-	1
Equine Herpesvirus Fluorescent Antibody	1	-
Total	6,891	9,823



Fig. 11—Biological Safety Cabinet (Pexels.com)

TEST DATA — MICROBIOLOGY

The Montana Veterinary Diagnostic Laboratory offers a wide range of clinical microbiology services including microorganism isolation and identification. Additional services rendered by the microbiology lab section include antibiotic sensitivity screening and parasite identification. The following table lists the number of microbiology related tests performed in FY2019 and FY2020.

Test Type	FY19	FY20
Aerobic Culture	1,788	1,515
Campylobacter Culture	1,676	1,471
Tritrichomonas foetus Culture	1,364	1,094
Fecal Flotation	694	793
Small Animal Antibiotic Sensitivity	518	516
Salmonella Enteritidis Culture	368	323
Salmonella Culture	325	226
Gram Stain	331	205
Additional Isolate - Aerobic	165	194
Mycoplasma Culture	277	132
Cryptosporidia	196	129
Brucella Culture	91	119
Equine Antibiotic Sensitivity	134	113
Giardia antigen ELISA	96	112
Heartworm ELISA	105	72
Abortion panel	49	72
Bovine Antibiotic Sensitivity	122	71
Dermatophyte/PAS	35	29
Mastitis Antibiotic Sensitivity	21	22
Liver Fluke Sedimentation	46	20
Ectoparasite Exam	12	11
Fungal Culture	11	11
Occult Blood Test	8	10
Direct Microscopic Exam	5	6
Anaerobic Culture	14	5
Endoparasite Exam	6	4
Microfilarial identification (Modified Knott's)	4	3
Trichinella Pepsin Degradation	3	3
Equine Abortion Panel	3	2
Electronic Somatic Cell Count	12	1
Coccidia Smear	3	1
Acid Fast Exam	2	0
Anthrax Lateral-Flow Test	1	0
Total	8,485	7,285

TEST DATA MOLECULAR DIAGNOSTICS (P C R)

Molecular diagnostics is an emerging area in the field of veterinary diagnostics due to the sensitivity and selectivity of these testing methods. Montana Veterinary Diagnostic Laboratory (MVDL) has a robust molecular diagnostics division that provides diagnostic testing for many potentially high consequence animal pathogens. The following table lists the total number of tests performed for FY2019 and FY2020 within the molecular diagnostics section of the laboratory.

Test Type	FY19	FY20
Tritrichomonas foetus Individual PCR	2,514	1,828
Tritrichomonas foetus Pooled PCR	1,376	1,499
Salmonella Enteritidis PCR Screen	952	1,024
M. avium subsp. paratuberculosis PCR	382	518
M. avium subsp. paratuberculosis pooled PCR	-	247
Bovine Rotavirus/Coronavirus Multiplex PCR	196	121
Bovine Viral Diarrhea Virus Pooled PCR	197	93
Bovine Viral Diarrhea Virus Individual PCR	68	27
E. coli K99 PCR	47	12
Avian Influenza Matrix PCR	74	1
Tritrichomonas foetus Confirmatory PCR	23	-
Avian Paramyxovirus-1 Matrix PCR	1	-
Total	5,830	5,370



Fig. 12—Lab bench (MVDL)

TEST DATA CLINICAL PATHOLOGY

Clinical pathology at the Montana Veterinary Diagnostics Laboratory helps aid in disease diagnosis, treatment, and prevention via laboratory testing of blood and other biological fluids for a wide range of large and small animals. The following table lists the total number of tests performed for FY2018 and FY2019 within the clinical pathology section of the laboratory.

Test Type	FY19	FY20
Small Animal CBC/Differential	1,254	996
Canine Small Animal Panel	1,002	936
Canine Clinical Profile	726	645
Urinalysis	413	288
Canine Thyroid Panel	397	331
Large Animal Chemistry Panel	381	373
Large Animal CBC/Differential	362	377
Large Animal Profile	307	300
Feline Small Animal Panel	318	249
Canine Total T4	225	218
Total T4	312	217
ACTH Stimulation	203	192
Dexamethasone Suppression	228	189
Cortisol	172	177
Phenobarbital	110	126
Feline Small Animal Clinical Profile	163	116
Urinalysis with Culture/Sensitivity	274	102
Free T4	48	66
Thyroid panel	87	63
Feline Infectious Anemia	69	59
PLI	39	56
Nitrate (Semi-quantitative)	58	55
Feline Profile	64	53
Fluid analysis	42	31
Bile Acid	42	29
Individual Chemistry Tests	-	27
Canine Health Screen	39	24
Electrolytes	13	22
Feline Health Screen	22	18
Small Animal Renal Panel	16	18
Cholesterol	7	17
ALT	87	16
Small Animal Hepatic Panel	32	16
Activated Partial Thromboplastin Time	18	16

CLINICAL PATHOLOGY

Test Type	FY19	FY20
Prothrombin Time	14	14
TSH	18	9
Small Animal Pre-Anesthetic Panel	31	7
Radial Immunodiffusion Test for Bovine IgG	11	7
Small Animal Pre-Anesthetic Profile	30	6
Total T3	4	6
Large Animal Health Screen	2	6
Calcium	15	5
Blood Count	7	5
Radial Immunodiffusion Test for Equine IgG	13	4
Feline Geriatric Panel	11	4
Coombs	8	4
Equine Fitness Profile	6	4
Magnesium	6	4
Feline Anemia Panel	3	4
Potassium	1	4
Sodium	1	4
CSF analysis	-	4
Albumin	17	3
BUN	8	3
Creatinine	7	3
Creatine Kinase	6	3
Phosphorous	6	3
Gamma-glutamyl Transferase	4	3
Total Protein	8	2
AST	5	2
Expanded Electrolytes Panel	2	2
Total Bilirubin	1	2
ALP	6	1
Fibrinogen (Heat Precipitated)	6	1
Globulin	4	1
Canine Endocrine Panel	3	1
Amylase	2	1
Direct Bilirubin	-	1
TCO2	2	-
Hemotropic Parasite Screen	1	-
Large Animal Hepatic Profile	1	-
Reticulocytes	1	-
Total	7,837	6,551

T E S T D A T A — H I S T O L O G Y

The histology section of the laboratory provides sample processing for microscopic evaluation of tissues by pathologists. Histochemical stains help identify specific tissue and cellular components. During FY2020, the Histology Laboratory was able to secure funding to make several equipment upgrades to improve operational throughput including equipment required to perform the immunohistochemical assays for detecting Chronic Wasting Disease and other agents. The following table reports the number of cases that included routine (H&E) histologic processing and the number of individual special stains prepared during FY2019 and FY2020.

Test Type	FY19	FY20
Hematoxylin & Eosin (number of cases)	2237	2095
Slide Processing (no interpretation)	236	185
CWD Tissue Processing	78	162
Gram (Brown & Brenn)	88	61
PAS	81	40
Acid Fast (Ziehl Neelsen)	21	39
Additional per slide	1	36
Giemsa	20	31
GMS	10	27
Decalcification	19	23
Warthin-Starry	23	15
Masson's Trichrome	3	15
Toluidine blue	37	14
Melanin Bleach	17	11
Von Kossa	5	10
Acid Fast (Fite's)	10	9
Purl's Prussian blue	2	8
Congo Red	4	6
Hall's Bilirubin	-	3
Steiner & Chapman	-	3
Alcian Blue pH 2.5	-	2
Fontana Masson	-	2
Gram (Brown & Hopps)	-	2
Decalcification/ keratin treatment	-	2
Luxol Fast Blue	5	1
Gimenez	-	1
Luxol Fast Blue	-	1
Macchiavello	-	1

TEST DATA — HISTOLOGY

Test Type	FY19	FY20
Melanin Bleach	-	1
Rhodanine	-	1
Van Gieson	-	1
CD-3 IHC	3	-
CD-79a IHC	3	-
CD-18 IHC	2	-
e-Cadherin IHC	1	-
Oil Red O	1	-
Total	2,907	2,808

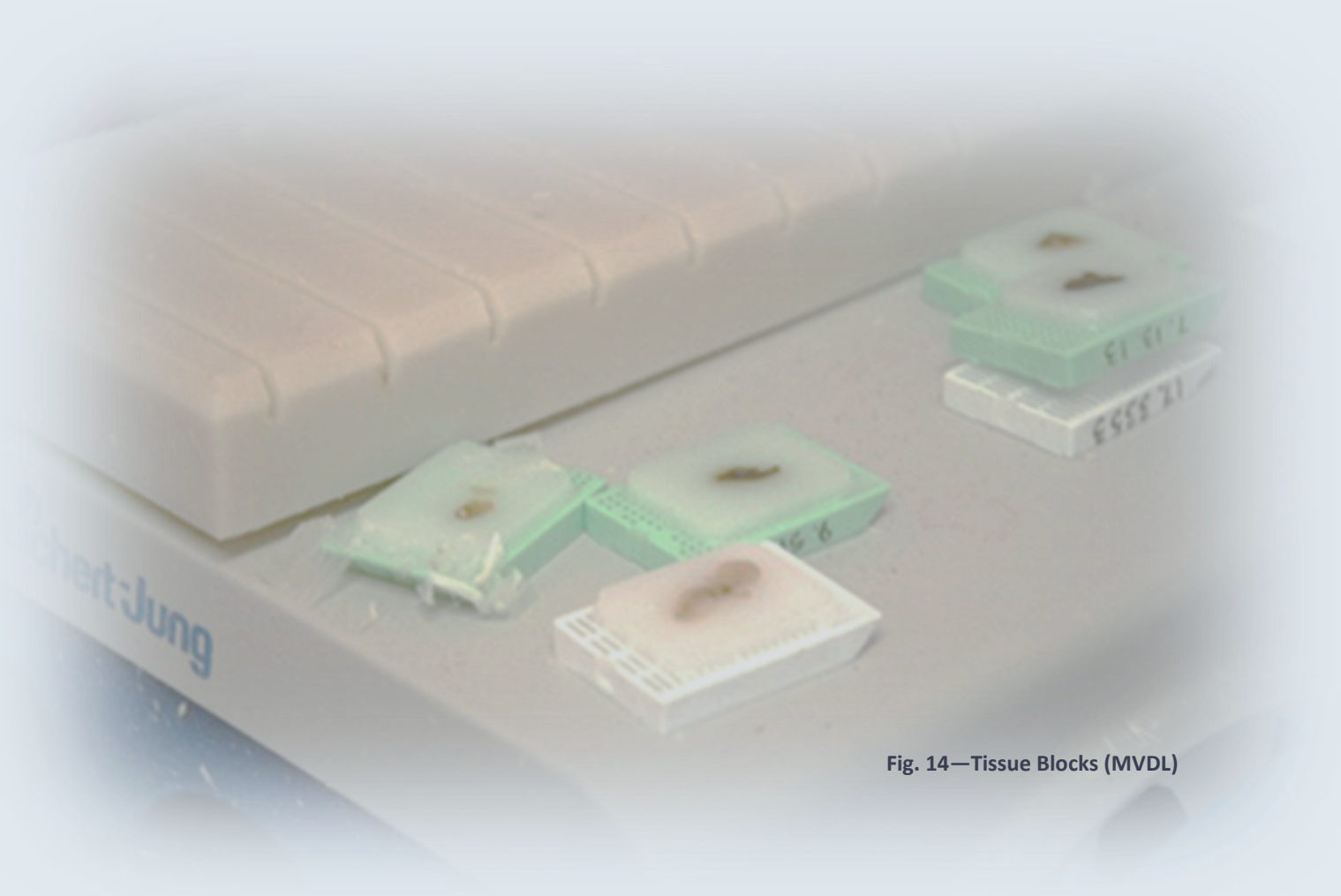


Fig. 14—Tissue Blocks (MVDL)

SERVICE DATA — PATHOLOGY

The Montana Veterinary Diagnostic Laboratory offers a full spectrum of pathology services including large and small animal necropsies, abortion investigation, cytology, histopathology for surgical biopsies and necropsies, and other ancillary testing. Our board certified pathology staff is always available for consultation upon request. The following table shows a comparison of FY2019 and FY2020 for all pathology services provided.

Service	FY19	FY20
Carcass Disposal (lbs)	30134	23328
Histopathology (biopsy/mail-in)	2092	1965
Cytology	313	312
Neonatal Diarrhea Panel	187	104
Necropsy (Livestock)	107	98
Necropsy (Other Species)	74	83
Remains Return/Transfer	25	32
Insurance/Legal case (hourly fee)	12	10
Spinal Cord Removal (Small Animal)	1	3
Spinal Cord Removal (Large Animal)	1	1
Total	32,946	25,936



Fig. 15—Microscope (Pexels.com)



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