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Animal Health MATTERS Newsletter

Veterinary and Biomedical Sciences

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Animal Health MATTERS

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Animal Health MATTERS

Vol. 12, Issue 2

July 2009



Early Spring Cow Losses in Southwest South Dakota

Clinical Presentations and Investigations

Russ Daly DVM, SDSU

From early March through April 2009, numerous ranches in southwest South Dakota—mostly Jackson and Shannon Counties and adjacent areas—reported higher than normal numbers of cows in late gestation on pastures dying. Typically these cows became thin, developed rough hair coats, became weak, and were unable to rise after lying down. For the most part, these cows were alert and aware of their surroundings. Some would remain down for one or two days before dying.

Q: How many cows were affected in these herds?

A: Although true numbers are hard to come by, it's estimated from veterinarian's reports that nearly 200 cows were lost from 16 herds recorded. The numbers affected per herd range from 1 to 55. According to information compiled, the median number of cows affected from these herds was six.

Q: Much was made about ticks as the cause of these losses. What was learned about the role of ticks?

A: One of the interesting aspects of these cases was that some—but not all—of the affected herds reported that the affected cows were covered with ticks. Early on, the onset of these cases of down, weak cows coincided with an unusually early tick hatch in those areas. Other herds reported finding only a few ticks on their affected cattle.

Q: What kind of tick was found on these animals in South Dakota?

A: Two species have been identified in these affected herds: *Dermacentor andersoni* (Rocky Mountain Wood Tick) and *Dermacentor albipictus* (Winter Tick). The normal ranges of these ticks are generally in the Rocky Mountain states, so finding these ticks here may represent a bit of a stretch outside their normal range.

Q: What problems could ticks cause for cattle?

A: First, ticks are the source of blood loss for cattle due to their feeding activities. This could cause some borderline anemia, and would affect the animal's ability to gain weight or produce milk. In addition, irritation from heavy infestations of ticks will likewise interfere with weight gains or production. This could be a very important issue in cows in late gestation that are already partitioning quite a bit of their energy and protein into the developing calf inside them.

Second, ticks can carry and spread certain viral, bacterial, and protozoal diseases. *Dermacentor andersoni* has been



Cow from southwest South Dakota herd found weak and unable to rise near creek bed, March 2009. (Photo: Russ Daly, DVM)

implicated in transmission of Rocky Mountain spotted fever, tularemia, Colorado tick fever, and Q fever in the USA, and is one of the causes of tick paralysis. *Dermacentor albipictus* may play a role in the transmission of anaplasmosis and Rocky Mountain Spotted Fever.

However, Rocky Mountain Spotted Fever (caused by *Rickettsia rickettsii*), and Colorado Tick Fever (caused by a tick-borne virus) have not been documented in cattle.

Although tularemia is endemic to this area of South Dakota, cattle are generally believed to be resistant to clinical effects. The causative organism, *Francisella tularensis*, was not isolated from any of the

Cow Death Losses

(Continued on page 2)

Director's Message-- The Cost of a Veterinary Medical Education

David H. Zeman, DVM, PhD

Last week a group of SDSU's prevet advisors met with leaders of Iowa State University's College of Veterinary Medicine. The meeting was graciously hosted by Dean Thomson, Associate Dean Uhlenhopp and other ISU CVM faculty members. States that had relationships with the ISU CVM were invited to share and discuss issues regarding veterinary medical education. South Dakota feels fortunate to have placed 10 students at the ISU CVM for the upcoming fall term.



Dr. Don Draper of the ISU CVM

shared some interesting information regarding the cost of a veterinary medical education across our country. I have digested and paraphrased some of his information to give you a quick sketch of the situation. Educational expenses are defined as the total cost for a year of CVM medicine including tuition, fees, books and living expenses. In general in veterinary colleges across the U.S., most resident students are paying \$30-40,000 per year and most non-resident students are paying \$50-60,000 per year. For four years, you can do the math. The students are putting in funds of their own from work or savings or family support to cover the bills. The current debt nationally for new DVM graduates is in the area of \$120,000. The good news is that Dr. Draper also showed the power of the in-

come level after graduation is still strong, making it a good investment in oneself.

However, the costs of professional education will continue to rise and the average debt load likely will also and this is of concern. What can we do? I encourage all friends of animal health to support education scholarships and remember this situation when you do estate planning. Please be as generous as you can. For example the SDSU Veterinary Science Department has several scholarships available for prevet students; we would like more. The SD Veterinary Medical Foundation has several scholarships for SD students in veterinary colleges across the country; they would like to do more. Thanks for listening and considering this situation. Have a great summer. ■

Cow Death Losses

(Continued from page 1)

cattle samples submitted.

One of the modes of transmission of Q Fever may include ticks and wild animals; however, its characteristic signs of late term abortions were not observed in these cases.

Tick paralysis, caused by a toxic substance in the tick's saliva, has been reported in cattle; however, it is usually observed in calves and younger cattle, rather than older cows.

"Tick fever" or "Texas tick fever" is caused by a protozoal organism carried by *Boophilus spp.* ticks, which have been eradicated from the United States, except for a permanent quarantine zone in south Texas. Another syndrome also called "tick fever" or "tick-borne fever" is carried by a *Ixodes ricinus*, found only in Europe.

Q: What about the possibility of

anaplasmosis?

A: Anaplasmosis is due to an infection caused by *Anaplasma marginale*, a bacteria that infects red blood cells of cattle. The bacteria may be spread from animal to animal by mechanical or biological means (biting flies or ticks). Infected red blood cells are removed by the animal's immune system, and anemia results. Clinical signs depend on the degree of anemia, and may include pale gums, weakness, dehydration, and lack of appetite. Dyspnea and belligerence may be noted as the condition progresses.

Q: How many of the cattle tested were positive for anaplasmosis?

A: None. Anaplasmosis can be diagnosed directly by examination of blood smears or by PCR techniques. Indirect evidence through measurement of *A. marginale* antibodies may be obtained with competitive ELISA serology. Nei-

ther blood smear examinations nor serology tests were positive for anaplasmosis in any samples obtained from cattle in these herds during this period.

In general, it takes 3 to 8 weeks from the introduction of the organism into the animal to the time when enough red blood cells are affected and removed by the body for clinical anemia to result. It is unlikely that appropriate vectors had been around long enough by the time clinical illness was apparent in these cattle.

Q: In some (but not all) of these areas, there were large numbers of deer die-offs. Can deer get anaplasmosis, too?

A: Experimentally, deer can become infected with anaplasmosis, as diagnosed with blood smears and by showing a long-lasting antibody response. But even experimentally, deer did not show anemia

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Cow Death Losses

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or clinical signs, let alone mortality. It is generally believed that the low level of bacterial infection in deer blood cells is below the threshold that would result in efficient transmission to cattle from biting flies.

The SDSU ADRDL examined blood samples and tissues from deer that died in the area. None had blood smears positive for *A. marginale*. Two of eight deer had positive serology, indicating exposure at some point.

Q: What caused the death losses in the deer in these areas?

A: Deer in these areas were subject to the same environmental, nutrition, and tick infestation factors that are present in the cattle populations. There was no evidence that cattle losses were caused by a reservoir of a disease in the deer, nor was there evidence that deer losses were caused by a reservoir of disease in cattle.

Q: What other lab results have come from the cows that were examined?

A: Most of the cows tested showed serologic evidence of exposure to bluetongue virus and epizootic hemorrhagic disease (EHD). However, the agents were not found in blood or tissues. Cattle are generally resistant to clinical signs, let alone death losses, from infections with these viruses. EHD has been known to cause large die-offs of wild deer, but not usually infect cattle. In 2007 in Ohio an outbreak of EHD in cattle occurred, resulting in mild oral lesions and lameness in affected animals. None of those signs or lesions were identified in these cattle, nor was EHD confirmed as a cause of mortality in the deer.

Additionally, blood samples from one deer revealed very high titers to *Ehrlichia canis*, a bacteria related to the causative agents of anaplasmosis and Rocky Mountain Spotted Fever. The serology test may have detected exposure to another *Ehrlichia* spp. There are no reports of clinical disease due to *Ehrlichia* in deer.

Several cattle blood samples submitted to Colorado State University were positive on a rickettsial PCR panel, but

to believe that a combination of nutritional factors, weather stress, blood loss due to tick infestation, the demands of the fetus or newborn on the mother's nutritional stores, and pregnancy-related immunosuppression all played varying roles in causing cows to become weak and eventually die.

Although it is not unusual for beef herds to contain a few cows that are unable to maintain body condition for various reasons, late gestation is a critical time to pay attention to cows' nutritional demands. The demands from the developing calf, and in many cases from adverse environmental conditions, may draw down a cow's nutritional reserves quickly. As stated above, it may be difficult to change this for a certain percentage of cows.

Q: What are general guidelines for feeding cows during late gestation? (see box at left)

Q: What are other recommendations for next year's late gestation cows?

A: Application of insecticides for ticks and other external parasites early next spring in these areas should be considered. Producers should use veterinary input in choosing a

product. Most of these products will not result in long-term residual protection and multiple applications may be necessary.

In some affected herds, treatment with antibiotics (especially tetracyclines) showed positive results. Producers should work with their veterinarians in making treatment decisions. Realize that cows may show some of these same signs when affected by conditions such as milk fever or grass tetany. ■

Feeding Cows During Late Gestation: General Guidelines

- **Crude Protein:**
 - $\frac{3}{4}$ to 1 pound per head per day will complement marginal forages. Cows in late gestation have a 9% (DM) protein requirement.
- **Energy:**
 - Cows may not be able to utilize energy from feed efficiently if protein is inadequate.
- **Examples: Supplements containing appropriate protein and energy content (per head per day):**
 - 3-5 # of 20-30% range cake
 - Distiller's grain: 3 # DDGS or 5 # MDGS or 8-9 # WDGS
 - 1 $\frac{1}{2}$ # soybean meal plus 3-6 # corn
 - 3 # corn (or up to .25% of body weight) without supplemental protein can be fed without negative effects
- **Lick tubs: Depending on tub protein content, cows may have to consume as much as $\frac{3}{4}$ # or more per head per day to meet protein requirements.**

(Source: Cody Wright, SDSU Extension Beef Specialist)

subsequent typing could only be performed for *Ehrlichia canis*, for which all samples were negative.

Q: In summary, what most likely caused the mortality in these cattle?

A: Likely, it was a combination of factors. Older cows in late gestation were more likely to be affected, and in many cases, tick infestation coincided with clinical signs. Whether an individual infectious agent such as a rickettsia contributed, was not proven. It is reasonable

Molecular Diagnostics: The “PCR” Lab at ADRDL

An area of explosive growth in diagnostic veterinary medicine over the past decade has been the field of molecular diagnostics. Better known to many as the “PCR lab” at the SDSU Animal Disease Research and Diagnostic Laboratory, this section performed over 59,000 separate tests in 2008.

“Molecular Diagnostics” is the broad term for procedures that detect an infectious agent or its predisposition for disease by analyzing the DNA or RNA of the organism. Polymerase Chain Reaction (PCR) is the most commonly employed molecular diagnostic procedure. PCR allows for the exponential amplification of an organism’s genetic material. This procedure may have several advantages over traditional culture techniques:

1. It may detect organisms more **quickly** than culture. For example, the causative agent of Johne’s disease in cattle may take up to 16 weeks to be grown in culture, while a PCR procedure may produce results in less than a day.
2. It may detect **viruses or bacteria that don’t grow very well in culture** systems, such as *Lawsonia intracellularis* or bovine leukosis virus.
3. PCR may be useful in detecting the presence of bacteria in **patients that have been treated with antibiotics**, where culture is difficult at times.
4. Since PCR techniques have the ability to detect specific areas of the or-



Molecular Diagnostics Staff at SDSU: Back Row (L-R): Roger Chapin, Senior Microbiologist; Travis Clement, Senior Microbiologist; Aaron Lambert, Microbiologist; Crystal Niemann Microbiologist. Front Row (L-R): Julie Nelson, Microbiologist; Jane Christopher-Hennings, Professor and Section Leader; Kelsey Bucholz, Microbiologist. Not Pictured: Andrew Rogen, Student Worker. (Photo: Russ Daly)

ganism’s genome, the procedure may be useful in **detecting different species** of an organism, such as Mycoplasmas. It also can be employed to determine whether isolates of organisms such as *Clostridium perfringens* carry certain toxin genes, allowing those organisms to be “typed.”

In some cases, however, PCR may not be the diagnostic procedure of choice--when it is important to determine the viability of potentially infectious organisms, for example, or when less expensive methods may suffice.

Besides PCR, molecular diagnostics also encompasses **molecular sequencing**. This has proven to be a very useful tool for practitioners dealing with PRRS virus in swine operations, for example. Differ-

entiating wild virus from vaccine virus, or determining whether an emerging infection is due to a novel PRRS strain or a strain endemic to a particular operation are examples of the applications of molecular sequencing.

The SDSU ADRDL molecular diagnostics section has a national reputation in Porcine Reproductive and Respiratory virus (PRRS) diagnostics. Currently, a large proportion of tests run by the molecular diagnostics section are to detect PRRS in serum, semen samples, or tissue. In FY 2008, almost 81 percent of the tests performed were for PRRS virus detection. Submissions for trichomoniasis, Johne’s Disease, and influenza (avian and swine) also account for an increasing number of test requests.

In addition to diagnostic work, the section also supports the research mission of the SDSU Veterinary Science Department by performing many tests for research projects, and the development of new molecular tests.

As the needs of veterinary practitioners and surveillance/regulatory programs evolve, the molecular diagnostics section has responded by adding new tests on a regular basis (see box).

A staff of two senior microbiologists, four microbiologists, one faculty member, and one student worker keeps this busy section running.

Section Leader: Jane Christopher-Hennings, DVM, MS has been the Molecular Diagnostics Section Leader for the past 12 years. This section evolved from her development of a PRRSV PCR assay and its subsequent publication in 1995. Dr. Christopher-Hennings is recognized as a national leader in veterinary molecular diagnostics and has served the profession in many roles, including membership in the Scientific Committee of the International PRRS Symposium, the Virology Committee of the American Association of Veterinary Laboratory Diagnosticians, and the National Animal Health Laboratory Network Technical Working Group, as well as serving as ad hoc reviewer for many journals and granting agencies.

In addition to her duties as section leader, she also has research and teaching responsibilities within the department, where she has been a faculty member since 1996. Dr. Christopher-Hennings spent 6 years in practice in Rapid City following her DVM degree from the University of Minnesota. She received an MS degree from the Uni-

Molecular Diagnostic Procedures at SDSU:

- BVD Virus
- Porcine Circovirus (ID & sequencing)
- *Clostridium* genotyping
- *E. colifimbriae* & toxin typing
- Johne's
- *Mycoplasma bovis*
- *Mycoplasma hyopneumoniae*
- PRRS virus (ID & sequencing)
- PRRS virus sequencing
- Foot and Mouth Disease
- Exotic Newcastle Disease
- Bovine Leukosis (added 2002)
- *Lawsonia intracellularis* (2004)
- BVD virus typing (2005)
- Avian influenza (2006)
- Trichomoniasis (2006)
- Classical Swine Fever (2007)
- Swine Influenza (ID & sequencing) (2008)

versity of Wisconsin-Madison and completed a post-doctoral course of study at SDSU following that.

Senior Microbiologists: Roger Chapin BS has seven years of experience at the SDSU ADRDL, including work with the bacteriology section, following two years at the South Dakota State Health Laboratory in Pierre. His section responsibilities consist of Johne's, avian influenza, BVDV, *Clostridium* and *E. coli* testing, in addition to new test development and validation. Roger has a degree in biology/microbiology from SDSU and is a representative for the SDSU Career Service Advisory Council.

Travis Clement BS, MS has a bachelor's degree in microbiology as well as a master's degree in Biological Science from SDSU, and has worked full time in the molecular diagnostics section since 2005. His areas of emphasis within the section include molecular sequencing and new test validation and development.

Microbiologists: Kelsey Bucholz BS graduated from the University of Minne-

sota in 2007 with a degree in biochemistry, and has been a part of the section for nearly a year. Her responsibilities include PRRS and *Tritrichomonas* testing. While working toward her degree, Kelsey did behavioral studies on Rhesus monkeys.

Aaron Lambert BS, specializes in molecular sequencing within the section. His background includes a degree in Clinical Lab Science from the University of Nebraska Medical Center, which he obtained in 2008.

Julie Nelson BS, MS, has a masters degree in biology, and been a part of the Veterinary Science Department for fourteen years. She has been with the molecular diagnostics section for the past year and a half, and specializes in PRRS diagnostics along with laboratory maintenance.

Crystal Niemann BS graduated from SDSU with a bachelor's degree in biology and has worked with the section for a little over a year. Her responsibilities include PRRS, PCV, and *M. hyo* testing.

Student help: Andrew Rogen is a native of Brandon, SD pursuing a degree in biology along with pre-veterinary studies. He currently is president of the SDSU Pre-Veterinary Club. He has worked in the section for the past two years and performs the duties of specimen container decontamination and reagent replenishment.

The molecular diagnostics section is always interested in communication with their clients and is eager to answer any questions that arise about current or possible future tests. They can be reached at 605-688-5171 or at jane.hennings@sdstate.edu ■

Pieces and Parts

Rabies Submission Reminder: Submit **whole brain** (with brainstem) **fresh** for rabies examination. ADRDL staff will fix the brain in formalin for histopathology examination after rabies testing has been completed.

Samples arriving to the laboratory **before 12 PM (noon)** will have results available the same day. Samples arriving after 12 PM (noon) will be tested the next business day.



ADRDL Hosts Heartland Veterinary Microbiology Annual Meeting

On April 24th and 25th, The ADRDL hosted the 15th annual meeting of the Association of Veterinary Microbiologists (AVM) Heartland Chapter at the Shamrock Banquet Hall in Brookings. The Chapter is comprised of bench microbiologists from 12 states working in bacteriology, virology, serology and PCR in the veterinary profession. Additionally, several companies serving the veterinary profession were in attendance.

The meeting included speakers and round table discussions where lab personnel share concerns, diagnostic techniques, QA/QC, protocols, etc.

Presenters from the ADRDL included: Drs. **David Knudsen** (Zoonotic Diseases in the Diagnostic Lab), **Russ Daly** (BVD and Salmonella in a SD Beef Herd); three presentations on aquaculture, including **Regg Neiger** (VHS and other Fish Diagnostics); **Chris Chase** (Role of Deer as a BVDV Reservoir); and **Seema Das** and Dr. **Larry Holler** (Anthrax Diagnostics). The SDSU Life Science Seminar by Dr Julia Ridpath on BVD Variations, and a tour of the ADRDL were also included. Breakout sessions included topics on Aquaculture, Bacteriology and Virology.

The host site committee consisted of **Linda Fawcett** (AVM Heartland president-elect), **Aaron Singrey**, **Craig Welbon**, **Seema Das** and **Deb Murray**. (Linda Fawcett, SDSU ADRDL)

Veterinary Science Graduate Student wins CRWAD Award

Lindsey Reister was honored as having the top poster presentation in the area of Biosafety and Biosecurity at the Conference of Research Workers in Animal Disease this past December in Chicago. Her project was titled, "Potential Mechanical and Antiviral Methods to Insure PRRSV Free Semen." Lindsey, a native of Washougal, Washington, recently completed her masters degree in Biological Sciences, under the direction of her advisor, **Dr. Jane Christopher-Hennings**. She recently joined the staff at the USDA -ARS Arthropod Borne Animal Disease Research Lab in Laramie, Wyoming.



Dr. Eric Nelson Receives Gamma Sigma Delta Research Award

In recognition of his substantial contributions to research, **Dr. Eric Nelson** (pictured at left with Veterinary Science Department Head David Zeman), professor of veterinary science and section leader of the ADRDL serology section, was presented the 2009 Research Merit Award from the South Dakota State University chapter of Gamma Sigma Delta, the honor society of agriculture, at its annual banquet on April 14, 2009. (Photo: SDSU Ag-Bio Communications)

New Tenure Track Faculty Positions Filled in Veterinary Science Department

Dr. Feng Li (Associate Professor), and **Dr. Ying Fang** (Assistant Professor) have been appointed to tenure track positions following completion of a search process. Dr. David Zeman, Veterinary Science Department Head said, "We are very fortunate to have these two new tenure track faculty members in our departments. They are proven researchers and grant writers." Both appointments are 85% research and 15% teaching, and both are joint appointments within the Veterinary Science and Biology/Microbiology Departments.

Rusk named SDSU Animal and Range Sciences Department Head

Dr. Clinton P. Rusk, Purdue University, has accepted an offer to serve as head of the SDSU Department of Animal and Range Sciences. Dr. Rusk intends to start at SDSU on September 1, 2009. Dr. Rusk received graduate degrees from Colorado State University, his B.S. degree from Kansas State University, and his A.A. degree from Colby Community College.

ADRDL Influenza Diagnostics in the Era of “Novel” H1N1

R Daly, E Nelson, J Christopher-Hennings, P Leslie-Steen, T Graham, SDSU ADRDL

The rise of a “novel” strain of H1N1 influenza in the human population this spring has veterinary implications due to the fact the virus contains genetic components of swine and avian influenza viruses. Recent (April 2009) research at the National Animal Disease Center indicates the virus has potential to cause illness in swine (see <http://www.ars.usda.gov/2009H1N1/> for more information), and illness in pigs due to the virus has been confirmed in a Canadian swine farm.

Swine and avian influenza diagnostics have been a part of the ADRDL’s work since its inception, and testing procedures continue to evolve as new strains, such as the novel H1N1 and the highly pathogenic avian H5N1 strains become more prominent in animal and public health. The following is a summary of

ADRDL influenza diagnostics in light of the novel H1N1 influenza virus:

Serology: Current tests available are the AGID for avian influenza and the H1 and H3 hemagglutination inhibition (HI) tests for swine influenza (SIV). Sensitivity of serology for SIV antibody detection is normally influenced by the variability in the H1 antigen among different SIV strains, including the novel H1N1 influenza strain.

Virology: Virus isolations have been used routinely at the ADRDL for the detection of swine influenza from nasal swabs and lung tissue. This test will detect the novel H1N1 and other swine influenza isolates but does not differentiate between them.

PCR: For PCR, samples (fresh lung or nasal swabs) are tested for an influenza “matrix” protein gene. This PCR detects both the novel H1N1 and other influenza A virus genes, but does not differentiate among them. If the matrix PCR is positive, a second PCR (“novel N1 assay”) can then be used to differentiate the novel H1N1 from other influenza A strains. The ADRDL has the capability to genetically sequence the H, N, and matrix genes of SIV isolates and is approved by the USDA to conduct testing for the voluntary SIV surveillance program.

Call the ADRDL at (605) 688-5171 with any questions you may have regarding influenza testing. ■

SDSU Students Accepted to Veterinary Schools for Fall 2009

Iowa State University:

- Samantha Brace, Dell Rapids
- Amber DeClercq, Milbank
- Theresa Henrickson, Hermosa
- Tim Kruse, Wetonka
- Kimberly Schultz, Sioux Falls
- Chuck Stango, Howard
- Joel Teachout, Yankton

Three additional South Dakota residents, completing pre-veterinary work at other colleges, are part of the entering class at Iowa State as well.

University of Missouri:

- Jennifer Olsem, Westbrook, MN ■

Calendar of Events

August 9-12, 2009

South Dakota Veterinary Medical Association Annual Meeting
Ramkota Inn, Sioux Falls, SD

Large and small animal sessions: Practice management; bovine surgery and pharmacology, companion animal vaccinations and infectious disease update, SDSU case reports, much more.

605-688-6649 or www.sdvmed.org

August 5-7, 2009

North Dakota Veterinary Medical Association Annual Meeting
International Inn, Minot, ND

<http://www.ndvma.com>

August 29-September 1, 2009

Central Veterinary Conference
Kansas City Convention Center, Kansas City, MO

<http://www.thecvc.com>

September 17-18, 2009

Iowa Veterinary Medical Association Annual Meeting

<http://www.iowavma.org/>

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Animal Health MATTERS

The SDSU Veterinary Science Department conducts research, teaching, professional service, and extension service to South Dakota and the surrounding region. Entities within the department include the South Dakota Animal Disease Research and Diagnostic Laboratory, the Olson Biochemistry Laboratory, and the Center for Infectious Disease Research and Vaccinology.

The South Dakota Animal Disease Research and Diagnostic Laboratory is a full-service, all-species diagnostic laboratory accredited by the American Association of Veterinary Laboratory Diagnosticians (AAVLD). The AAVLD accreditation program complies with international expectations for quality diagnostic services under the guidance of the World Organization for Animal Health (the OIE). The ADRDL collaborates with the USDA National Veterinary Services Laboratory on many federal disease monitor and eradication programs and is a member of the National Animal Health Laboratory Network. For information regarding the laboratory's Quality System, contact Rajesh Parmar – ADRDL Quality Manager, at 605 688 4309.

Editor: Russ Daly, DVM

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