



NDSU Veterinary Diagnostic Laboratory

Fall 2014, Vol. 1, No. 3

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A newsletter about diagnostic trends at the laboratory, animal health topics, interesting cases and new test offerings.

www.vdl.ndsu.edu

We welcome comments, questions and suggestions. Please email us at ndsu.vetlab@ndsu.edu or call the laboratory at (701) 231-8307.

This has been an enjoyable summer thus far, with the laboratory receiving a steady stream of interesting cases, along with the typical seasonal afflictions such as anthrax, blue-green algae toxicoses and summer pneumonias.

With fall herd health testing right around the corner, please note the laboratory has a new electronic herd submission form and updated submission guides for Johne's and BVDV testing. With the new herd submission form, animal identifications can be pasted from existing spreadsheets or directly typed. Please take advantage of these time-saving forms.

As a reminder, if you have yet to visit the new website, please do so. You will find information on every test we offer, such as what type/amount of sample to submit, the day or days the test is run and when results will be available.

Finally, the annual North Dakota Veterinary Medical Association (NDVMA) meeting will be held Aug. 17-19 in Fargo, and I hope to see many of you there.

Sincerely,

Brett T. Webb, DVM, PhD, DACVP
Veterinary Pathologist
NDSU Veterinary Diagnostic Laboratory

NDSU VETERINARY DIAGNOSTIC LABORATORY
North Dakota State University

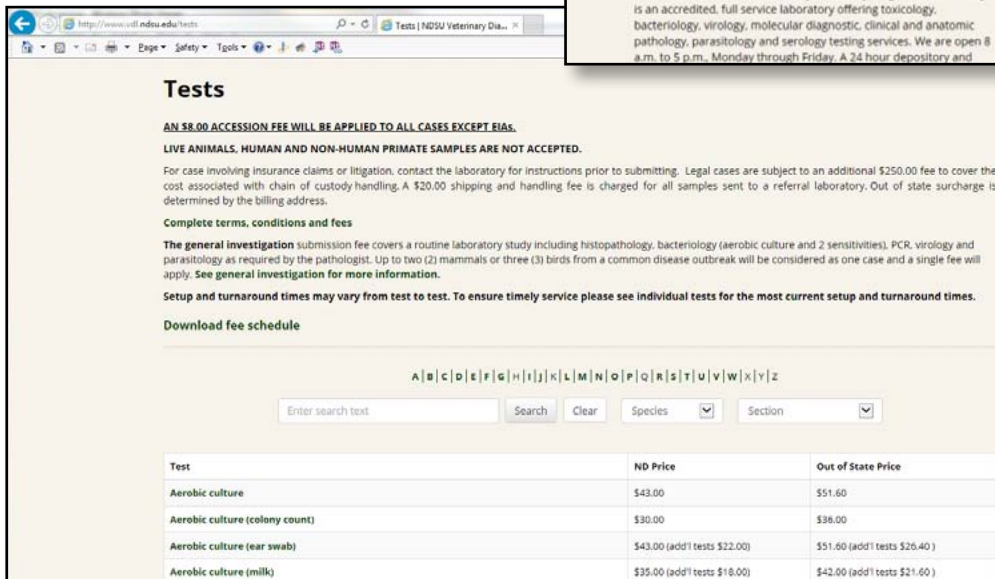
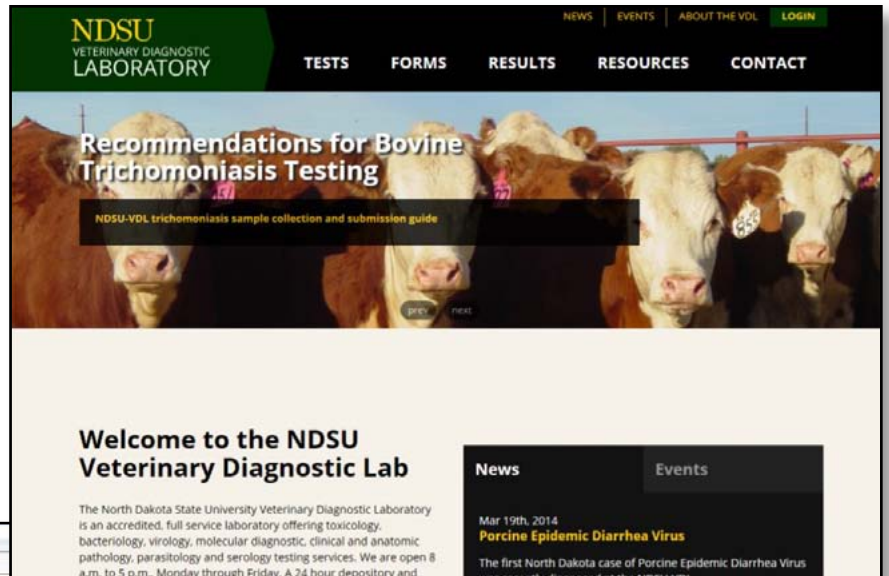
New Website, New Features

Does the VDL offer this test?

Search test offerings for sample information, testing schedule and pricing.

Need faster results? Request online access.

The website, www.vdl.ndsu.edu, is packed with new features to help your busy practice quickly access test information, test results, fillable submission forms and other useful resources.



New Tests

New PCR Tests	Price
Porcine delta coronavirus	\$45
Porcine diarrhea panel (includes TGE, Rotavirus A, PEDV and PDCoV)	\$65
Anaplasmatataceae (detects <i>Anaplasma</i> sp. and <i>Ehrlichia</i> sp.)	\$35
<i>Campylobacter jejuni</i> , fetus, <i>venerialis</i>	\$35

Diagnostic Laboratory Calendar

- Aug. 17-19, Annual NDVMA meeting – Fargo

The diagnostic laboratory will be closed on the following holidays:

- Sept. 1, Labor Day
- Nov. 11, Veterans Day
- Nov. 27, Thanksgiving
- Dec. 24, Christmas Eve – the laboratory closes at noon
- Dec. 25, Christmas Day



VDL Welcomes New Faculty

The VDL is excited to announce Claire Miller, DVM, Ph.D., a veterinary microbiologist, has joined the laboratory. She comes to North Dakota from the Washington State University Animal Disease Diagnostic Laboratory, where she completed residency training and graduate work in microbiology.

Miller's dissertation focused on characterizing the methylome, transcriptome and proteome of a DNA adenine methylase mutant strain of *Salmonella typhimurium* shown to induce protection in a calf model of disease.

She will begin her appointment Aug. 18 and be responsible for overseeing testing services in the bacteriology, virology and serology section laboratories. We are excited to have aboard an individual with Miller's level of training and expertise, and look forward to improving microbiology testing services at the laboratory.

Submission Tips

Tired of writing out animal IDs on page after page of our serology forms? Use the new electronic herd submission form. Visit the laboratory's website (www.vdl.ndsu.edu/forms) to download the form. The electronic form is the most efficient means for the laboratory to process your submission, and the results can be returned to you in electronic format.

Form Instructions:

- Paste or type in animal IDs.
- Fill out the remainder of the form.
- Email the completed form with owners name in subject line to ndsu.vetlab@ndsu.edu.
- Print the form and mail it with your samples.

Submit photos or radiographs with your cases. Email them to ndsu.vetlab@ndsu.edu and include the owner's last name in the subject line.

Noteworthy Case

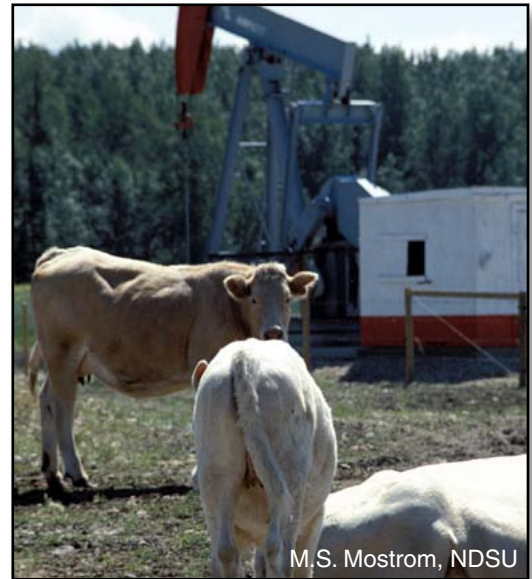
Crude Oil Toxicity

Tissues from a 2-year-old ewe were submitted to the laboratory for evaluation of potential ingestion of crude oil. The flock had been exposed to crude oil from a leaking tank and a couple ewes had died and others had aborted.

Intestinal contents and feces were grayish black and watery, and contained a barely perceivable oil sheen. Also, a petroleum smell was detected easily in both samples.

In-house GC-MS analysis of intestinal contents and feces confirmed the presence of high-branched chained alkanes consistent with ingestion of unrefined petroleum or crude oil. No significant gross or microscopic lesions were observed. The final disposition of the case was unknown at the time this newsletter went to press.

With the increasing number of petroleum, brine and waste water spills and leaks reported almost weekly, the VDL encourages veterinarians to determine whether the case has potential for litigation and, if so, to contact the laboratory prior to submission to obtain sampling recommendations and chain-of-custody forms. A chain-of-custody form is available on the VDL website, www.vdl.ndsu.edu/forms.



Polioencephalomalacia

Polioencephalomalacia (PEM) or cerebrocortical necrosis is a common cause of neurologic disease in ruminants and is clinically recognized as two distinct syndromes: 1) acute onset of recumbency and opisthotonos, from which the animal typically doesn't recover despite treatment and 2) subacute onset of ataxia, circling, tremors, cortical blindness and star gazing, from which appropriately treated animals sometimes recover.

Cerebrocortical necrosis is a nonspecific lesion that can be caused by thiamine deficiency, sodium toxicity/water deprivation, lead toxicity and consumption of excess dietary sulfur, although the latter two causes are most common.

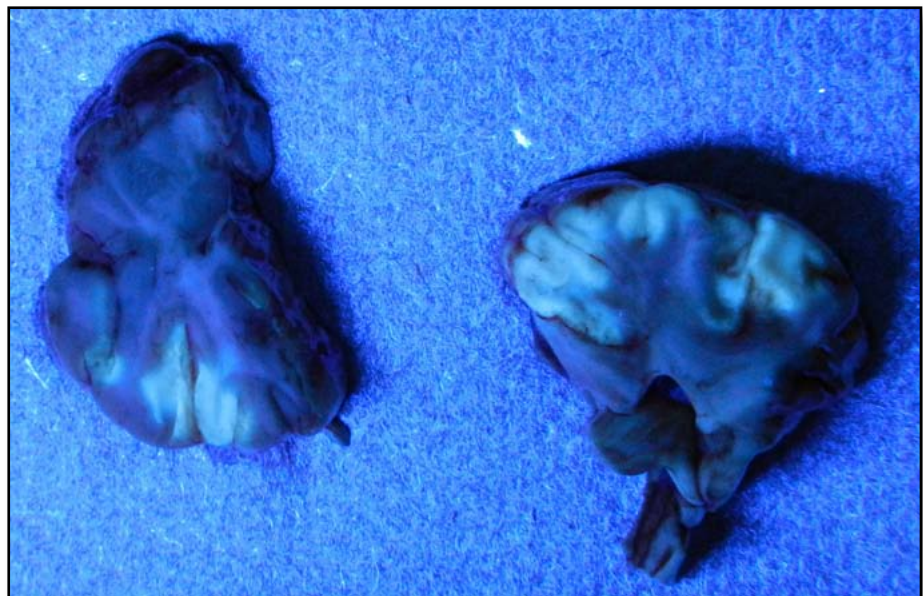
Much of North Dakota's surface and subsurface waters are quite high in sulfate, particularly in the western portion of the state. Although the majority of sulfur-induced PEM cases submitted to the VDL are caused by high water sulfates, some forages including Bermuda grass, *Kochia* sp. and other sulfur-accumulating plants can have more than 3,000 parts per million (ppm) of sulfur, so sulfur toxicity should not be ruled out solely on the basis of low water sulfates. The table details maximum sulfur and sulfate concentrations in various species.

The type of ration has a significant influence on sulfur tolerance, with high-concentrate rations leading to significantly lower sulfur tolerance when compared with forage-predominant diets. Influence of diet on sulfur tolerance is complex but mainly due to the effects of rumen pH and rumen bacterial flora on hydrogen sulfide production.

Unfortunately no economical methods are available to remediate high sulfate levels in water, so lowering total sulfur intake by providing an alternate source of water, reducing ration concentrate

Maximum sulfur and sulfate concentrations in various species.

		Maximum Sulfer In Diet	Drinking Water mg/L
Cattle and sheep	> 85% concentrate concentrate (< 15% forage)	0.3%	< 600 sulfate (< 200 sulfur)
Cattle and other ruminants	> 40% forage	0.5%	< 2,500 sulfate (< 834 sulfur)
Swine		0.4%	< 3,000 sulfate (< 1,000 sulfur)
Dogs and cats		0.6%	
Chicks		~0.4%	< 1,000 sulfate (< 333 sulfur)



A cross-section of cerebral cortex under UV light with patchy autofluorescence of the outer cortical lamina. (B.T. Webb)

levels or changing forage type are the only viable options.

The gross lesions of PEM often are absent, and when present, typically are subtle and consist of cerebral edema, which is most apparent by the flattened appearance to cerebral gyri and slight yellowish discoloration. If a UV light source is available, a cortical laminar pattern of autofluorescence can be seen in some more advanced cases.

The VDL recommends submitting a complete set of organ samples including the head or whole fresh brain (to rule out rabies when applicable), whole blood (EDTA) or liver or kidney tissue (10 grams minimum), and a water sample (50 ml minimum).

Cyanobacteria or harmful blue-green algae

Michelle S. Mostrom, DVM, Ph.D., DABVT, DABT,
Veterinary Toxicologist, NDSU-VDL

Areas of North Dakota have had several harmful blue-green algae blooms on freshwater sloughs, lakes and ponds.

Typically, for a harmful blue-green algae bloom, the water source should be warm (more than 20 C or 68 F), have relatively low turbulence and adequate light, and be mesotrophic or eutrophic, with a phosphate concentration greater than 30 micrograms per liter ($\mu\text{g/L}$) and nutrient concentration generally greater than 300 $\mu\text{g/L}$. Blooms can persist for several weeks, but in fertile water bodies, cyanobacteria can persist through the summer and into fall. Blue-green algae can overwinter under ice in the Arctic.

Cyanobacterial blooms occur in North Dakota

The NDSU-VDL typically identifies *Microcystis* sp., *Anabena* sp., *Aphanizomenon* sp. and occasionally *Oscillatoria* sp. in water samples. These samples need to be kept cool and submitted to the lab fairly soon after sampling; the lab needs about 10+ milliliters (mL) in a well-sealed container. These identifications are based on characteristic shape and presentation in the water sample and provide a “suggested” diagnosis in livestock toxicosis.

Following ingestion of water containing cyanobacteria blooms, livestock can develop clinical signs within minutes to hours. The toxins are released with cell wall damage and cell death. Microcystin toxins are hepatotoxins and are distributed rapidly to liver, lungs, heart and other organs. Clinical signs are vomiting, diarrhea, weakness, pale mucous membranes, shock and often death. If animals survive, they can develop hepatogenous photosensitization and nephrotoxicity.

Anabena, *Aphanizomenon* and *Oscillatoria* can produce anatoxins that are primarily neurotoxins and are potent cholinergic agonists on nicotinic acetylcholine receptors in neurons at neuromuscular junctions.

Clinical signs in livestock following anatoxin-a ingestion can include a rapid onset of rigidity and muscle tremors, followed by paralysis, convulsions and rapid death. Anatoxin-a(s) toxin can cause excessive salivation, lacrimation, diarrhea, urination, tremors, convulsion, recumbency and respiratory arrest in minutes following consumption.

The actual detection of toxins in the water and animal tissues provides a confirmatory diagnosis; however, the cost of analytical detection of cyanotoxins can be quite expensive.



Anabaena flos-aquae bloom on pond. (M.S. Mostrom)

Oftentimes, animals are found dead close to a water source, with other dead wildlife near the water.

Microcystis often produces a strong, somewhat oily smell. A recent cyanobacterial bloom (typically bluish green) and wave action that concentrates the bloom against a shoreline often precede the deaths.

Management of cyanobacterial toxicosis is removal of the livestock from the contaminated water source and symptomatic and supportive treatment of clinical signs.

Often the veterinarian is asked about treating the water to destroy the algae and toxins in a farm pond. Unfortunately, a simple answer is not available. The general algacide used is copper sulfate, which can affect many organisms in the water system, including fish and zooplankton, which can feed on the algae. The livestock producer will need to correct underlying conditions that cause the bloom (nutrient enrichment of the water) or another bloom is likely to occur.

Microcystin toxins released with algae death are resistant to environmental breakdown (unless very high temperatures or extreme water pH exists) and can have half-lives up to 10 weeks (some sources state toxins persist from three weeks to five months), which varies with water inflow/outflow rates and sedimentation.

Typically, it is recommended livestock be kept away from copper-treated water sources for more than 14 days, but the persistence of toxins in the water may extend this period to a point that the use of copper sulfate treatment is questioned.

Cyanobacterial blooms occur in North Dakota
(Continued on back page)

Cyanobacterial blooms occur in North Dakota (Continued from page 5)

The North Dakota Department of Health requires notification if copper sulfate is used on a water body. The notification permit can be found at www.ndhealth.gov/WQ/sw/Z7_Publications/PesticideNotificationRequirementsfortheApplicationofPesticidestoWatersoftheState.pdf.

Recommendations for the use of copper sulfate on a dugout or pond can be found in numerous agricultural publications on the Internet. Given the difficulty of adequately dispersing copper sulfate, it is not recommended for large sloughs. Basically, one pound of copper sulfate (by weight) will treat 250,000 gallons of water, with a recommendation to treat at the beginning of the bloom.

The common application methods are to 1) dissolve the copper sulfate in warm water and spray over the water's surface or 2) place the copper sulfate in a weighted cloth bag with a rope spread side to side and drag it back and forth by boat across the water surface.

If a dugout has fish, it is recommended that only one-third of the dugout should be treated with one-third of the recommended copper sulfate and applied in treatments during a three-day period.

Copper sulfate treatment is most successful when the water pH is between 7 and 8, alkalinity is between 50 to 150 mg/L, water temperature is above 15 C or 59 F, and the weather is sunny and calm. If the treatment is ineffective, do not repeat or increase the dose. Copper will not control green or brown algae.

Several methods may prevent blue-green algae blooms on ponds and sloughs. Moving the water with aeration techniques on a pond promotes cycling of nutrients and prevents a buildup of nutrients used in a bloom.

The old-time approach to prevent algae blooms was to drop a large-round bale of barley straw into the water; the mechanisms that prevent an algae bloom are not known. Also, spreading straw over the water surface will decrease light and help prevent a bloom, but this approach would only be temporary.

Cover photo by Brett Webb, NDSU

Contact Information

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For more information on this and other topics, see www.vdl.ndsu.edu

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