

# **TVMDL Syndromic Approach to Bovine Testing**

**Equine and Small Ruminant  
Syndromic Testing**



Version 1.0 (2021)

# TABLE OF CONTENTS

## Contents

<b>Equine Testing Recommendations</b> .....	<b>3</b>
Equine Respiratory Disease: Adult .....	3
Equine Respiratory Disease: Foal .....	6
Equine Diarrhea – Foal up to 4 months .....	8
Equine Diarrhea – Weanling to Yearling .....	10
Equine Diarrhea – Adult.....	12
Equine Infectious Abortion .....	14
Equine Neurologic Disease .....	17
Equine (Foal) Joint Disease .....	19
Equine Ophthalmology .....	20
Equine Dermatology.....	21
Equine Cushing’s Syndrome / Pituitary Pars Intermedia Degeneration (PPID).....	22
Testing Options .....	22
Treatment Response Testing .....	24
Equine Metabolic Syndrome (EMS) Testing .....	25
Testing Options: Insulin Dysregulation Diagnostics .....	25
Treatment Response Testing .....	27
<b>Small Ruminant Testing Recommendations</b> .....	<b>28</b>
Equine Pre-Purchase/Biosecurity .....	28
Caprine/Ovine Respiratory Disease .....	30
Caprine/Ovine Diarrhea – Kids & Lambs.....	32
Caprine Adult Diarrhea/Poor Production .....	34
Caprine/Ovine Infectious Abortion .....	37
Caprine/Ovine Neurologic Disease .....	40
Caprine/Ovine Sudden Death .....	44
Caprine/Ovine Pigmenturia .....	47
Caprine/Ovine Anemia .....	50
Caprine/Ovine Ophthalmology .....	51
Caprine/Ovine Dermatology .....	52
Caprine/Ovine Pre-Purchase/Biosecurity .....	53
<b>Contributors</b> .....	<b>55</b>

# Equine Testing Recommendations

TVMDL has compiled syndrome specific diagnostic plans to assist clients in efficient diagnostic testing strategies based on clinical signs or gross necropsy findings. The client still has the ability to select the tests within the diagnostic plans that fit with the diagnostic goals and pre-test clinical suspicion of each case. Simply select the syndrome most appropriate for the case to review the testing recommendations and sampling requirements. Submit the appropriate samples and indicate which tests are desired by writing them in the “tests requested:” section of the submission form or electing them through the portal submission system. Listed tests are grouped by testing section and listed alphabetically.

Access the full [TVMDL Equine Test Catalog](#) on the TVMDL website.

## Equine Respiratory Disease: Adult

This plan was created to assist with the investigation of etiologic agents that may cause respiratory disease in adult equines.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	Fresh tissue or swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Equine Herpesvirus – Types 1 & 4 (rtPCR)	Deceased animal: 1 g each fresh tissue (spleen, liver, kidney, lung, pharynx). Live animal: nasal swabs or 1-2 mL EDTA whole blood.	1-4 days	Molecular Diagnostics	College Station	TWRF
Influenza A Matrix (rtPCR)	One or more of the following: tracheal or nasal swabs, 1 g fresh trachea or lung, 1-2 mL tracheal wash.	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Streptococcus equi (rtPCR)	One or more of the following: 1-3 mL guttural pouch washing, 1-3 mL pharyngeal wash, 1-3 mL nasal secretion, nasopharyngeal swab, 1-2 g fresh lung, bacterial isolate.	1-4 days	Molecular Diagnostics	Canyon	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Mycoplasma spp. – Companion Animal (Culture)	Fresh tissue or swabs	14 days	Bacteriology	Canyon College Station	MTWRFS
Baermann Test	5 g feces	1-3 days	Clinical Pathology	College Station	MTWRF
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Cytology – Aspirate/Smear	Air-dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Necropsy	Fresh carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Equine Arteritis Virus (VN)	1 mL serum	3 days	Virology	Canyon College Station	TF MF
Equine Herpesvirus – Types 1 & 4 (VN)	1 mL serum	3-5 days	Virology	Canyon College Station	TF MF
Equine Influenza Virus Antibody Titer Panel (HI)	1 mL serum	2-3 days	Virology	College Station	R
Virus Isolation (Cell Culture)	One or more of the following: 2-5 g fresh tissue, 0.5-1 mL semen, 5-10 mL heparin whole blood, swabs from affected area(s), other samples as deemed appropriate by submitter and/or professional staff.	14-21 days	Virology	Canyon College Station	TF T
Equine Herpesvirus 2 PCR	Nasopharyngeal swab; EDTA blood; tracheal wash; tissue culture supernatant; tissues	-	Referral	Cornell AHDC	-
Equine Herpesvirus 2 SN	1 ml serum	-	Referral	Cornell AHDC	-
Equine Herpesvirus 5 PCR	Lung tissue; nasopharyngeal swab; EDTA blood; tracheal wash; tissue culture supernatant	-	Referral	Cornell AHDC	-
EQ Rhinitis Virus A & B PCR	(5 gm) Fresh Lung, Nasal Swab	-	Referral	KSVDL	-
Streptococcus equi (ELISA) [Referral] SeM ELISA	2 mL serum	-	Referral	EDS KY	-
Cornell EQ Respiratory PCR Panel: EHV1, EHV4, EAD1, EAD2, ER-A, ER-B, IV-A, EAV, S. equi equi	1)Nasal Swab or 2) deep pharyngeal swab or 3) trans-tracheal wash or Bronchoalveolar lavage or 4) lung tissue / Nasal, nasopharyngeal, or oropharyngeal swabs collected from horses with respiratory disease signs	-	Referral	Cornell	-
Cornell Equine Respiratory Serology Panel: EAD SN, EAV SN, EIV HAI, EHV-1 SN, ER-A SN, ER-B SN	3 ml serum	-	Referral	Cornell AHDC	-
KSVDL EQ Respiratory Viral PCR Panel: EHV1w, EHV1m, EHV4, EIV H3N8, EAV	(5 gm) Fresh Lung, Nasal Swab	-	Referral	KSVDL	-

Equine lower airway PCR panel: S. equi zooepidemicus, A. equuli, K. pneumonia, Rhodococcus equi, C. pseudotuberculosis, C. immitis, A. fumigatus	Bronchoalveolar lavage or transtracheal wash fluid.	-	Referral	UC Davis rtPCR	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine Respiratory Disease: Foal

This plan was created to assist with the investigation of etiologic agents that may cause respiratory disease in foals.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	Fresh tissue or swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Equine Herpesvirus Types 1 & 4 (rtPCR)	Deceased animal: 1 g each fresh tissue (spleen, liver, kidney, lung, pharynx). Live animal: nasal swabs or 1-2 mL EDTA whole blood.	1-4 days	Molecular Diagnostics	College Station	TWRF
Influenza A Matrix (rtPCR)	One or more of the following: tracheal or nasal swabs, 1 g fresh trachea or lung, 1-2 mL tracheal wash.	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Mycoplasma spp. – Companion Animal (Culture)	Fresh tissue or swabs	14 days	Bacteriology	Canyon College Station	MTWRFS
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Cytology – Aspirate/Smear	Air-dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Necropsy	Fresh carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Equine Arteritis Virus (VN)	1 mL serum	3 days	Virology	Canyon College Station	TF MF
Equine Herpesvirus – Types 1 & 4 (VN)	1 mL serum	3-5 days	Virology	Canyon College Station	TF MF
Equine Rhinitis Virus A & B PCR	5 g Fresh Lung, Nasal Swab	-	Referral	KSVDL	-
Immunoglobulin IgG TIA	Serum	-	Referral	Cornell AHDC	-
Rhodococcus equi virulence PCR (isolate)	1) culture (solid or liquid) or isolate; 2) tracheal wash; 3) tissue (min. 5 g)	-	Referral	Cornell AHDC	-
Rhodococcus equi (vapA gene) PCR	Feces	-	Referral	UC Davis rtPCR	-
Cornell EQ Respiratory PCR Panel: EHV1, EHV4, EAD1, EAD2, ER-A, ER-B, IV-A, EAV, S. equi equi	1) Nasal Swab or 2) deep pharyngeal swab or 3) trans-tracheal wash or Bronchoalveolar lavage or 4) lung tissue / Nasal, nasopharyngeal, or oropharyngeal swabs collected from horses with respiratory disease signs	-	Referral	Cornell AHDC	-
Cornell Equine Respiratory Serology Panel: EAD SN, EAV SN, EIV HAI, EHV-1 SN, ER-A SN, ER-B SN	3 mL serum	-	Referral	Cornell AHDC	-
KSVDL EQ Respiratory Viral PCR Panel: EHV1w, EHV1m, EHV4, EIV H3N8, EAV	5 g Fresh Lung, Nasal Swab	-	Referral	KSVDL	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Equine Diarrhea – Foal up to 4 months

This plan was created to assist with the investigation of etiologic agents that may cause diarrhea in foals up to 4 months of age.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification – Companion Animal (Aerobic & Anaerobic Culture) Includes Salmonella and Clostridium culture	Feces	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Clostridium perfringens Typing (rtPCR)++	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Salmonella Genus (rtPCR)	1 g feces, Fecal swab, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Clostridium difficile Toxin A & B (ELISA)	2 g feces	1-2 days	Serology	Canyon College Station	MTWRF
Electron Microscopy – Rotavirus/ Coronavirus	5 g feces, 2-5 g intestine, 2-5 mL intestinal content	5-7 days	Virology	College Station	Variable
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					



## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Selenium (ICP/MS)	1 mL EDTA whole blood (preferred), 2 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Selenium (ICP/MS)	5 g Liver, 50 mg Liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Fecal Occult Blood (Guiaac)	1 g Feces	1 day	Clinical Pathology	College Station	MTWRF
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Urinalysis	3 mL urine	1 day	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Cryptosporidium sp. rtPCR	1 g feces, 1 mL GI content, 2 g intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Lawsonia intracellularis (rtPCR)+	1 g feces and/or fresh intestine	1-4 days	Molecular Diagnostics	College Station	WF
Necropsy	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Equine Enteric Coronavirus PCR	Feces, Fecal swab, intestine	-	Referral	Cornell AHDC	-
Immunoglobulin IgG TIA	0.5 mL serum	-	Referral	Cornell AHDC	-
Rhodococcus equi (vapA gene)	Feces	-	Referral	UC Davis rtPCR	-
Rotavirus Antigen Detection, group A (LA)	5 mL Feces	-	Referral	Cornell AHDC	-
Rotavirus, group A IHC	Intestine	-	Referral	IA State VDL	-
Foal and Neonate GI/Diarrhea PCR panel: C. difficile toxin A & B, Eq coronavirus, L. intracellularis, Salmonella spp, Cryptosporidium spp, Eq rotavirus, R, equi (vapA), C. perfringens antigens & toxins	Feces, Fecal swab	-	Referral	UC Davis rtPCR	-
+ Equine proliferative enteropathy generally manifests in foals < 1 year of age (usually 4-7 months of age)					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine Diarrhea – Weanling to Yearling

This plan was created to assist with the investigation of etiologic agents that may cause diarrhea in equines age weanling to yearling.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification – Companion Animal (Aerobic & Anaerobic Culture) Includes Salmonella and Clostridium culture	Feces	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Clostridium perfringens Typing (rtPCR)	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Lawsonia intracellularis (rtPCR)+	1 g feces and/or fresh intestine	1-4 days	Molecular Diagnostics	College Station	WF
Salmonella Genus (rtPCR)	1 g feces, Fecal swab, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Clostridium difficile Toxin A & B (ELISA)	2 g feces	1-2 days	Serology	Canyon College Station	MTWRF
+ Equine proliferative enteropathy generally manifests in foals < 1 year of age (usually 4-7 months of age)					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Selenium (ICP/MS)	1 mL EDTA whole blood (preferred), 2 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Selenium (ICP/MS)	5 g Liver, 50 mg Liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Fecal Occult Blood (Guaiac)	1 g feces	1 day	Clinical Pathology	College Station	MTWRF
Urinalysis	3 mL urine	1 day	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Cryptosporidium sp. rtPCR	1 g feces, 1 mL GI content, 2 g intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Necropsy	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Electron Microscopy – Rotavirus/ Coronavirus	5 g feces, 2-5 g intestine, 2-5 mL intestinal content	5-7 days	Virology	College Station	Variable
Equine Enteric Coronavirus PCR	Feces, Fecal swab, intestine	-	Referral	Cornell AHDC	-
Immunoglobulin IgG TIA	0.5 mL serum	-	Referral	Cornell AHDC	-
Rhodococcus equi (vapA gene)	Feces	-	Referral	UC Davis rtPCR	-
Rotavirus Antigen Detection, group A (LA)	5 mL Feces	-	Referral	Cornell AHDC	-
Rotavirus, group A IHC	Intestine	-	Referral	IA State VDL	-
Foal and Neonate GI/Diarrhea PCR panel: C. difficile toxin A & B, Eq coronavirus, L. intracellularis, Salmonella spp, Cryptosporidium spp, Eq rotavirus, R, equi (vapA), C. perfringens antigens & toxins	Feces, Fecal swab	-	Referral	UC Davis rtPCR	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine Diarrhea – Adult

This plan was created to assist with the investigation of etiologic agents that may cause diarrhea in adult equines.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification – Companion Animal (Aerobic & Anaerobic Culture) Includes Salmonella and Clostridium culture	Feces	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Clostridium perfringens Typing (rtPCR)++	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Salmonella Genus (rtPCR)	1 g feces, Fecal swab, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Clostridium difficile Toxin A & B (ELISA)	2 g feces	1-2 days	Serology	Canyon College Station	MTWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Arsenic – Inorganic (Reinsch)	500 g GI content, 500 g soil, 10 g suspect powder	1-3 days	Analytical Chemistry	College Station	MTWRF
Beetle Identification (Microscopy)	Suspect blister beetle	1-2 days	Analytical Chemistry	College Station	MTWRF
Cantharidin (LC/MS)	500 g GI content, 500 g feed, 5 ml urine, 5 mL serum	2-10 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	Both 0.5 mL EDTA whole blood and 1 mL serum (royal blue top tube)	1-3 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Hemoparasite Exam (Wright-Giemsa Stain)	0.5 mL EDTA whole blood or air dried slide	1 day	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Lawsonia intracellularis (rtPCR)+	1 g feces and/or fresh intestine	1-4 days	Molecular Diagnostics	College Station	WF
Necropsy	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Neorickettsia risticii (IFA)	1 mL serum	1-4 days	Serology	College Station	TF
Equine Enteric Coronavirus PCR	Feces, Fecal swab, intestine	-	Referral	Cornell AHDC	-
Lawsonia intracellularis (IPMA)+	1 mL serum	-	Referral	UMN VDL	-
Neorickettsia risticii (qPCR)	10 mL EDTA whole blood and 5 g feces or fecal swab. For post mortem testing, 0.5 g mucosal scraping	-	Referral	UKY VDL	-
+ Equine proliferative enteropathy generally manifests in foals < 1 year of age (usually 4-7 months of age)					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine Infectious Abortion

This plan was created to assist with the investigation of abortion in the equine.

### Recommended Initial Testing: Fetus & Placenta

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification -Companion Animal (Aerobic & Anaerobic Culture)	Fresh tissue or swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Equine Herpesvirus – Types 1 & 4 (rtPCR)	Aborted fetus: 1 g each fresh tissue (lung, liver, adrenal, lymphoid, placenta). Dam: 1-2 mL EDTA whole blood	1-4 days	Molecular Diagnostics	College Station	TWRF
Leptospira spp. (rtPCR)	One or more of the following: 1 g fresh tissue (kidney, liver, placenta).	1-4 days	Molecular Diagnostics	College Station	TWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing: Fetus & Placenta

Test	Samples	TAT	Section	Laboratory	Schedule
Metal/Mineral Panel (ICP/MS): Manganese, cobalt, copper, iron, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g fresh liver or 50 mg fresh liver biopsy (approx. 3 Tru-Cut samples)	2-5 days	Analytical Chemistry	College Station	MTWRF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	5 g fresh liver or 50 mg fresh liver biopsy (approx. 3 Tru-Cut samples)	2-5 days	Analytical Chemistry	College Station	TF
Vitamin E (HPLC)	10 g liver	1-7 days	Analytical Chemistry	College Station	M
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Salmonella spp. (Culture)	One or more of the following: fresh tissue, feces, feed, drag swabs, other environmental specimen.	7 days	Bacteriology	Canyon College Station	MTWRF S
Equine Arteritis Virus (rtPCR)	One or more of the following: 1 mL tissue culture fluid, 1 mL semen, 1 mL EDTA whole blood.	1-4 days	Molecular Diagnostics	College Station	TWRF
Equine Herpesvirus – Type 1 (rtPCR)	One or more of the following 1 g fresh tissue (liver, spleen, brain, placental tissue)	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Salmonella genus (rtPCR)	One or more of the following: 1 g feces, fecal swabs, 1 g fresh intestine, bacterial cultures.	1-4 days	Molecular Diagnostics	College Station	TWRF
Necropsy – Aborted Fetus or Fertile Egg	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Virus Isolation (Cell Culture)	One or more of the following: 2-5 g fresh tissue, 0.5-1 mL semen, 5-10 mL heparin whole blood, swabs, other samples as deemed appropriate	14-21 days	Virology	Canyon College Station	TF T

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing: Dam &/or Fetal Serology

Test	Samples	TAT	Section	Laboratory	Schedule
Selenium (ICP/MS)	1 mL EDTA whole blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Fungal Identification (Culture)	One or more of the following: fresh tissue, urine, swabs, feces, fungal isolate	21 days	Bacteriology	Canyon College Station	MTWRFS
Progesterone (ChL)	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Histopathology – Equine Uterine Biopsy	Tissue in 10% NBF	2-3 days	Histopathology	Canyon College Station	MTWRF
Leptospira Panel – 5 serovars (MAT)	1 mL serum	1-3 days 1-2 days	Serology	Canyon College Station	MWF MTWRF
Leptospira Panel – 6 serovars (MAT)	1 mL serum	1-3 days 1-2 days	Serology	Canyon College Station	MWF MTWRF
Leptospira Panel – 7 serovars (MAT)	1 mL serum	1-3 days 1-2 days	Serology	Canyon College Station	MWF MTWRF
Leptospira Panel – 8 serovars (MAT)	1 mL serum	1-3 days 1-2 days	Serology	Canyon College Station	MWF MTWRF
West Nile Virus IgM (ELISA)	1 mL serum or cerebrospinal fluid (CSF)	2-3 days 2-4 days	Serology Virology	Canyon College Station	MR TR
Equine Arteritis Virus (VN)	1 mL serum	3 days	Virology	Canyon College Station	TF MF
Equine Herpesvirus – Types 1 & 4 (VN)	1 mL serum	3-5 days	Virology	Canyon College Station	TF MF
Equine Influenza Virus Antibody Titer Panel (HI)	1 mL serum	2-3 days	Virology	College Station	R
Salmonella abortus-equi (Tube Agglutination) [Referral]	2 mL serum	-	Referral	NVSL	-
Standard Equine Abortion PCR Panel: Amycolatopsis spp, Crossiella equi, Escherichia coli (FhuA gene), equine herpesvirus 1 (genotype and quantitative load), Pantoea agglomerans, Klebsiella pneumoniae, Leptospira spp, Panfungal, Pseudomonas aeruginosa, Streptococcus dysgalactiae subsp equisimilis, Streptococcus equi subsp zooepidemicus	Uterine swab, placenta tissue, and/or fetal tissue (stomach fluid, liver, lung)	-	Referral	UC Davis rtPCR	-
Supplementary Equine Abortion PCR Panel: Actinobacillus equuli, equine arteritis virus, Salmonella spp, Staphylococcus aureus (MRSA)	Uterine swab, placenta tissue, and/or fetal tissue (stomach fluid, liver, lung)	-	Referral	UC Davis rtPCR	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					



## Equine Neurologic Disease

This plan was created to assist with the investigation of etiologic agents that may cause neurologic disease in the equine species.

### Recommended Initial Testing: Antemortem

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	0.1 ml CSF in sterile red top tube or swab	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
CSF Analysis – Cytology	0.5 ml CSF split into red top tube and EDTA tube along with air dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Equine Herpesvirus – Types 1 & 4 (rtPCR)	1 mL serum	1-4 days	Molecular Diagnostics	College Station	TWRF
Equine Encephalitis Panel (ELISA) WNV and EEE IgM ELISA	1 mL serum or cerebrospinal fluid (CSF)	2-4 days	Serology	College Station	TR
Sarcocystis neurona (ELISA) EPM SAG 2/4/3 serum-to-CSF titer ratio	1 mL serum and 1 mL CSF in red top tubes	-	Referral	EDS KY	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

### Recommended Initial Testing: Postmortem

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	Fresh brain tissue, CSF, or swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Equine Herpesvirus - Types 1 & 4 (rtPCR)	1 g each fresh tissue (spleen, liver, kidney, lung, pharynx)	1-4 days	Molecular Diagnostics	College Station	TWRF
West Nile Virus (rtPCR)	fresh brain, spinal cord, or cerebral spinal fluid (CSF)	1-4 days	Molecular Diagnostics	College Station	TWRF
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Rabies Virus (FA) [Referral]	Fresh brain (all animals)	-	Referral	TX DSHS	-
Lead (ICP/MS)	0.50 mL EDTA whole blood or heparinized blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Metal and Mineral Panel – (ICP/MS)	5 grams fresh liver	2-5 days	Analytical Chemistry	College Station	TF
Toxicology Evaluation (Microscopy)	2 cups to 1 quart of GI content	1-5 days	Analytical Chemistry	College Station	MTWRF
Vitamin E (HPLC)	10 g liver or 2 mL serum	1-7 days	Analytical Chemistry	College Station	M
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Equine Herpesvirus – Type 1 (rtPCR)	One or more of the following: nasal swabs, 1-2 mL EDTA whole blood, 1 g fresh tissue (liver, spleen, brain, aborted fetal tissue, placental tissue).	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Necropsy	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
West Nile IgM Capture (ELISA)	1 mL serum or cerebrospinal fluid (CSF)	2-4 days	Serology Virology	Canyon College Station	MF TF
Western Equine Encephalitis (VN)	1 mL serum or cerebrospinal fluid (CSF)	3-4 days	Virology	Canyon	TF
Botulism types A, B, & C rtPCR	Feces, GI Samples, feed	-	Referral	PennVet	-
EEE PCR (Brain)	Brain tissue	-	Referral	NVSL	-
Equine Encephalomyelitis HI	1.0 ml serum	-	Referral	NVSL	-
Muscle Biopsy: GBED, RER, PSSM	Link to Instructions	-	Referral	NMDL-MSU	-
Neospora hughesi/ caninum (CSF or Brain)	CSF, aborted material, brain or heart tissue	-	Referral	UC Davis rtPCR	-
Neospora hughesi SAG 1 ELISA	1ml serum or 1ml CSF in red top tube	-	Referral	EDS KY	-
Sarcocystis neurona (ELISA) EPM SAG 2/4/3 serum-to-CSF titer ratio	1 mL serum and 1 mL CSF in red top tubes	-	Referral	EDS KY	-
Sarcocystis neurona PCR (brain)	brain tissue or CSF	-	Referral	UC Davis rtPCR	-
Sarcocystis neurona PCR (CSF)	1 mL CSF in EDTA tube	-	Referral	EDS KY	-
Sarcocystis neurona (Western blot)	1ml serum or 1ml CSF in red top tube	-	Referral	EDS KY	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine (Foal) Joint Disease

This plan was created to assist with the investigation of etiologic agents that may cause joint disease in the foal.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	0.5 mL joint fluid, swab	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CBC – Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Joint Fluid Cytology	0.5 ml joint fluid split into red top tube and EDTA tube along with air dried slide	1-2 days	Clinical Pathology	College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

### Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Fungal Identification (Culture)	Fresh tissue, swabs, fungal isolate	21 days	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Necropsy	Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Immunoglobulin IgG TIA	0.5 mL serum	-	Referral	Cornell AHDC	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Equine Ophthalmology

This plan was created to assist with the investigation of etiologic agents that may cause ophthalmic disease in the equine.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification - Companion Animal (Aerobic and Anaerobic Culture)	Corneal swab, conjunctival swab	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Fungal Identification (Culture)	Fresh tissue, urine, swabs, feces, fungal isolate	21 days	Bacteriology	Canyon College Station	MTWRFS
Cytology – Aspirate/Smear	0.5 ml aspirate fluid split into red top tube and EDTA tube along with air dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Leptospira Panel – 6 serovars (MAT)	1 mL serum	1-2 days	Serology	Canyon College Station	MWF MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

### Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Conjunctival Biopsy Includes filarid exam	Formalin (NBF) fixed conjunctival tissue	2-3 days	Histopathology	Canyon College Station	MTWRF
Borrelia species (rtPCR)	0.5-2.0 ml EDTA blood	1-3 days	Molecular Diagnostics	College Station	TWR
Leptospira spp. (rtPCR)	1-2 mL urine, 1 g fresh tissue (kidney, liver, placenta)	1-4 days	Molecular Diagnostics	College Station	TWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Equine Dermatology

This plan was created to assist with the investigation of etiologic agents that may be associated with dermatologic conditions in the equine.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Equine (MIC)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification - Companion Animal (Aerobic & Anaerobic Culture)	Fresh skin tissue, swab	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Fungal Identification (Culture)	Fresh tissue, swabs, fungal isolate	21 days	Bacteriology	Canyon College Station	MTWRFS
Cytology (Skin scraping/ impression smear)	Skin scraping material or air-dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology – skin biopsy	Formalin (NBF) fixed skin tissue	2-3 days	Histopathology	Canyon College Station	MTWRF
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

### Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Dermatophilus sp. (Stain)	Tissue, aspirates, exudates, impression smears	1 day	Bacteriology	Canyon College Station	MTWRF
Dermatopathology	Formalin fixed skin tissue	-	Referral	TAMU CVM	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Equine Cushing's Syndrome / Pituitary Pars Intermedia Degeneration (PPID)

PPID is a neurodegenerative disease of the dopaminergic periventricular neurons of the hypothalamus that project and physiologically inhibit the pituitary gland; the cause of this degeneration is multifactorial and not yet fully understood, it is promoted by aging, and results in an excessive production of pro-opiomelanocortin (POMC) and its related peptides, including ACTH.

### Testing Options

#### 1. Baseline ACTH

- Indication: horses with moderate to advanced clinical signs of PPID.
- Specimen requirements: 0.5 to 1 mL of EDTA plasma within a plastic tube
- Sampling & shipping
  - Fasted horse (minimize lipemia)
  - Collect within a purple top tube
  - Centrifuge immediately (gravity-separated samples return falsely high results)
  - Transfer plasma into a plastic tube (do not send whole blood) free of any additive
  - Place the sealed tube into a secondary container filled with water (without reaching the top of the tube) and freeze altogether
  - Label the sample, and ship overnight on cold packs or dry ice so sample arrives frozen
- Limits
  - Gray zone: regardless of the method (RIA or ChL), the ACTH measurement is not interpreted with a single threshold: there is always a gray zone interval separating normal from increased concentrations
  - False positive can happen
    - In sick, non PPID horses: any inflammation or stress triggers an ACTH response: test only horses with a moderate to high positive predictive value
    - In the late summer to early fall (August to October): there is a physiologic increase in ACTH (in both normal and PPID horses): avoid testing in this period, or use reference intervals specific for this season for a given technique (RIA, chemiluminescence...)
    - Sporadically in normal horses
  - False negative can happen
    - In delayed, heated, or multiple times frozen/thawed samples (ACTH degradation)
    - Sporadically in PPID horses

#### 2. Dynamic ACTH: TRH stimulation test (T0 and T10 min)

- Indication: horses with mild or questionable clinical signs of PPID, or horses with baseline ACTH results in the gray zone
- Specimen requirements: 0.5 to 1 mL of EDTA plasma within a plastic tube for each tube
- Sampling & shipping
  - Can be tested after hay is fed, but not within 12 hours after a grain meal
  - (Do not perform within at least 24 hours after an oral sugar test)
  - Collect and process the same way than baseline ACTH (see above)
  - Administer 0.5 mg (horses < 250 kg) or 1mg (horses > 250 kg) of TRH intravenously
  - Collect the second sample at exactly 10 min post injection
  - Process and ship the same way than baseline ACTH (see above)
- Limits

- Currently, seasonally adjusted reference ranges are only established for testing performed from mid-November to mid-July; testing performed from mid-July to mid-November will be refused, or perform without interpretation guidelines
- False positive can happen
  - In sick, non PPID horses: any inflammation or stress triggers an ACTH response: test only horses with a justified suspicion of PPID (significant positive predictive value) and no overt intercurrent disease
  - Sporadically in normal horses, theoretically less than baseline ACTH (the TRH stimulation test has a higher specificity at the optimal threshold)
- False negative can happen:
  - The same way than for baseline ACTH: in delayed, heated, or multiple times frozen/thawed samples (ACTH degradation)
  - Sporadically in PPID horses, theoretically less than baseline ACTH (the TRH stimulation test has a higher sensitivity at the optimal threshold)

### 3. Baseline insulin and concomitant glycemia

- Indication: horses with insulin dysregulation. PPID horses in moderate to advanced stages commonly have insulin dysregulation (due to peptides from POMC other than ACTH directly stimulating insulin secretion), however some PPID horses don't.
- Specimen requirements: 1 mL of serum (do not send whole blood)
- Sampling & shipping
  - Fasting is not necessary in horses (hay is allowed), however avoid feeding grain at least 4 hours prior to sample collection
  - (Measuring the glycemia and adding this information with the proper units on the insulin submission form is always very helpful)
  - Centrifuge to separate serum from the clot within 30 minutes of collection.
  - Transfer serum into leakproof tube. Refrigerate sample until shipment
  - Label sample, and ship overnight with an ice pack.
- Concomitant glycemia
  - It is typically performed at the same time than insulin measurement, as it increases the sensitivity of the test (allows for identification of insulin resistance on top of hyperinsulinemia)
  - It is not mandatorily recommended by the EEG, however a basal glycemia is mandatory to rule out diabetes mellitus before potentially performing any dynamic insulin testing (see EMS).

### 4. Overnight Dexamethasone suppression test (ODST)

- Indication: horses with suspicion of PPID; however, the ODST is not part anymore of the algorithm for the diagnosis of PPID by the EEG 2017.
- Specimen requirements: 0.5 of serum for each tube
- Sampling & shipping
  - Collect baseline serum cortisol sample in the late afternoon
  - Administer dexamethasone at 40 µg/kg IM (20 mg to a 500 kg horse),
  - Then collect sample(s) between 15-19 hours later
  - Separate serum and place in a new tube; special care should be taken in not inverting tubes when placing serums in new tubes: label properly
  - Ship overnight with an ice pack

- Limits
  - False positive can happen with any disease, inflammation, or stress
  - False negative can also happen due to the imperfect sensitivity of the test

## 5. Prolactin

- Indication: horses with suspicion of PPID. (increase in prolactin can also be observed in various cyclicity or fertility perturbations)
- Specimen requirements: 1 mL of serum or plasma (do not send whole blood)
- Sampling & shipping
  - Fasting is not necessary
  - Centrifuge within 30 minutes of collection
  - Transfer into leakproof tube. Refrigerate sample until shipment
  - Label sample, and ship overnight with a cold pack.
- Availability
  - Validated for horses in Europe (Laboniris, Veterinary College of Nantes, France)
  - Available in human laboratories in the USA, without proper validation for horses and without available threshold for PPID

## 6. Previous/Other PPID Testing Options: according to the Equine Endocrinology Group consensus 2019:

- Are **no longer recommended**: oral domperidone challenge test, combined dexamethasone suppression test/TRH stimulation test with cortisol measured
- Are **not appropriate**: ACTH stimulation test, baseline cortisol, TRH stimulation test with cortisol measured

## Treatment Response Testing

The biological response to treatment can be assessed after at least one month of treatment: (see protocols above):

### Baseline ACTH

- Or TRH stimulation test (depending on which test was performed at diagnosis)
- +/- insulin and concomitant glycemia (if ID identified at diagnosis)
  - For all these tests, blood sampling should be performed 3 to 5 hours post medication (pergolide)

The clinical response to treatment can be assessed after at least 2 months of treatments. Clinical and biological monitoring are recommended every 6 months for treated horses (usually once in the spring and once in the fall, the latter mandatorily with baseline ACTH).



## Equine Metabolic Syndrome (EMS) Testing

EMS is currently described as “a collection of risk factors for endocrinopathic laminitis with insulin dysregulation as a central and consistent feature.” Insulin dysregulation corresponds with any combination of basal hyperinsulinemia (beyond the reference interval), postprandial hyperinsulinemia (beyond the threshold of dynamic tests or challenge), or insulin resistance (excessive insulin concentration relative to glucose concentration).

EMS is a syndrome with multiple components, and there is no single test able to diagnose EMS reliably. The most reliable approach consists in testing for insulin dysregulation in clinically suspicious horses (laminitis, overweight – though lean EMS also exist – etc...), so that the positive predictive value of the test is increased. Investigating EMS thus always starts with testing for insulin dysregulation (baseline insulin first, followed, if necessary, by dynamic insulin tests). Other tests may be useful, as for example triglycerides, leptin, thyroid hormones (though not diagnostic by themselves).

There is currently no consensus in the field about the potential utility of ACTH testing in EMS horses: some authors argue that some EMS horses can have increased ACTH as part of the syndrome, whereas other argue that if these horses have increased ACTH, they are actually likely PPID on top of EMS (see last paragraph). Interpretation will depend on the presentation:

- Young overweight EMS horses with increased ACTH probably have their ACTH increasing due to EMS itself (as ACTH may increase from any other disease than PPID)
- Older lean EMS horses with increased ACTH may on the other hand have both EMS and PPID (meaning PPID developing in an aging EMS horse).

The use of pergolide in the younger overweight EMS horses with increased ACTH is also heavily debated in the field with no consensus. In case of marked increase, pergolide is likely to facilitate the medical management of these horses.

### Testing Options: Insulin Dysregulation Diagnostics

#### 1. Baseline insulin and concomitant glycemia

- Protocol: see PPID testing options in companion PPID information
- Interpretation:
  - Significant hyperinsulinemia or insulin resistance is diagnostic for insulin dysregulation
  - Normal results or doubtful results (in the gray zone) are non-diagnostic and should be followed by dynamic insulin testing if the clinical signs are supportive for EMS.

#### 2. Dynamic insulin testing: Oral Sugar Test (OST)

- Indication: EMS suspected horses for which baseline insulin failed highlighting an insulin dysregulation
- Sample requirements: 1 mL serum for each time point (baseline and post)
- Protocol
  - Leave only 1 flake of hay in after 10 pm the night prior to testing
  - The following morning, collect blood for serum preparation (centrifuge by 30 min, place in a new plain tube, and refrigerate)

- After the first blood collection, administer 0.15 mL/kg of corn syrup orally via dose syringe (administering 0.45 mL/kg instead increases the sensitivity of the test)
- Collect blood 60 or 90 min after the corn syrup administration (note the exact timing on your submission form) and prepare serum the same way
- Label, keep refrigerated and ship same day overnight with a cold pack.
- Despite low within-horse repeatability, OST is preferred over ITT due to:
  - Readily availability of corn syrup and its easy administration
  - Broad assessment of the insulin response to ingested sugar
    - Whereas ITT assesses only tissue response to insulin
  - A higher sensitivity to insulin dysregulation at the optimal threshold

### 3. Dynamic insulin testing: Insulin Tolerance Test (ITT)

- Indication: same as OST
  - ITT has a lower sensitivity for insulin dysregulation than OST, which is why negative or inconclusive ITT are followed by an OST; in order to save that step, directly performing an OST when baseline insulin fails highlighting an insulin dysregulation is preferred.

## Other Potentially Useful Testing

### 1. Triglycerides

- Indication: Hypertriglyceridemia is associated with insulin dysregulation, obesity, and negative energy balance. It is a predictor of laminitis risk (at least in ponies)
- Sample requirements: 1 mL serum from a fasted horse; usually part of a serum biochemistry.
- Limits
  - False positive can happen with postprandial status
  - The specificity for EMS is low

### 2. Leptin

- Indication: leptin is produced by adipocytes, so that higher concentrations are associated with increased adiposity (especially useful to provide evidence for increased internal adiposity). This hormone is more associated with obesity than with insulin dysregulation. It is expected to increase in EMS, and normalizes before insulin in horses undergoing treatment.
- Sample requirements: 1 mL serum (do not send whole blood)
- Sampling & shipping: same as baseline insulin (see companion PPID information)

### 3. Thyroid hormones: T4, T3

- Indication: advanced overweight EMS (not lean EMS, even if advanced)
- Sample requirements: 1 mL serum (do not send whole blood)
- Sampling & shipping: same than baseline insulin (see PPID above)
- Utility: overweight hypothyroid horses with weight loss resistance can be put on high dose levothyroxine transiently, with a gradual decrease of treatment aiming for discontinuation after 3 to 6 months of treatment. T4 therapy comes on top of hygienic, environmental, physical, and diet management: it can't substitute to these aspects of EMS management. Of note, lean EMS should not be put on levothyroxine, as weight loss should be avoided.

#### 4. Baseline ACTH

- See companion PPID information for protocol and EMS introduction for interpretation.

#### **Treatment Response Testing**

The biological response to treatment can be assessed after several months of multi aspect management with tests that were abnormal at diagnosis (see protocols above):

- Baseline insulin
- Oral Sugar Test (OST)
- Leptin
- Triglycerides
- Baseline ACTH
- T4, T3

#### **Concomitant PPID & Equine Metabolic Syndrome**

PPID and EMS do not exclude each other: the one same horse can have one or both (if both, it generally starts with EMS, and then progresses with PPID). Because both syndromes can share similar biological modifications (increase in ACTH, insulin dysregulation...), signalment history and clinical signs are mandatory to reach the correct interpretation for the panel of tests performed on a given horse.

# Small Ruminant Testing Recommendations

## Equine Pre-Purchase/Biosecurity

The following tests are available to detect or gain relevant information on diseases that are common risks to herd biosecurity when introducing new animals to the population. The final testing package will depend on individual operation biosecurity protocols and management goals.

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
CBC - Equine	1 mL EDTA whole blood or lithium heparin whole blood and 1-2 air dried slides	1 day	Clinical Pathology	Canyon College Station	MTWRF
Chemistry Profile - Equine	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	Canyon College Station	MTWRF
Parasite and Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	Canyon College Station	MTWRF
Equine Infectious Anemia Virus (ELISA)	2 mL serum	1-2 days	Serology	Canyon College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

### Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Drug Screen – Equine Pre-Purchase (LC/MS)	5 mL serum	1-3 days	Analytical Chemistry	College Station	MTWRF
Equine Arteritis Virus (VN)	1 mL serum	3 days	Virology	Canyon College Station	TF MF
Equine Herpesvirus – Types 1&4 (VN)	1 mL serum	3-5 days	Virology	Canyon College Station	TF MF
Equine Influenza Virus Antibody Titer Panel (HI)	1 mL serum	2-3 days	Virology	College Station	R
Equine Encephalomyelitis PRNT Panel (EEE, WEE +/- VEE)	2 mL serum	-	Referral	NVSL	-
Rabies Virus Antibody Endpoint Titer (RFFIT)	2 mL serum	-	Referral	KSU RL	-
Streptococcus equi (ELISA) [Referral] SeM ELISA	2 mL serum	-	Referral	EDS KY	-
West Nile Virus IgG/IgM Capture ELISA Combination	2mL serum or CSF	-	Referral	Cornell AHDC	-
West Nile Virus (PRNT)	2 mL serum	-	Referral	NVSL	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

TVMDL has compiled syndrome specific diagnostic plans to assist clients in efficient diagnostic testing strategies based on clinical signs or gross necropsy findings. The client still has the ability to select the tests within the diagnostic plans that fit with the diagnostic goals and pre-test clinical suspicion of each case. Simply select the syndrome most appropriate for the case to review the testing recommendations and sampling requirements. Submit the appropriate samples and indicate which tests are desired by writing them in the “tests requested:” section of the submission form or electing them through the portal submission system. Listed tests are grouped by testing section and listed alphabetically.

Access the full [TVMDL Caprine Test Catalog](#) on the TVMDL website.

Access the full [TVMDL Ovine Test Catalog](#) on the TVMDL website.

## Caprine/Ovine Respiratory Disease

This plan was created to assist with the investigation of the pathophysiology and etiologic agents involved with the illness and/or death of small ruminants with clinical signs or postmortem findings consistent with lower respiratory system disease and/or bronchopneumonia.

### Common Differentials:

Most cases of lower respiratory tract disease are of mixed etiology with various host, pathogen, and environmental predisposing factors.

#### Bacterial:

*Bibersteinia trehalosi*

*Bordetella parapertussis*

*Helcococcus ovis*

*Mannheimia haemolytica*

*Mycoplasma ovipneumoniae*

*Mycoplasma spp.*

*Pasteurella multocida*

#### Viral:

Adenovirus 6

Parainfluenza 3

Respiratory syncytial virus

Lentivirus

Bluetongue virus

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Fresh respiratory tissue, TTW, BAL, swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Mycoplasma spp. – Livestock (Culture)	Fresh respiratory tissue, swabs	14 days	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Bovine Respiratory Syncytial Virus (rtPCR)++	1 g lung &/or trachea; 2 mL TTW or BAL; swab	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Respiratory Disease Panel – Bacterial (rtPCR)++ (M. haemolytica, P. multocida, H. somni, M. bovis, T. pyogenes)	1 g lung &/or trachea; 2 mL TTW or BAL; swab	1-3 days	Molecular Diagnostics	Canyon College Station	TWRF
Virus Isolation (Cell Culture)	2-5 g fresh tissue, swabs, 5-10 mL heparin whole blood	14-21 days	Virology	Canyon College Station	TF T

++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Toxicology Evaluation (Microscopy)	1 qt rumen contents, 20 mL water, 500 g feed, 4 flakes hay	1-5 days	Analytical Chemistry	College Station	MTWRF
Baermann Test	5 g feces	1-3 days	Clinical Pathology	College Station	MTWRF
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	Canyon College Station	MTWRF
Chemistry Profile – Ruminant	0.5 mL serum, lithium heparin plasma	1 day	Clinical Pathology	Canyon College Station	MTWRF
Bluetongue & Epizootic Hemorrhagic Disease Virus Multiplex (rtPCR)	1 g fresh spleen, 2 mL EDTA blood	1-4 days	Molecular Diagnostics	College Station	TWRF
Bluetongue Virus (rtPCR)	1 g fresh spleen, 2 mL EDTA blood	1-4 days	Molecular Diagnostics	College Station	TWRF
Bluetongue Virus Serotyping (rtPCR) (serotypes 2, 10, 11, 12, 13, and 17)	Previously extracted nucleic acid	1-4 days	Molecular Diagnostics	College Station	TWRF
Chlamydia spp. (rtPCR)	1 g fresh respiratory tissue, swab	1-4 days	Molecular Diagnostics	College Station	TWRF
Malignant Catarrhal Fever (rtPCR) (ovine, ibex, white tail deer, caprine and alcelaphine herpesvirus-1 strains)	1 g fresh lymph node, liver, spleen, kidney, lung; 2 mL EDTA blood	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Mycoplasma spp. (PCR)	1 g fresh lung tissue, 0.5-2 mL joint fluid, swabs	3-7 days	Molecular Diagnostics	Canyon College Station	WR TR
Necropsy	Fresh Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Bluetongue Virus (cELISA)	1 mL Serum	1-2 days 1-3 days	Serology	Canyon College Station	MR MR
Mannheimia haemolytica (Microagglutination)	1 mL serum or plasma	1-2 days	Serology	Canyon	MTWRF
Small Ruminant Lentivirus (cELISA) (CAE/OPP)	1 mL serum	1-3 days	Serology	College Station	MR
Bovine Respiratory Syncytial Virus (VN) <sup>++</sup>	1 mL serum	3-5 days	Virology	Canyon	TF
Caprine Herpesvirus SN	1 mL serum	-	Referral	Cornell AHDC	-
<p><sup>++</sup>Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.</p>					
<p>TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)</p>					

## Caprine/Ovine Diarrhea – Kids & Lambs

This plan was created to assist with the investigation of etiologic agents that may cause or contribute to diarrhea in kids and lambs.

### Common Differentials:

#### Bacterial:

*Clostridium perfringens*  
*Escherichia coli*  
*Salmonella* spp.

#### Parasitological/Protozoal:

Cryptosporidia  
 Coccidia  
*Giardia*

#### Viral:

Rotavirus group A and/or B

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture) Includes Salmonella culture	Feces, fresh intestines, swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite & Ova Count (McMasters) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Calf Diarrhea Multiplex (rtPCR)++: Rotavirus group A, BCoV, cryptosporidium	5-10 f feces, 1-2 mL intestinal content, 1-2 g fresh intestine, colon	1-4 days	Molecular Diagnostics	College Station	TWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					



## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Salmonella spp. (Culture)	Feces, fresh intestines or LNN, swabs	7 days	Bacteriology	Canyon College Station	MTWRFs
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Clostridium perfringens Typing (rtPCR)	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Cryptosporidium & Giardia Panel (rtPCR)	1-2 g feces, 1 g intestine, 1-2 mL intestinal content	1-4 days	Molecular Diagnostics	College Station	TWRF
E. coli Toxin Typing – Ruminant (rtPCR)	Pure bacterial isolate	1-4 days 1-2 days	Molecular Diagnostics	Canyon College Station	MTWRF W
Salmonella genus (rtPCR)	1 g feces, swabs, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Electron Microscopy – Rotavirus	5 g feces, 2-5 g fresh intestine, 2-5 mL intestinal content	5-7 days	Virology	College Station	Variable
Salmonella Serotyping [Referral]	Pure bacterial isolate	-	Referral	NVSL	-
Rotavirus Ag Detection, group A (LA)	5 mL feces	-	Referral	Cornell AHDC	-
Rotavirus FA	Fresh small intestine	-	Referral	Cornell AHDC	-
Bovine Enteric PCR Panel Rotavirus group A, BCoV, Salmonella spp, E coli K99, Cryptosporidium parvum	Feces, intestinal content, fresh intestine, colon, swab	-	Referral	IA State VDL	-
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine Adult Diarrhea/Poor Production

This plan was created to assist with the investigation of etiologic agents that may cause diarrhea, malabsorption, weight loss, or poor production in adult goats. The final testing plan will differ slightly for acute vs. chronic cases.

### Common Differentials:

#### Bacterial:

Endoparasitism  
Coccidiosis

#### Parasitical:

Johne's Disease (MAP)

#### Viral:

Rotavirus, group A &/or B

#### Other (Systemic Disease):

Indigestion  
Ingestion of toxins  
Liver Failure  
Peritonitis  
Renal Disease  
Rumen acidosis  
Sepsis/Toxemia

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Feces, fresh intestines, swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Ruminant TP, ALB, AG ratio, globulin, Ca, P, Mg, glucose, CPK, BUN, creatinine, tBili, AST, GGT, GLDH, Na, K, Cl	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Liver Profile GGT, AST, GLDH, NEFA, Cholesterol, tBili, triglycerides, NEFA:Cholesterol ratio	0.5 serum	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Electron Microscopy – Rotavirus	5 g feces, 2-5 g fresh intestine, 2-5 mL intestinal content	5-7 days	Virology	College Station	Variable
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Selenium (ICP/MS)	1 mL EDTA blood (preferred), 2 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Selenium (ICP/MS)	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	TF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Vitamin E (HPLC)	10 g liver, 2 mL serum	1-7 days	Analytical Chemistry	College Station	M
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Salmonella spp. (Culture)	Feces, fresh intestines, swabs	7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite Identification (Gross Identification)	Whole parasite (helminth/arthropod)	1-3 days	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Bovine Viral Diarrhea Virus (rtPCR) <sup>++</sup>	1-2 mL EDTA blood, 1 g lung, trachea, swab	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Calf Diarrhea Multiplex (rtPCR) <sup>+++</sup> : Rotavirus group A, BCoV, cryptosporidium	5-10 f feces, 1-2 mL intestinal content, 1-2 g fresh intestine, colon	1-4 days	Molecular Diagnostics	College Station	TWRF
Clostridium perfringens Typing (rtPCR)	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Cryptosporidium & Giardia Panel (rtPCR)	1-2g feces, 1 g fresh intestine, 1-2 mL intestinal content	1-4 days	Molecular Diagnostics	College Station	TWRF
E. coli Toxin Typing – Ruminant (rtPCR)	Pure bacterial isolate	1-4 days 1-2 days	Molecular Diagnostics	Canyon College Station	MTWRF W
Mycobacterium avium subsp. paratuberculosis (rtPCR): (Johne's disease)	1 g feces, 1-2 g intestines, 1 mL intestinal content	1-4 days	Molecular Diagnostics	College Station	TWRF
Salmonella genus (rtPCR) <sup>++</sup>	1 g feces, swabs, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF

## Secondary/Additional Recommended Testing (continued)

Corynebacterium pseudotuberculosis – Caprine/Ovine (SHI)	2 mL serum, sterile collection technique	2-4 days	Serology	College Station	MTWR
Mycobacterium avium subsp. paratuberculosis – Serum or Plasma (ELISA) (Johne's disease)	1 mL serum or plasma	1-3 days	Serology	Canyon College Station	TWR MR
Small Ruminant Lentivirus (cELISA)	1 mL serum	1-3 days	Serology	College Station	MR
Virus Isolation (Cell Culture)	Fresh tissue, swabs, heparin whole blood	14-21 days	Virology	Canyon College Station	TF T
Salmonella Serotyping [Referral]	Pure bacterial isolate	-	Referral	NVSL	-
Johne's Culture – Non-Bovine	1) 15g fresh feces; 2) Fresh distal ileum, ileocecal junction and associated lymph nodes	-	Referral	Cornell AHDC	-
Rotavirus FA	Fresh small intestine	-	Referral	Cornell AHDC	-
Rotavirus Ag Detection, group A (LA)	Feces	-	Referral	Cornell AHDC	-
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine/Ovine Infectious Abortion

This plan was created to assist with the investigation of etiologic agents that may cause abortion in caprine or ovine females.

### Common Differentials:

#### Bacterial/Protozoal:

*Brucella* spp.  
*Campylobacter fetus* subsp. *fetus*  
*Campylobacter jejuni*  
*Chlamydomphila abortus*  
*Coxiella burnetii*  
*Leptospira* spp.  
*Listeria* spp.  
*Salmonella* spp.  
*Toxoplasma gondii*  
*Yersinia* spp  
 MISC other bacteria/fungi

#### Viral:

Bluetongue virus (*Orbivirus*)  
 Border disease virus (*Pestivirus*)  
 Cache Valley virus (*Bunyavirus*)

#### Other (noninfectious mimics):

Energy/Protein deficiency  
 Copper deficiency  
 Heavy metal intoxication  
 Iodine deficiency +/- *Brassica* plants  
 Nitrate-nitrite toxicity  
 Toxic plants

### Recommended Initial Testing: Fetus & Placenta

Test	Samples	TAT	Section	Laboratory	Schedule
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Abortion Panel – Livestock Bacterial (Culture): includes trichomonas, campylobacter, brucella, and listeria	Fetal stomach contents, fetal tissue, placenta	10 days	Bacteriology	Canyon College Station	MTWRFS
Coxiella burnetii (rtPCR)	1 g fetal liver or fetal lung, 1-2 mL fetal stomach content, 1 g placenta, 1-2 mL vaginal discharge, 1-2 mL colostrum or milk	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF
Campylobacter jejuni (rtPCR)	1 g fresh fetal tissue or placenta, 1-2 mL fetal stomach content, 1-2 mL uterine discharge or cervical mucous	1-3 days	Molecular Diagnostics	Canyon College Station	TWRF
Chlamydia spp. (rtPCR)	1 g fetal liver or spleen, 1 g placenta	1-4 days	Molecular Diagnostics	College Station	TWRF
Toxoplasma gondii (rtPCR)	1-2 g fresh fetal tissue	1-4 days	Molecular Diagnostics	College Station	TWRF
Bovine Viral Diarrhea Virus (rtPCR)++	1 g fetal lung, 1-2 mL semen, 1-2 mL EDTA blood	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Abortion Panel – Caprine/Ovine Serology: Leptospira Panel – 5 Serovars (MAT), Toxoplasma IgG (IFA), Coxiella burnetii (ELISA), Bluetongue Virus (AGID), and Brucella abortus (Card Agglutination)	2 mL fetal body fluids	2-4 days	Serology	Canyon College Station	MTWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing: Fetus & Placenta

Test	Samples	TAT	Section	Laboratory	Schedule
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g fetal liver, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Nitrates – Fluids (Colorimetric)	1 mL ocular fluid, eyeball	1-2 days	Analytical Chemistry	College Station	MTWRF
Trace Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc	5 g fetal liver, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Campylobacter spp. (Culture)	Swabs (charcoal), fetal stomach content, fetal fluid, fetal tissue	7 days	Bacteriology	Canyon College Station	MTWRFS
Salmonella spp. (Culture)	Fetal stomach contents, fetal tissue, Amies culture swabs	7 days	Bacteriology	Canyon College Station	MTWRFS
Bluetongue Virus (rtPCR)	1 g fetal spleen, 2 mL EDTA whole blood, 1-2 mL semen	1-4 days	Molecular Diagnostics	College Station	TWRF
Bunyavirus & Cache Valley Virus (PCR)	1 g fresh fetal kidney, brain, &/or placenta	4-5 days	Molecular Diagnostics	Canyon	R
Campylobacter fetus Differentiation (rtPCR)	1 g fetal tissue (lung) &/or placenta, 2 mL fetal stomach contents, bacterial isolate, 1-2 mL preputial wash, uterine wash, or cervical swab	1-3 days	Molecular Diagnostics	Canyon College Station	TWRF
Leptospira spp. (rtPCR)++ (Caprine)	1 g fresh fetal kidney, liver, &/or placenta, 1-2 mL urine	1-4 days	Molecular Diagnostics	College Station	TWRF
Malignant Catarrhal Fever (rtPCR) Ovine, ibex, white tail deer, caprine and alcelaphine herpesvirus-1 strains	1 g fetal liver, spleen, kidney, lung, or lymph node, 1-2 mL EDTA blood	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Neospora caninum (rtPCR)	1 g fetal brain (preferred), placenta, liver, lung, &/or heart	2-3 days	Molecular Diagnostics	College Station	TWRF
Bluetongue Virus Isolation (Egg Inoculation)	2-5 g fetal spleen, 1 mL semen, 2-5 mL whole blood	7-21 days	Virology	College Station	R
Virus Isolation (Cell Culture)	2-5 g fresh tissues, swabs, 1 mL semen, 5-10 mL heparin blood	14-21 days	Virology	Canyon College Station	TF T
Salmonella Serotyping [Referral]	Pure bacterial isolate	-	Referral	NVSL	-
Leptospira spp. PCR (Ovine)	5 gm tissue (kidney, fetal material, placenta)	-	Referral	KSVDL	-
Listeria monocytogenes PCR	10 gm tissue (liver, spleen, brain, fetus, placenta)	-	Referral	KSVDL	-
Listeria monocytogenes (PCR) [Referral]	5 g brain or fetal tissue, 2 mL EDTA blood, 2 mL CSF, 50 mL milk	-	Referral	Cornell AHDC	-
Campylobacter IHC	Fixed tissue	-	Referral	MSU VDL	-
Leptospira spp IHC	Fixed kidney	-	Referral	MSU VDL	-
Listeria monocytogenes IHC	Fixed tissue	-	Referral	MSU VDL	-
Toxoplasma gondii IHC	Fixed tissue	-	Referral	MSU VDL	-
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing: Dam Serology

Test	Samples	TAT	Section	Laboratory	Schedule
Selenium (ICP/MS)	1 mL EDTA blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Bovine Viral Diarrhea Virus (rtPCR)++	1-2 mL EDTA blood	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Campylobacter fetus (Microagglutination)	1 mL serum or plasma	1-2 days	Serology	Canyon	MTWRF
Abortion Panel – Caprine/Ovine Serology: Leptospira Panel – 5 Serovars (MAT), Toxoplasma IgG (IFA), Coxiella burnetii (ELISA), Bluetongue Virus (AGID), and Brucella abortus (Card Agglutination)	2 mL serum	2-4 days	Serology	Canyon College Station	MTWRF
Neospora caninum (ELISA)++	1 mL serum	1-3 days	Virology Serology	Canyon College Station	MR
Toxoplasma gondii IgG (IFA)	1 mL serum	1-3 days 1-2 days	Serology	Canyon College Station	MTWR MTWRF
Bovine Viral Diarrhea Virus Panel (VN)++ BVD types 1a, 1b, and 2	1 mL serum	3 days	Virology	Canyon	TF
Cache Valley Virus (VN)	1 mL serum	3 days	Virology	Canyon College Station	TF MF
Chlamydia psittaci CF Enzootic ovine abortion	2-3 mL serum	-	Referral	NVSL	-
Caprine herpesvirus SN	1 mL serum	-	Referral	Cornell AHDC	-
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine/Ovine Neurologic Disease

This plan was created to assist with the investigation of etiologic agents that may cause neurologic abnormalities or disease in sheep or goats.

### Common Differentials:

#### **Bacterial:**

Bacterial meningitis/  
encephalitis  
Enterotoxemia – *C. perfringens*  
Listeriosis  
Tetanus

#### **Metabolic:**

Hypocalcemia  
Hypomagnesemia  
Hypophosphatemia  
Negative Energy  
Balance

#### **Viral:**

Lentivirus (CAEV/  
MVV)  
Rabies virus

#### **Other:**

Acidosis  
Hepatic  
Encephalopathy  
Lead toxicosis  
Meningeal worm  
Organophosphate  
toxicity  
Polioencephalomalacia  
Sodium toxicosis  
Space occupying lesion  
(abscess, etc)  
Sulfur toxicosis  
Thiamine deficiency  
Toxic Plants  
Trauma  
Urea Toxicity  
Water deprivation

### Recommended Initial Testing: Antemortem

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	0.5 mL CSF (red top tube)	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CSF Cytology: gross exam, total protein, cell counts, microscopic evaluation	0.5 mL CSF (EDTA tube)	1-2 days	Clinical Pathology	College Station	MTWRF
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Ruminant	0.5 mL Serum	1 day	Clinical Pathology	College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)



## Recommended Initial Testing: Postmortem

Test	Samples	TAT	Section	Laboratory	Schedule
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, and thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Toxicology Evaluation (Microscopy)	1 qt rumen contents, 20 mL water, 500 g feed, 4 flakes hay	1-5 days	Analytical Chemistry	College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	0.5 mL CSF or 1 g brain	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Fresh kidney or liver	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CSF Cytology: gross exam, total protein concentration, cell counts, microscopic evaluation	0.5 mL CSF (EDTA tube) & air dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Magnesium: Ocular fluid	0.5 mL ocular fluid, eyeball	1 day	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Rabies Virus (FA) [Referral]	Fresh entire brain	-	Referral	TX DSHS	-
Cholinesterase (Kinetic pH/Kinetic Colorimetric)	Entire fresh brain, 5 mL EDTA blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	5g kidney, 3 mL urine	2-5 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	1 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Lead (ICP/MS)	0.5 mL EDTA or heparin whole blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Lead (ICP/MS)	5 g kidney, 5 g liver, 50 mg liver biopsy, 500 g feed, 5 mL water	2-5 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, and thallium	Both 0.5 mL EDTA whole blood and 1 mL serum (royal blue top tube)	1-3 days	Analytical Chemistry	College Station	MTWRF
Pesticide Screen (GC/MS)	30 g GI content, 10 g bait, 40 g forage or hay, 20 g liver, 20 mL water, 20 g soil, swab	1-5 days	Analytical Chemistry	College Station	MTWRF
Pesticide Quantitation (GC/MS): measures pesticides previously identified by Pesticide Screen test	30 g GI content, 10 g bait, 40 g forage or hay, 20 g liver, swabs	1-5 days	Analytical Chemistry	College Station	MTWRF
pH (pH Electrode)	500 g rumen content	1-3 days	Analytical Chemistry	Canyon College Station	MTWRF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	TF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Vitamin A (HPLC):	10 g liver, 2 mL serum (protect from light)	1-7 days	Analytical Chemistry	College Station	M
Vitamin E (HPLC)	10 g liver, 2 mL serum	1-7 days	Analytical Chemistry	College Station	M
Septicemia (Culture)	Blood inoculated into blood culture media	14 days	Bacteriology	Canyon College Station	MTWRFS
CSF Analysis – Creatine Kinase (CK) <sup>++</sup>	0.5 mL CSF (red top tube)	1 day	Clinical Pathology	College Station	MTWRF
CSF Analysis – Electrolytes: Na, Cl, K <sup>++</sup> Paired CSF and serum recommended	0.5 CSF (red top tube) and 0.5 mL serum	1 day	Clinical Pathology	College Station	MTWRF
Cytology (Digital)	2-10 JPEG/PNG images of slide(s)	1 day	Clinical Pathology	College Station	MTWRF (8am-4pm)
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	Canyon College Station	MTWRF

## Secondary/Additional Recommended Testing (continued)

Test	Samples	TAT	Section	Laboratory	Schedule
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Clostridium perfringens Typing (rtPCR)	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
G6S Detection (rtPCR)	1-2 mL EDTA blood	1-4 days	Molecular Diagnostics	College Station	TR
Necropsy	Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Small Ruminant Lentivirus (cELISA) (CAE/OPP)	1 mL serum	1-3 days	Serology	College Station	MR
Virus Isolation (Cell Culture)	2-5 g fresh tissue, 5-10 mL heparin whole blood	14-21 days	Virology	Canyon College Station	TF T
Sodium (FAAS) [Referral]	Fresh brain hemisphere (20 g)	-	Referral	CSU VDL	-
Listeria monocytogenes (PCR) [Referral]	5 g brain, 2 mL EDTA blood, 2 mL CSF, 50 mL milk	-	Referral	Cornell AHDC	-
Listeria monocytogenes PCR	10 gm tissue (liver, spleen, brain)	-	Referral	KSVDL	-
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine/Ovine Sudden Death

This plan was created to assist with the investigation of etiologic agents that may cause peracute or sudden mortality in goat or sheep patients.

### Common Differentials:

#### Infectious:

Acute septicemia  
Anthrax  
Clostridial disease  
Coliform mastitis  
Listeriosis  
Mycoplasmosis  
Pasteurellosis  
Septic metritis

#### Environmental:

Blue-green algae  
Heat stress/Hyperthermia  
Lightening  
Ruminal acidosis  
Toxic plants/Other toxins  
Water deprivation/Sodium toxicity

#### Other:

Anaphylaxis  
Copper  
Liver Flukes  
Polioencephalomalacia

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Toxicology Evaluation (Microscopy) Rumen Content	1 qt rumen contents, 20 mL water, 500 g feed, 4 flakes hay	1-5 days	Analytical Chemistry	College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Fresh tissue (Brain or CSF, Intestines, +/- Lung, Kidney), swabs	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Clostridium spp. (FA)++	Fresh or fixed liver	1 day	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Respiratory Disease Panel – Bacterial (rtPCR)++ (M. haemolytica, P. multocida, H. somni, M. bovis, T. pyogenes)	1 g lung &/or trachea; 2 mL TTW or BAL; swab	1-3 days	Molecular Diagnostics	Canyon College Station	TWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Cholinesterase (Kinetic pH/ Kinetic Colorimetric)	Entire fresh brain, 5 mL EDTA blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	5g kidney, 3 mL urine	2-5 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	1 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Copper (ICP/MS)	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Toxicology Evaluation (Digital)	2-10 JPEG/PNG images of plant, beetle, mushroom, blue-green algae, etc.	1-5 days	Analytical Chemistry	College Station	MTWRF
Herbicide (GC/MS)	30 g GI contents, 10 g bait (source material), 40 g forage or hay, 20 g liver	1-5 days	Analytical Chemistry	College Station	MTWRF
Ionophores (LC/MS)	500 g feed or GI content	1-6 days	Analytical Chemistry	College Station	F
Lead (ICP/MS)	0.5 mL EDTA or heparin whole blood	1-3 days	Analytical Chemistry	College Station	MTWRF
Lead (ICP/MS)	5 g kidney, 5 g liver, 50 mg liver biopsy, 500 g feed, 5 mL water	2-5 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	MTWRF
Heavy Metal Panel (ICP/MS) Lead, zinc, arsenic, cadmium, thallium	1 mL EDTA blood	1-3 days	Analytical Chemistry	College Station	TF
Heavy Metal Panel (ICP/MS) Lead, zinc, arsenic, cadmium, thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Nitrates – Fluids (Colorimetric)	1 mL ocular fluid, entire eye ball, 1 mL urine, 1 mL serum, 20 mL water	1-2 days	Analytical Chemistry	College Station	MTWRF
Nitrates – Hay/Forage (Ion Selective)	8-15 fresh forage stalks or 1 plastic or paper bag containing core samples from baled hay	2-5 days	Analytical Chemistry	College Station	MTWRF
Pesticide Screen (GC/MS)	30 g GI content, 10 g bait, 40 g forage or hay, 20 g liver, 20 mL water, 20 g soil, swab	1-5 days	Analytical Chemistry	College Station	MTWRF
Pesticide Quantitation (GC/MS): measures pesticides previously identified by Pesticide Screen test	30 g GI content, 10 g bait, 40 g forage or hay, 20 g liver, swabs	1-5 days	Analytical Chemistry	College Station	MTWRF
pH (pH Electrode)	500 g rumen content	1-3 days	Analytical Chemistry	Canyon College Station	MTWRF

## Secondary/Additional Recommended Testing (continued)

Test	Samples	TAT	Section	Laboratory	Schedule
Selenium (ICP/MS)	1 mL EDTA blood, 2 mL serum or plasma	1-3 days	Analytical Chemistry	College Station	MTWRF
Selenium (ICP/MS)	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	TF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacillus anthracis (Culture)	Blood, swabs from orifices, spleen	3 days	Bacteriology	Canyon College Station	MTWRFS
Mastitis (Culture)	Milk	7 days	Bacteriology	Canyon College Station	MTWRFS
Mycoplasma spp. – Livestock (Culture)	Fresh lung or other indicated tissue	14 days	Bacteriology	Canyon College Station	MTWRFS
Mycoplasma spp. – Milk (Culture)	Milk	14 days	Bacteriology	Canyon College Station	MTWRFS
Septicemia (Culture)	Blood inoculated into blood culture media	14 days	Bacteriology	Canyon College Station	MTWRFS
Salmonella spp. (Culture)	Fresh intestines, LNN, other tissue or swabs	7 days	Bacteriology	Canyon College Station	MTWRFS
Magnesium: Ocular fluid	0.5 mL ocular fluid, eyeball	1 day	Clinical Pathology	College Station	MTWRF
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Clostridium perfringens Typing (rtPCR)	Pure bacterial isolate	1-4 days	Molecular Diagnostics	Canyon College Station	R
Mycoplasma spp. (PCR)	1 g fresh tissue, 0.5-2 mL joint fluid, swab	3-7 days	Molecular Diagnostics	Canyon College Station	WR TR
Salmonella genus (rtPCR)	1 g feces, swabs, 1 g fresh intestine	1-4 days	Molecular Diagnostics	College Station	TWRF
Necropsy	Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Virus Isolation (Cell Culture)	2-5 g fresh tissue, 5-10 mL heparin blood	14-21 days	Virology	Canyon College Station	TF T
Salmonella Serotyping [Referral]	Pure bacterial isolate	-	Referral	NVSL	-
Sodium (FAAS) [Referral]	Fresh brain hemisphere (20 g)	-	Referral	CSU VDL	-
Listeria monocytogenes (PCR) [Referral]	5 g brain, 2 mL EDTA blood, 2 mL CSF, 50 mL milk	-	Referral	Cornell AHDC	-
Listeria monocytogenes PCR	10 gm tissue (liver, spleen, brain)	-	Referral	KSVDL	-
Feed Nutritional Testing [Referral]	1 lb. feed	-	Referral	Servi-Tech Labs	-
Water Analysis	Water Sample Link 500 mL water	-	Referral	TAMU AgriLife	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Caprine/Ovine Pigmenturia

This plan was created to assist with the investigation of etiologic agents that may be associated with pigmenturia in caprine or ovine patients.

### Common Differentials:

**Hematuria:** cystitis, pyelonephritis, urolithiasis, trauma, reproductive tract contamination, bracken fern toxicity, septicemia/DIC

**Hemoglobinuria:** copper toxicity, leptospirosis, bacillary hemoglobinuria (*C. novyi* D), toxic plant ingestion, water intoxication/isoerytholysis, phosphorus deficiency

**Myoglobinuria:** myositis, prolonged recumbency/compartment syndrome, trauma, severe myodegeneration, toxic plant ingestion

### Recommended Initial Testing: Antemortem

Test	Samples	TAT	Section	Laboratory	Schedule
Copper (ICP/MS)	3 mL urine	2-5 days	Analytical Chemistry	College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Urine	2-7 days	Bacteriology	Canyon College Station	MTWRFS
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Ruminant	0.5 mL Serum	1 day	Clinical Pathology	College Station	MTWRF
Urinalysis	3 mL urine	1 day	Clinical Pathology	College Station	MTWRF
Leptospira spp. (rtPCR)++ (Caprine)	1-2 mL urine	1-4 days	Molecular Diagnostics	College Station	TWRF
Leptospira Panel – 5 Serovars (MAT) pomona, ictero., canicola, grippo., and hardjo	1 mL serum	1-2 days	Serology	Canyon College Station	MWF MTWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Recommended Initial Testing: Postmortem

Test	Samples	TAT	Section	Laboratory	Schedule
Copper (ICP/MS)	5g kidney	2-5 days	Analytical Chemistry	College Station	MTWRF
Toxicology Evaluation (Microscopy)	1 qt rumen contents, 20 mL water, 500 g feed, 4 flakes hay	1-5 days	Analytical Chemistry	College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Renal pelvis &/or urine	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Clostridium spp. (FA)++	Fresh or fixed liver	1 day	Bacteriology	Canyon College Station	MTWRFS
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF
Leptospira spp. (rtPCR)++ (Caprine)	1 g fresh kidney, liver	1-4 days	Molecular Diagnostics	College Station	TWRF
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					



## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Copper (ICP/MS)	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	1 mL EDTA blood and 1 mL serum in royal blue top tube	1-3 days	Analytical Chemistry	College Station	MTWRF
Metal & Mineral Panel (ICP/MS): cobalt, copper, iron, manganese, molybdenum, selenium, zinc, arsenic, cadmium, lead, thallium	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	MTWRF
Plant Identification	Intact, preserved plant	1-5 days	Analytical Chemistry	College Station	MTWRF
Toxicology Evaluation (Digital)	2-10 JPEG/PNG images of plant, beetle, mushroom, blue-green algae, etc.	1-5 days	Analytical Chemistry	College Station	MTWRF
Trace Mineral Panel (ICP/MS): copper, cobalt, iron, manganese, molybdenum, selenium, zinc	5 g liver, 50 mg liver biopsy, 500 g feed	2-5 days	Analytical Chemistry	College Station	TF
Urolith Composition (FTIR)	Clean, dry uroliths	1-3 days	Analytical Chemistry	College Station	MTWRF
Urine Crystal Identification	3 mL urine	1 day	Clinical Pathology	College Station	MTWRF
Necropsy	Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF
Leptospira Panel – 6 Serovars (MAT) pomona, ictero., canicola, grippo., hardjo, and bratislava	Serum	1-2 days	Serology	Canyon College Station	MWF MTWRF
Leptospira Panel – 7 Serovars (MAT) pomona, ictero., canicola, grippo., hardjo, bratislava, and autumnalis	Serum	1-2 days	Serology	Canyon College Station	MWF MTWRF
Leptospira Panel – 8 Serovars (MAT) pomona, ictero., canicola, grippo., hardjo, bratislava, autumnalis, and sejroe	Serum	1-2 days	Serology	Canyon College Station	MWF MTWRF
Water Analysis – Routine [Referral] ions (calcium, magnesium, sodium, potassium), sulfates, chloride, pH, conductivity, and total dissolved salts (TDS)	Water Sample Link 500 mL water	-	Referral	TAMU AgriLife	-
Water Analysis – Routine & Metals [Referral]: ions (calcium, magnesium, sodium, potassium), sulfates, chloride, pH, conductivity, and total dissolved salts (TDS), and metals (zinc, iron, copper, manganese)	Water Sample Link 500 mL water	-	Referral	TAMU AgriLife	-
Water Analysis – Routine & Heavy Metals [Referral]: ions (calcium, magnesium, sodium, potassium), sulfates, chloride, pH, conductivity, and total dissolved salts (TDS), as well as metals (zinc, iron, copper, manganese), and heavy metals (arsenic, barium, chromium, cadmium, fluoride, nickel lead)	Water Sample Link 500 mL water	-	Referral	TAMU AgriLife	-
Feed Nutritional Testing [Referral]	1 lb feed	-	Referral	Servi-Tech Labs	-
Livestock Water Suitability: Nitrate-nitrogen, Chloride, Sulfate-sulfur, Calcium, Magnesium, Sodium, Potassium, Total dissolved solids, Total hardness, Electrical conductivity, Water pH, Livestock hazard ratings	500 mL water	-	Referral	Servi-Tech Labs	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Caprine/Ovine Anemia

This plan was created to assist with the investigation of etiologic agents that may be associated with pale mucous membranes or anemia in caprine or ovine patients.

**Common Differentials:** endoparasitism, ectoparasitism, blood loss/trauma, chronic disease

### Recommended Initial Testing: Antemortem

Test	Samples	TAT	Section	Laboratory	Schedule
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Ruminant	0.5 mL Serum	1 day	Clinical Pathology	College Station	MTWRF
Parasite & Ova Count (McMasters) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

### Recommended Initial Testing: Postmortem

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Feces, intestines, abnormal tissues	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Parasite & Ova Count (McMasters) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation) (if > 3 wks old)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology	Tissues in 10% NBF	2-5 days	Histopathology	Canyon College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

### Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Hemoparasite Examination (Wright-Giemsa Stain)	0.5 mL EDTA blood or air-dried slide	1 day	Clinical Pathology	College Station	MTWRF
Fecal Occult Blood (Guicac)	1 g feces	1 day	Clinical Pathology	Canyon College Station	MTWRF
Iron Profile	0.5 mL serum	1 day	Clinical Pathology	College Station	MTWRF
Septicemia (Culture)	Blood inoculated into blood culture media	14 days	Bacteriology	Canyon College Station	MTWRFS
Necropsy	Carcass	1-4 days	Necropsy	Canyon College Station	MTWRF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Caprine/Ovine Ophthalmology

This plan was created to assist with the investigation of etiologic agents that may be associated with ophthalmic abnormalities in caprine and ovine patients.

**Common Differentials:** Trauma, *Mycoplasma keratoconjunctivitis* (*Mycoplasma* spp), *Chlamydophila Keratoconjunctivitis* (*Chlamydophila* spp), other bacterial infections (*Branhamella* spp., *Moraxella* spp., *Mycoplasma* spp., *Pasteurella* spp.), Neoplasia

- **Bacterial blepharitis:** *Actinobacillus lignieresii*, *Clostridium novyi*, *Dermatophilus congolensis*
- **Viral blepharitis:** parapoxvirus, capripoxvirus, orbivirus
- **Parasitic/Other blepharitis:** mange mites, photosensitization, aberrant elaeophoriosis, contact hypersensitivity, cutaneous myiasis
- **Infectious keratoconjunctivitis** (primary pathogen): *Mycoplasma conjunctivae*, *Chlamydophila pecorum*

### Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Swab – Amies Charcoal (lesion, conjunctiva, cornea, 3 <sup>rd</sup> eyelid)	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Campylobacter spp. (Culture)	Swab – Amies Charcoal (lesion, conjunctiva, cornea, 3 <sup>rd</sup> eyelid)	7 days	Bacteriology	Canyon College Station	MTWRFS
Mycoplasma spp. – Livestock (Culture)	Swab – Amies Charcoal (lesion, conjunctiva, cornea, 3 <sup>rd</sup> eyelid)	14 days	Bacteriology	Canyon College Station	MTWRFS
Cytology – Aspirate/Smear - Cornea	Air dried slides	1-2 days	Clinical Pathology	College Station	MTWRF
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Dermatophilus sp. (Stain)	Exudate, impression smears	1 day	Bacteriology	Canyon College Station	MTWRF
Fungal Identification (Culture)	Swab (lesion, cornea)	21 days	Bacteriology	Canyon College Station	MTWRFS
Bovine Herpesvirus Type 1 (rtPCR) <sup>++</sup>	PCR swab (lesion, cornea) 2 mL EDTA blood	1-4 days	Molecular Diagnostics	Canyon College Station	MTWRF TWRF
Bluetongue Virus (rtPCR)	2 mL EDTA blood	1-4 days	Molecular Diagnostics	College Station	TWRF
Mycoplasma spp. (PCR)	PCR swab	3-7 days	Molecular Diagnostics	Canyon College Station	WR TR
Parapoxvirus (rtPCR)	1 g fresh lesions or scabs	1-4 days	Molecular Diagnostics	College Station	TWRF
Electron Microscopy	2-5 g fresh samples	5-7 days	Virology	College Station	Variable
Listeria monocytogenes (PCR) [Referral]	2 mL EDTA blood	-	Referral	Cornell AHDC	MTWRF
<sup>++</sup> Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements. However, testing results will be confirmed with positive and negative controls.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine/Ovine Dermatology

This plan was created to assist with the investigation of etiologic agents that may be associated with dermatopathology in caprine and ovine patients.

**Common Differentials:** Mites (mange), lice (pediculosis), dermatophytosis (ringworm), bacterial infection, parapoxvirus infection (orf/contagious ecthyma), dermatophilosis, photosensitization, fly bite dermatitis

## Recommended Initial Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Bacterial Identification – Livestock (Aerobic & Anaerobic Culture)	Fresh skin tissue, swab	2-7 days	Bacteriology	Canyon College Station	MTWRFS
Dermatophilus sp. (Stain)	Exudate, impression smears	1 day	Bacteriology	Canyon College Station	MTWRF
Fungal Identification (Culture)	Fresh tissue, swabs, fungal isolate	21 days	Bacteriology	Canyon College Station	MTWRFS
Cytology (Skin scraping/ impression smear)	Skin scraping material or air-dried slide	1-2 days	Clinical Pathology	College Station	MTWRF
Histopathology – skin biopsy	Formalin (NBF) fixed skin tissue	2-3 days	Histopathology	Canyon College Station	MTWRF
Parapoxvirus (rtPCR)	1 g fresh lesions or scabs	1-4 days	Molecular Diagnostics	College Station	TWRF
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Dermatopathology	Formalin fixed skin tissue	-	Referral	TAMU CVM	-
Plant Identification	Intact, preserved plant	1-5 days	Analytical Chemistry	College Station	MTWRF
Toxicology Evaluation (Microscopy)	1 qt rumen contents, 20 mL water, 500 g feed, 4 flakes hay	1-5 days	Analytical Chemistry	College Station	MTWRF
Antimicrobial Susceptibility – Food Animal (indicate MIC or KB preference)	Pure bacterial isolate	1 day	Bacteriology	Canyon College Station	MTWRF
Clostridium spp. (FA)++	Fresh or fixed liver	1 day	Bacteriology	Canyon College Station	MTWRFS
CBC – Livestock	1 mL EDTA whole blood and 1-2 air dried slides	1 day	Clinical Pathology	College Station	MTWRF
Chemistry Profile – Ruminant TP, ALB, AG ratio, globulin, Ca, P, Mg, glucose, CPK, BUN, creatinine, tBili, AST, GGT, GLDH, Na, K, Cl	0.5 mL serum or lithium heparin plasma	1 day	Clinical Pathology	College Station	MTWRF
Corynebacterium pseudotuberculosis – Caprine/Ovine (SHI) (caseous lymphadenitis)	2 mL serum	2-4 days	Serology	College Station	MTWR
Electron Microscopy	2-5 g fresh samples	5-7 days	Virology	College Station	Variable
Virus Isolation (Cell Culture)	2-5 g fresh tissue, 5-10 mL heparin blood	14-21 days	Virology	Canyon College Station	TF T
++Due to the limited number of submissions from some species, validation of test results cannot be accomplished within AAVLD requirements.					
TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)					

## Caprine/Ovine Pre-Purchase/Biosecurity

The following tests are available to detect or gain relevant information on diseases that are common risks to operation biosecurity when introducing new animals to the population. The final testing package will depend on individual operation biosecurity protocols and management goals.

**Common diseases of concern to small ruminant operations:** small ruminant lentivirus (CAE/OPP), corynebacterium pseudotuberculosis (caseous lymphadenitis), Mycobacterium avium subsp. paratuberculosis (Johne's disease), parapoxvirus (orf/contagious ecthyma), Coxiella burnetii (Q fever)

## Basic Serology Screening: Caprine/Ovine

Test	Samples	TAT	Section	Laboratory	Schedule
Corynebacterium pseudotuberculosis – Caprine/Ovine (SHI) (caseous lymphadenitis)	2 mL serum	2-4 days	Serology	College Station	MTWR
Small Ruminant Lentivirus (cELISA) (CAE/OPP)	1 mL serum	1-3 days	Serology	College Station	MR
Mycobacterium avium subsp. paratuberculosis – Serum or Plasma (ELISA) (Johne's disease)	1 mL serum or plasma	1-3 days	Serology	Canyon College Station	TWR MR

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Comprehensive Screening Panel: Caprine/Ovine

Test	Samples	TAT	Section	Laboratory	Schedule
Corynebacterium pseudotuberculosis – Caprine/Ovine (SHI) (caseous lymphadenitis)	2 mL serum	2-4 days	Serology	College Station	MTWR
Small Ruminant Lentivirus (cELISA) (CAE/OPP)	1 mL serum	1-3 days	Serology	College Station	MR
Mycobacterium avium subsp. paratuberculosis – Serum or Plasma (ELISA) (Johne's disease)	1 mL serum or plasma	1-3 days	Serology	Canyon College Station	TWR MR
Mycobacterium avium subsp. paratuberculosis (rtPCR)	1 g feces	1-4 days	Molecular Diagnostics	College Station	TWRF
Coxiella burnetii (ELISA)	1 mL serum or plasma	1-3 days	Serology	College Station	TF

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

## Secondary/Additional Recommended Testing

Test	Samples	TAT	Section	Laboratory	Schedule
Parapoxvirus (rtPCR)	1 g fresh lesions or scabs	1-4 days	Molecular Diagnostics	College Station	TWRF
Parasite & Ova Count (McMasters)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Parasite & Ova Identification (Fecal Floatation)	3-5 g feces	1-2 days	Clinical Pathology	College Station	MTWRF
Scrapie genetic testing (Sheep / Goats)	Submission Form Link	-	Referral	Gene Check, Inc	-

TAT = Testing Result Turnaround Time, Schedule = (M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, S (Saturday)

# Contributors

## Other Spp. Syndromic Testing Editors

- Guy Sheppard
- Jessie Monday
- Reviewers: Gayman Helman, Terry Hensley
- Communications Support: Mallory Pfeifer

## Equine Testing Recommendations

- Terry Hensley
- Guy Sheppard
- Jessie Monday
- Holly Ernst
- 2019 Revisions/Updates: Stephanie Merrell

## Equine Endocrinology Testing Resources

- Jeremie Korchia
- Jessie Monday
- Guy Sheppard

## Small Ruminant Testing Recommendations

- Jessie Monday
- Guy Sheppard
- Stephanie Merrell