



# Neurological diseases in cattle:

## Considerations for the producer and practicing veterinarian

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Disorders of the nervous system are important diseases in domestic animals, and cattle are certainly not an exception. Some diseases are of zoonotic potential and can seriously impact human health. Other disorders are of herd health significance, leading to increased sickness and death. Lastly, some diseases affecting the nervous system are congenital or hereditary and have the potential to adversely affect the reproductive health of a herd for years if not recognized.

It is realistic to ask where we stand concerning our knowledge of neurological diseases in cattle. The spectrum of diseases affecting the nervous system of cattle

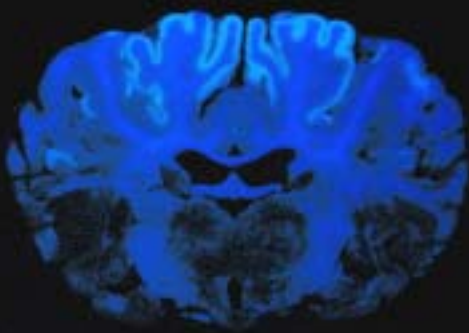
is extensive. This body of knowledge is a tribute to the care and concern animal producers, seeking to better understand and correct potential health problems that exist in the herd, have for their animals. The current extensive knowledge of neurological diseases in cattle can also be attributed to the practicing veterinarians who go the extra step in characterizing the disorders from a clinical standpoint and who submit animals or tissues for diagnostic evaluation. Producers, clinical veterinarians, and diagnosticians also have to be continually cognizant of new emerging or exotic diseases, with bovine spongiform encephalopathy (known as “mad cow

disease”) being a perfect example.

There is no doubt that the antemortem (prior to death) diagnosis of these disorders is problematic and that a definitive diagnosis is often elusive until after the death of the animal when appropriate samples can be collected and tests performed. Even then, the complexities of the nervous system may confound the best attempts at diagnosis. To start with, there is no substitute for collecting all the pertinent information possible. The age of onset, breed, any change in feed or management, the introduction of new animals, the character and progression of symptoms, and any other informa-



A normal brain (top) and a brain from a calf with cerebellar hypoplasia (bottom) due to utero bovine virus diarrhea (BVD) infection are shown.



Polioencephalomalacia in a steer is shown. This coronal section of brain viewed under ultraviolet light reveals a laminar pattern of bright blue fluorescence indicating areas of brain damage.

tion that may be deemed important, however minor, should be collected.

Animals affected at birth or during the neonatal period or of a specific breed may be victims of congenital or hereditary problems. Sudden changes in feed or rations may cause systemic changes or disturbed metabolism that may be manifested as neurological disease. Replacement animals in a herd may introduce new diseases. A good clinical examination and knowledge of the progression of symptoms may help localize the injury to certain areas of the nervous system. Antemortem tests including blood work and serology may point to a specific cause but are often unrewarding. Animals with vague, usually non-progressive, neurological disease may recover, or the symptoms may remain static. Severely affected animals and animals with progressive diseases are commonly killed or die of the condition.

Postmortem examination is often the only way of arriving at a specific or at least a more precise diagnosis. Even if not definitive, a diagnostic workup may help

to better characterize and place a disorder into a more definitive category of disease, hence the producer may be more aware of the potential impact on the health of the herd.

An entire freshly dead or terminal live animal, along with a complete history, is the best specimen for further diagnostic workup. A complete field necropsy is the next best option for gathering information. It is important to emphasize that a complete necropsy is needed. Diseases affecting other organs can result in neurological disease, with acute or chronic liver disease leading to liver failure being a prime example. Clinical signs will often point to specific areas of the nervous system for sampling. The collection and submission of brain samples alone may be unrewarding if clinical signs point to a spinal cord or peripheral nerve disorder. Removal of the brain and spinal cord can be problematic under field conditions.

Despite some misconceptions, the nervous system can withstand postmortem decomposition fairly well, and it is

certainly permissible to send an entire head and/or spinal column (divided into segments, some is better than none) for removal by diagnostic laboratory personnel. The brains of fetuses and neonates have very high water content, making intact removal difficult. In these situations, it may be preferable to send the entire head to the lab.

For very careful postmortem examination by a pathologist, the brain and spinal cord need to be removed intact with as little disruption as possible. This allows for more precise correlation of anatomy and brain function with the presence of lesions. If rabies or other septic/infectious diseases are a consideration, swabs may be taken of portions of the brain, or small sections of cerebellum and terminal brain stem can be removed and submitted fresh for the appropriate testing. Another misconception is that the intact brain does not fix well in formalin. The brain should not be randomly sliced prior to fixation because this often disrupts the tissue, preventing adequate sectioning on arrival at a laboratory.

Traditional categories of diseases affecting the central nervous system can be complex. Practicing veterinarians are well aware of the common diseases affecting the nervous system of cattle. Clinical signs and history can often point to a specific diagnosis, but confirmation usually requires laboratory testing. The primary example of a disease with public health impact is rabies, and all individuals must be cognizant of this disease.

Common infectious or septic disorders, some occurring sporadically, include the congenital brain malformations associated with in utero bovine virus diarrhea infection, meningitis associated with neonatal septicemias, brain abscesses, listeriosis, and thrombotic meningoen- cephalitis caused by *Haemophilus somnus*. Parasitic disorders include *Neosporum* and *Sarcocystis* as well as the neurological disease associated with intestinal coccidiosis. Metabolic diseases associated with liver or other organ failure, acid-based disturbances, and micro mineral imbalances are commonly associated with

neurological deficits. One metabolic disease, polioencephalomalacia, is commonly associated with disturbances in rumen micro flora, often due to a change in diet, ruminal acidosis, or increases in dietary sulfur. Toxicities from exposure to or ingestion of lead and other heavy metals, salt (most often accompanied by water deprivation), pesticides, and poisonous plants can lead to significant death losses.

The final category of diseases affecting the nervous system is those having a familial or hereditary basis. Purebred cattle are most commonly affected, but some diseases can occur in crossbred animals. The various disorders can be associated with neurological symptoms at the time of birth, but clinical signs with several of the diseases are delayed and may not be apparent until the animals are several days, weeks, or months old.

### Diseases affecting the cerebellum

These disorders are generally manifested as incoordination, and clinical signs can be observed at or near the time of

Table 1. Storage diseases reported in cattle categorized by type of storage material and breed(s) affected.

Storage material	Cattle breed affected
Gangliosidoses	Friesian
Mannosidoses	Angus, Murray Grey, Galloway, Salers
Glycogenoses	Beef Shorthorn, Brahman
Ceroid lipofuscinosis	Devon cattle, Beefmaster

birth or can be delayed. Breeds affected include Angus, Charolais, Ayshire, Shorthorn, Hereford, and Polled Hereford crosses.

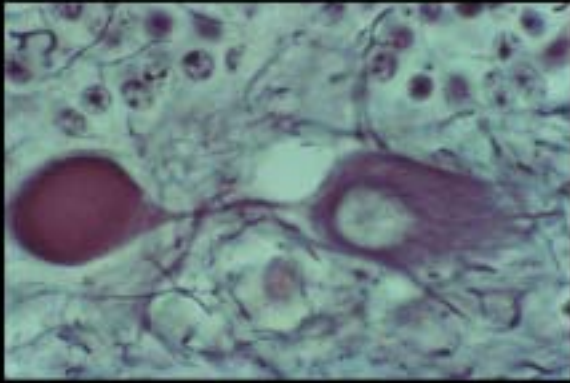
### Storage diseases

These diseases are associated with specific enzyme deficiencies or intracellular metabolic defects that allow the accumulation of metabolic products within cells of the nervous system, leading to altered function of the cells. Clinical signs are varied and reflect altered mentation to locomotor difficulties. These diseases are categorized further by the specific enzyme deficiency and the primary substance that is accumulated in the cells (see Table 1).

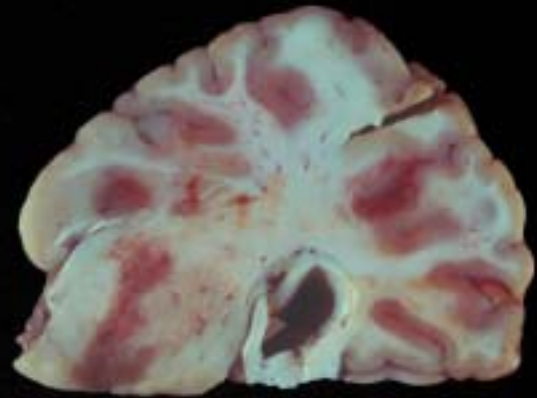
### Metabolic encephalopathies

These disorders are due to specific defects in metabolic pathways used by cells in different organs throughout the body, but clinical signs and lesions are generally referable to the brain. The diseases include maple syrup urine disease in Herefords and citrullinemia in Friesian cattle. Affected animals usually display clinical signs within a few days after birth. The disease in Herefords is due to the defective metabolism of branched-chain amino acids that allows the acids to accumulate. These amino acids impart a characteristic sweet odor to the urine. The disease





This microscopic photo of hereditary cerebellar disease in an Angus calf shows a Purkinje cell (one of the neuronal types in the cerebellum) with a fusiform swelling of the axon called a "torpedo body."



Blotchy areas of hemorrhage and inflammation due to *Haemophilus somnus* are shown in a steer with thrombotic meningoencephalitis.

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rapidly progresses to recumbency and death. Citrullinemia is due to a defective enzyme in the urea cycle, allowing ammonia to accumulate in blood. Clinical signs are depression, blindness, seizures, and rapid progression to coma and death within four to six days.

#### Motor neuron diseases

These diseases are reported in Hereford, Brown Swiss, and Red Danish calves. Clinical signs are referable to spinal cord damage and consist of tremors, difficulty rising and stand-

ing, wobbly gait, and incoordination. Herefords are usually affected within a few hours of birth while the disease in Swiss and Danish cattle is delayed two to six weeks.

Additional familial or hereditary diseases have been reported in Simmental, Limousin, Brown Swiss, Murray Grey, Holstein-Friesian, and Charolais cattle. It should be mentioned that not all of these hereditary or familial diseases have been reported in the United States. With the global trade in genetic material and cattle for breeding pur-

poses, it would not be unexpected that some of these "exotic" diseases could occur in this country or arise spontaneously in native cattle.

The Wyoming State Veterinary Laboratory (WSVL) employs experienced and knowledgeable specialists in several disciplines who can assist producers and practicing veterinarians in the diagnosis and further understanding of these difficult-to-diagnose and often complex disorders affecting the nervous system in cattle. For additional information or assistance, please feel free to call the WSVL at (307) 742-6638.

