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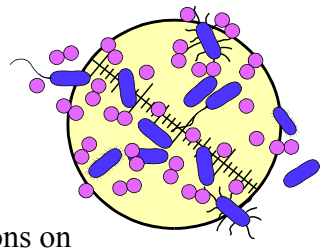
Potential Pitfalls when Interpreting Antimicrobial Sensitivity Data

J. T. McClure, Atlantic Veterinary College, and Tim Blackwell, Veterinary Science, OMAF



Antimicrobial sensitivity data have been commonplace in veterinary medicine for decades and have proved to be useful when making decisions on appropriate antimicrobial therapy. However, treatment failures occur with antimicrobials that should be susceptible to the bacterial isolate according to the sensitivity panel. Treatment successes occur even though the sensitivity report indicates that the antimicrobial you empirically prescribed prior to culture results was resistant to the isolated pathogen. What causes such discrepancies between the *in vitro* sensitivity testing and the *in vivo* treatment results?

The most commonly reported antimicrobial sensitivity information is qualitative data that classifies isolates as sensitive, intermediate, or resistant to the antimicrobial drug being tested. This is usually determined by a diffusion test where a disc impregnated with a standardized concentration of antibiotic is placed on an agar plate that has been inoculated with a standardized concentration of the isolated bacteria. This plate is then incubated for 24 hours, during which the antimicrobial diffuses across the agar and the bacteria grow. The subsequent diameter of the zone of inhibition of bacterial growth that develops around the antimicrobial disk is inversely correlated with the minimum concentration of drug that inhibits bacterial growth, also known as the minimum inhibitory concentration (MIC). The larger the zone of inhibition the lower the concentration of drug needed to inhibit bacterial growth. For each antimicrobial-bacterial combination, breakpoint zones of inhibition have been predetermined. If the zone of inhibition is smaller than this breakpoint, it is considered resistant and, if it is larger than this breakpoint, it is considered sensitive. The report the veterinarian reads gives no quantitative information as to how sensitive or resistant the bacteria are. A veterinarian may choose a sensitive antimicrobial that was close to the breakpoint and, as a result, have a less effective treatment than if an antimicrobial with a wider zone of inhibition was used.

The breakpoint concentrations used to determine the sensitivity of an antimicrobial are often based on human bacterial isolates and antimicrobial pharmacokinetic data from humans. Consequently, it is assumed that the bacterial isolates, pharmacokinetics and dosage forms used in

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livestock species are similar to humans, but this is not always the case. A good example of this is ampicillin whose sensitivity breakpoint, based on human data, is set at 8 µg/ml for *E. coli*. If you are administering sodium ampicillin intravenously, you will easily achieve drug concentrations above this breakpoint for several hours. However, if you are using the food animal approved ampicillin trihydrate salt (e.g., Polyflex®) at the label dose of 6 mg/kg IM, peak serum concentrations of only 2-3 µg/ml will be achieved. This results in sub-therapeutic dosing for many *E. coli* isolates that appear susceptible on a sensitivity panel. The pharmacodynamic properties of antimicrobials should also be considered when determining an effective dosage regimen. Most antimicrobials' efficacy is a factor of the time they spend above the MIC of the bacterial isolate of concern. However, the bacterial killing of certain antimicrobial classes, namely the fluoroquinolones and aminoglycosides, are concentration dependent and most effective when drug concentrations are 8-10 times the MIC of the bacterial isolate. Thus appropriate dosage regimens are best determined by having quantitative antimicrobial MIC data on the pathogen of concern. The US National Committee for Clinical Laboratory Standards (NCCLS) Veterinary Antimicrobial Susceptibility Testing (VAST) Subcommittee has determined veterinary specific breakpoints for major antimicrobials and swine pathogens. This information should be available on-line in the near future.

Finally, the *in vitro* conditions of an antimicrobial sensitivity test are quite different than the *in vivo* environment where the bacterial infection is taking place. *In vitro* testing requires exposing a standardized concentration of bacterial inoculum to a constant concentration of drug for a fixed period of time under consistent pH, oxygen tension and temperature conditions. However, there is nothing standardized *in vivo*. The antimicrobial drug concentrations are continually fluxuating. An infection, such as an abscess, may have a low pH, limited oxygen tension, and/or have purulent material that can inhibit the activity of many antimicrobials. Furthermore, physiological barriers, such as the central nervous system and mammary gland, or pathological barriers, such as the wall of an abscess, can limit the penetration of many antimicrobials. Alternatively, the effects of an intact immune system or the *in vivo* sub-MIC therapeutic effects of some antimicrobials may result in a therapeutic success even though the antimicrobial used was classified as resistant.

With increased emphasis on prudent antimicrobial usage by veterinarians, decisions on which antimicrobial to choose to treat an infection becomes more complicated. For example, it may be more appropriate to increase the dose of a drug with intermediate or low sensitivity to a bacterial isolate, such as tetracycline, rather than use a drug listed as sensitive, such as a cephalosporin or fluoroquinolone. The CVMA is currently working on establishing basic therapeutic guidelines for dairy, beef, poultry and swine to assist veterinarians with these difficult decisions.

Suggested reading:

Walker RD. Antimicrobial susceptibility testing and interpretation of results. In: Prescott, JF, Baggot, JD, Walker, RD, eds. Antimicrobial Therapy in Veterinary Medicine, 3rd ed., Ames: Iowa State Press, 2000: 12-27.

Veterinary Science Review

In November, 2003, OMAF conducted a review of the Veterinary Science's program. Invited stakeholders from industry, veterinary associations and government provided useful feedback and comments on how we can better deliver the services we provide. A final report has been distributed to all participants. To address the recommendations made by participants at these sessions, OMAF is conducting an internal review of all our veterinary science resources. **Thanks to all those who contributed to the process.**

Ontario Herds - Information on Mastitis Bacteria from Culture of Milk Samples

Ann Godkin, Veterinary Science, OMAF

Many of us assume our dairy-producer clients have a good knowledge of the mastitis bacteria likely to cause problems in their own herds. This could be true, but is it?

When mastitis is suspected, a sample of milk can be collected from the quarters of cows likely to be affected. These samples are cultured at a diagnostic laboratory to identify and enumerate the mastitis bacteria present. Frequently, samples are submitted to the provincial diagnostic laboratory, the Animal Health Laboratory (AHL) in Guelph, operated by the University of Guelph. Alternatively, some samples are cultured in laboratories at veterinary clinics or commercial labs.

To estimate the proportion of herds that submitted milk samples for mastitis culture in 2003, the results of the AHL milk samples were tabulated by owner's name and submission numbers.

Ontario currently has about 5,600 licensed milk shippers (dairy-cattle farms) in total. For 2003 (January 1 to December 31), 509 herd owners (about 9%) submitted at least 1 milk sample to the lab; 753 (13%) submitted between 2 and 10 samples; and 35 (.18%) submitted more than 10 samples. In total, 1,297 (23%) producers received some results from mastitis cultures.

This is likely an underestimate of the proportion of herd owners receiving information as they may use a laboratory other than the AHL for milk culturing. On the other hand, if your herds submit exclusively to the AHL is it enough that only about 1 in 4 of your clients know the names of the mastitis bacteria attacking their herds? Can you fine tune prevention and control programs to make them specific for each herd with this level of definition of the problem?

The goal of milk culturing must be to gather information about the pattern of mastitis in a particular herd so that prevention programs can be tailored to fit that herd's problems. Among Ontario's dairy herds, over the last 10 to 12 years, most herds have shifted from having contagious mastitis infections to having those that involve environmental bacteria. Even among low SCC herds, environmental mastitis causes very significant problems with lost production, elevated SCCs and clinical mastitis. Because each herd is a unique system that differs in environment and management, the disease prevention strategy too must be herd specific. Yet only a few producers (35) submitted enough samples that would lead you to believe they were tracking the pattern of mastitis in their herd.

To improve submission rates and to improve the submission of good quality samples from useful cases of mastitis, it is time to enroll herds on scheduled milk sample submission. Some programs involve sampling herds at specific times such as:

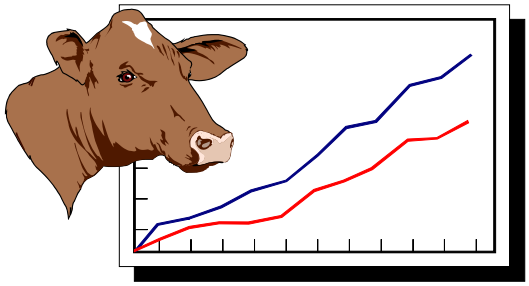
- Immediately post calving - this gives information on the individual cow early in lactation AND provides a running commentary on what pathogens are challenging the fresh udders in a particular herd seasonally.
- At the time of a clinical case - this provides an ongoing assessment of mastitis severe enough to challenge a cow's defenses to the point of clinical signs of mastitis AND provides a list of clinical mastitis cases.

- All cows on the day of dry off - this illustrates the status of the udder before dry cow antibiotic treatment, which may be useful in low SCC herds for developing more selective dry cow treatment programs, AND provides information about subclinical mastitis pathogens to which the cow has been exposed during the current lactation (such as *Staph. aureus*, Strep. ag. or Mycoplasma).

Not all herds should submit samples at these three times. Herd culture programs for mastitis profiling should be designed to be specific to the herd and its current milk quality queries. Once in place, culture programs should be reviewed frequently to ensure that they are still relevant to changes in the herd's udder health or quality problems.

Milk Quality and Mastitis Snippets

Ann Godkin, Veterinary Science, OMAF



It has always been attractive to try to predict the pathogen causing a particular case of clinical mastitis by the pattern of test-day SCCs of the affected individual cow. Most practitioners know that generally this is difficult to do.

Dutch researchers are working on a method of assessing the pattern of peaks of individual cow SCCs as a means of predicting the most likely bacterial pathogen. They compared the SCC patterns of individual cows to the timing and occurrence of clinical cases of mastitis caused by specific mastitis pathogens. They had data for 24,012 complete lactations from 19,733 cows. During the study period, 3,393 lactations (14%) had at least one case of clinical mastitis.

Peaks in cow SCCs were classified into five patterns – quick recovery, slow recovery, slow rise, no recovery and lactation average SCC over 200,000 cells/ml. Exact details of the classification system can be found in the paper.

While some significant associations between a particular SCC pattern and pathogen were found, generally the relationships were not strong. Clinical *E. coli* mastitis was significantly associated with the "quick recovery" pattern (OR = 3.14) and clinical *S. aureus* mastitis with the "no recovery" pattern (OR > 6). Clinical Streptococcal mastitis (*dysgalactiae* or *uberis*) was not significantly associated with a particular pattern. The biological characteristics of particular mastitis patterns likely explain the association of a pathogen with a particular SCC pattern.

SCC patterns were not predictive of the major mastitis pathogen isolated from a particular cause of clinical mastitis. Predictive values of a pattern to predict a pathogen were very low (< 20% when all lactations were considered and < 45% when only lactations with at least one case of clinical mastitis were considered). This suggests that these SCC patterns would not be useful in predicting the cause of a particular cow's case of clinical mastitis. Additionally, the lag involved (4 months to define a pattern) would limit the usefulness of this technique as an individual cow diagnostic tool.

However, at the herd level, where patterns would be analyzed for a large number of cows over time and on a continuing basis, it might be possible to detect repeated patterns that would indicate the predominant pathogens. Additionally, pattern analysis might also indicate if changes in the pathogen profile were likely. This could be of some value in developing culture

programs, determining when to intervene in a developing milk quality problem and as a tool for ongoing mastitis monitoring using data we already have available. These researchers are continuing their work in this area.

The full citation is:
De Haas Y, Veerkamp RF, Barkema HW, Grohn YT, Schukken YH. Associations between pathogen-specific cases of clinical mastitis and somatic cell count patterns. J. Dairy Sci 2004;87: 95-105.

Most Common Signs for Clinical Diagnosis of BSE

Kathy Zurbrigg, Veterinary Science, OMAF

A recent study published in the Journal of Clinical Microbiology compared the data from 272 suspect BSE cases to 30 confirmed cases in Belgium. The goal of the study was to identify signs that would allow practitioners to classify cows as "highly suspect BSE cases." Symptoms from the confirmed cases were compared to suspect cases and the adjusted-odds ratio was calculated. The risk of actually having BSE was increased with the presence of the following significant signs (from most predictive to least):

- kicking in the milk parlour
- hypersensitivity to touch and/or sound
- head shyness
- panic stricken response
- reluctance to enter the milking parlour
- abnormal ear movement or carriage
- increased alertness behaviour
- reduced milk yield
- teeth grinding
- temperament change.

Ataxia did not appear as a significant sign of BSE in this study. The best results for correct classification of the animals occurred when two to four of the signs were present.

The study stated that the reason behavioural changes predominated as indicator signs was due to the site of localization of the neuronal vacuolization in cattle. It was also stressed that no single clinical sign is reliably indicative of BSE.

For the full article see:
Saegerman C, Speybroeck N, Roels S, Vanopdenbosch E, Thiry E, Berkvens D. Decision support tools for clinical diagnosis of disease in cows with suspected BSE. Journal of Clinical Microbiology 2004; Jan:172-178.

Veterinary Science would like to offer our congratulations to **Dr. Otto Radostits**, who was recently awarded the Order of Canada for his longstanding contribution to the field of veterinary medicine and biosecurity.

Dr. Radostits is widely respected for his leadership and innovation in the profession. We can only try to follow his example.

Timely Help for Beef Cow-calf Herds

Ann Godkin, Veterinary Science, OMAF

Recently another veterinarian reminded us of an excellent article published in JAVMA in 1995. The article was entitled "Use of epidemiological principles to identify risk factors associated with the development of diarrhea in calves in five beef herds" written by J.C. Clement *et al.*

Clement collected data from five commercial cow-calf herds in North Dakota. The herds had a history of neonatal calf diarrhea (NCD) affecting from 15 to 50% of calves in the previous two calving years. The study objective was to identify factors that affected the proportion of calves with NCD in well-managed herds. As our Ontario beef herds approach calving and the "diarrhea season," this article provides a good reminder of interventions that could be put in place now, on premises where diarrhea has been a problem in the past.

There were a number of factors identified at the animal level that determined which calves within herds were at risk of NCD. Calves born to heifers were 3.9 times more likely to have NCD than those born to cows. The time of calving during the calving season (twice the risk of NCD for calves born later in the season) and sex of the calf (bulls at 1.4 times greater risk) were also important. Dystocia and body condition score of the cow at calving were not.

What is useful to us as herd-management advisors, however, were the different management strategies employed by herd owners that successfully reduced the herd's risk of high rates of NCD. Previous researchers reported that the herd of origin was the only risk factor associated with NCD in ten Colorado herds. This suggests that the herd-management factors outweigh individual animal differences in determining whether an outbreak of NCD will occur. Far from being a disease that can't be controlled, outbreaks of NCD are heavily influenced by management practices.

Herd management strategies shown to impact on the risk of NCD outbreaks in cow-calf herds are:

- Calving heifers in the same location as cows - increases mortality of calves from diarrhea;
- Isolating scouring calves and their dams from the rest of the herd - results in a reduction in the spread of NCD;
- Nutrition of the dam prior to calving - reduces the susceptibility of her calf to NCD; and
- Treatment as soon as the scouring calf is noticed - reduces mortality due to NCD.

Herd outbreaks of NCD occur among cow-calf herds because each year there are conditions we can't control, such as weather, and because each year herd managers fail to adopt strategies known to control the risk.

You can help your clients prepare for calving season now by helping them to:

- Plan to separate calving heifers from calving cows;
- Plan a sequence for using different pastures or lots for calving;
- Plan a quarantine area for scouring calves and their mothers;
- Check that feeding (energy, protein and minerals) in the last 1/3rd of gestation meets the needs of periparturient cows, and

- Have a treatment plan and supplies on hand for those cases of NCD that do occur.

As practitioners of preventive medicine we need to convince producers to do this before they experience an outbreak of NCD that increases their labour (treating calves) and deprives them of up to 20% of their calf crop.

This year is tough economically for Ontario's beef cattle producers. None of these strategies are expensive and they have been proven to save calves. Even more than in past years, those saved calves will be a substantial portion of the difference in herd income over expenses.

The full citation is:
Clement JC et al. Use of epidemiological principles to identify risk factors associated with the development of diarrhea in calves in five beef herds. JAVMA 1995; 207(10, Nov 15):1334-1338.

Poul's Bridge to Biosecurity

Neil Anderson, Veterinary Science, OMAF

Poul Villumsen built a bridge to avoid walking through manure in a cow alley. Poul crosses the bridge several times a day when walking between his feed alley, farm office and utilities room. The bridge keeps his boots, office, and his feed free from manure. Poul also saves time and water by not having to stop to wash his boots with each passage.

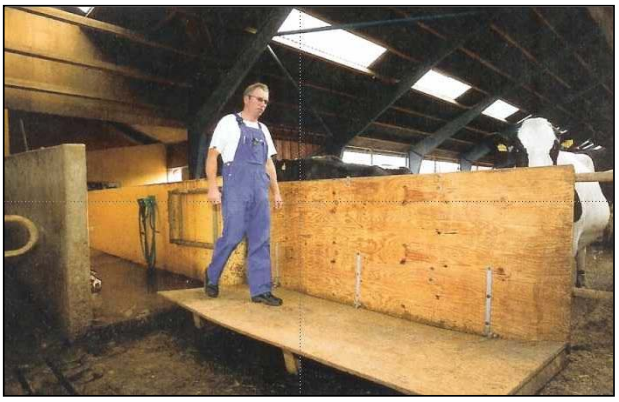


Photo: Jens Tønnesen. Kvæg, September 2003

Poul Villumsen's *bridge to biosecurity* provides clean passage across a cow alley. It folds up when not in use. Poul attached the bridge to an existing gate and swings it out of the way when cows use the alley to access the milking parlor. Villumsen received an award for his idea.

Johne's Continuing Education

The University of Wisconsin School of Veterinary Medicine, in cooperation with the Wisconsin Department of Agriculture, Trade and Consumer Protection, has made Johne's training available online: no scheduled sessions, fully independent, anytime and anywhere.
http://vetmedce.org/

Two CE modules are available: 1) the basics of Johne's disease, and
2) diagnostic tests and test interpretation.

Also available are certification programs containing a series of 6-7 CE modules. These certification programs are currently recognized as official by Wisconsin and Nebraska. More states may adopt this method of certifying veterinarians in the near future.

Johne's Certified Veterinarians are allowed to do herd risk assessments and design herd management plans. These plan are then filed with the state Designated Johne's Coordinator.

Importance of Biosecurity: "Never Let Your Guard Down"

Babak Sanei and Paul Innes, Veterinary Science, OMAF

Biosecurity is an essential part of poultry husbandry. Charles Beard, vice president of research for the U.S. Poultry and Egg Association, emphasized this concept at the International Poultry Exposition in Atlanta; "We are going down this road. We may go kicking and screaming, but the industry will be forced to increase its biosecurity."

Two important points to remember:
First, never let your guard down. Advise your clients (producers) to apply biosecurity measures on their farms at all times. Work with them to develop a comprehensive biosecurity plan, addressing key factors such as sources of birds, feed and water, visitor movement and access (including vehicles), rodent and wild bird control measures and other disease prevention steps. Strict biosecurity by veterinarians who deal with outbreak investigations is also important.

Second, although some diseases occur infrequently in commercial poultry in Ontario, e.g., Low Pathogenic Avian Influenza (LPAI) and *Mycoplasma gallisepticum* (MG), these pathogens should be considered when investigating disease outbreaks.

For more information on preparing a detailed Poultry Biosecurity Plan, contact Babak Sanei, (519) 824-4120 ext. 54650, fax: (519) 824-5930, babak.sanei@omaf.gov.on.ca

Poultry Disease Update: *Mycoplasma Gallisepticum* Outbreak

Babak Sanei, Veterinary Science, OMAF

In December 2003, there was a positive diagnosis of *Mycoplasma gallisepticum* (MG) in a commercial poultry flock. There has not been a positive occurrence of MG in a commercial flock in Ontario for a very long time. The source of the infection is still under investigation, but wild birds are suspected.

Historically, there was a single positive serology for MG in a layer breeder flock in 1994, and again in a small multi-aged layer flock in 2002. Annually, there are several small backyard flocks (chickens and/or turkeys) diagnosed with MG infection in Ontario.

Avian Influenza (US, Asia and Canada)

Babak Sanei and Paul Innes, Veterinary Science, OMAF

On February 17, 2004, routine monitoring detected an H5 strain of Avian Influenza (AI) virus in a broiler flock in Gonzales County, Texas (50 miles east of San Antonio). Preliminary investigation based on clinical signs and moderate mortality suggested a low pathogenicity infection. However, further laboratory results (DNA sequencing) determined the virus to be Highly Pathogenic AI (H5N2). The infected flock (6,600 broiler chickens) has been depopulated and buried on site. Active surveillance of all poultry flocks within a 10-mile radius and an

epidemiological investigation are underway. Dr. Ron DeHaven, Chief Veterinary Officer (USDA-APHIS), announced that the Federal Response System has been activated and State and Federal officials, in cooperation with poultry industry, are taking appropriate preventive actions. This outbreak is not linked to the H5N1 AI outbreak in Asia, and the H5N2 strain is not known to cause human illness. The last outbreak of HPAI in the US (also H5N2) occurred in Pennsylvania in 1983-84. Two strains of low pathogenic AI (H7N2 in Delaware and New Jersey and H2N2 in Pennsylvania) were also detected early in March 2004.

The Canadian Food Inspection Agency (CFIA) has placed restrictions on the importation of certain products from these affected areas. For more details, contact your local CFIA office or refer to the CFIA web site (www.inspection.gc.ca).

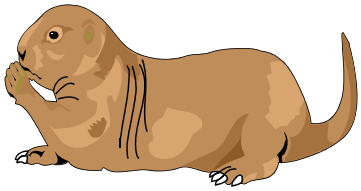
The H5N1 outbreak in East Asia continues to spread, particularly in Thailand and China. Millions of chickens in South Korea (first reported December 2003), Japan, Vietnam, Laos, Cambodia, Thailand, Hong Kong (January 2004), China, and Indonesia (February 2004) have died or been depopulated due to infection with this virus. Cases of H5N1 have also been reported in other avian species such as ducks, falcons and cranes. Infections in cats (leopards, tigers and domestic cats) fed raw infected poultry carcasses have also been reported. As of February 25, there have been a total of 32 laboratory confirmed human cases, of which 22 have died. Historically, H5N1 is the only Avian Influenza virus strain that has been able to cause severe human illness (Hong Kong 1997). H7N7 and H9N2 strains have also been reported to cause mild illness and one death.

Recently, two poultry flocks in British Columbia were confirmed positive for an avian influenza virus. The CFIA has identified a mixed avian influenza infection of high and low pathogenicity. So far, there is no known connection to the outbreaks in the US, and wild waterfowl are suspected as being the source of infection. Limited outbreaks of LPAI occur periodically in Canada, including Ontario (2000). The CFIA has depopulated the infected flocks. Active surveillance of commercial flocks within the disease control zone and discussions with trading partners regarding regionalization are underway.

- OMAF and CFIA are participating in cross-ministry federal-provincial meetings, through the office of the Commissioner of Public Safety and Security, to discuss Avian Influenza, emergency preparedness and strategies to minimize risks to public and poultry health in Ontario.
- The Ontario Animal Health Surveillance Network, through OMAF, the Animal Health Laboratory (AHL) and CFIA (Ontario), continue to monitor these and other disease threats to the Ontario poultry industry. Expertise and advice are available from OMAF, AHL and CFIA veterinarians with respect to biosecurity, Foreign Animal Disease (FAD) emergence and diagnostic testing. Alerts were sent to veterinarians in Ontario.
- Poultry producers, veterinarians and industry personnel should continue to observe strict biosecurity measures. Important hazards, such as Avian Influenza virus, can be present in wild bird populations. Producers need to protect their poultry flocks from coming in contact with migratory waterfowl and wild birds; this includes protecting feed and water from contamination by these sources.
- Veterinarians and producers should also be vigilant for signs of FADs in all species of poultry and birds. All cases of unusual morbidity and mortality should be investigated by submitting appropriate samples to the AHL for diagnosis. The CFIA district veterinarian must be contacted if a FAD is suspected.

Exotic Pets – Be Aware of the Risks

Paul Innes, Veterinary Science, OMAF



In 2003, the first documented outbreak of monkeypox virus in the US resulted in 37 human illnesses. The outbreak was associated with domestic prairie dogs from a commercial pet wholesaler, which had come in contact with several species of rodents imported from Africa. In 2002, an outbreak of Tularemia (*Francisella tularensis*) was detected in captured wild prairie dogs at a commercial exotic animal distribution facility in Texas. Some of the prairie dogs that survived remained culture positive, indicating this species may act as a source of pet-to-human transmission.

These two examples highlight a potentially serious gap in provincial and national biosecurity. Exotic and wild animals can be very popular and trendy pets. The Canadian Food Inspection Agency (CFIA) regulates the importation of certain, but not all, exotic pet species under the *Health of Animals Act*. Others may be regulated through the Convention on International Trade in Endangered Species (CITES). Prior to the monkeypox outbreak, there were no restrictions on importing rodents from any country under the Act. The CFIA has since restricted importation of prairie dogs, squirrels, and Gambian rats from all origins, as well as all rodent species from Africa.

Many exotic pets may pose no more of a zoonotic risk than our traditional domestic companion animals. However, those imported from the US and abroad, and those captured from the wild, may carry unknown or undetected hazards. This presents a potentially serious biosecurity risk to human and animal health, including wildlife. At the very least, clients should be made aware of the risks associated with purchasing exotic pets. Many may not be aware of the animal's origin, or how it made its way to the local pet store (or online distributor). The following excerpt from an article in Emerging Infectious Diseases outlines some of the serious implications of the exotic pet issue.

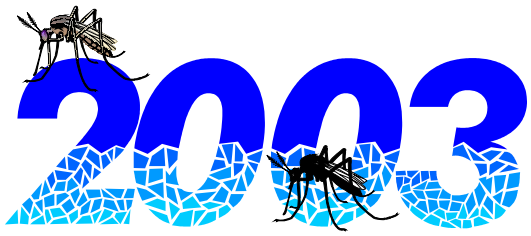
- Exotic animal import and export have altered the composition of native fauna and flora throughout the world and have been associated with disease outbreaks.
- Translocation of animals, in some circumstances, has provided the opportunity for pathogens to jump species and become established in native animal populations. Examples abound of intentionally or accidentally imported exotic species introducing new pathogens (e.g., rats introducing *Yersinia pestis*, the etiologic agent of plague, to the western United States) and allowing them to become established in native animal populations.
- The prairie dog-associated monkeypox outbreak highlights the speed with which exotic rodent species, transported worldwide, allow virulent pathogens to jump species and be transmitted to humans. …The infected animals can also become "silent" carriers and serve as a new reservoir for the introduced pathogen.
- Recent incidents involving plague, tularemia, and monkeypox transmission to humans by pet prairie dogs are a wake-up call for better surveillance of wild-caught animals before they are sold internationally and imported into the United States. Relying on visual inspection to select healthy animals is virtually impossible, since wild-caught animals often do not exhibit signs of overt disease and may not appear sick during the early stages of infection with *Y. pestis* or *F. tularensis*.

Veterinarians can help by educating their clients about the risks associated with these pets.

Azad AF. Prairie dog: cuddly pet or Trojan horse? Emerg Infect Dis [serial online] 2004 March. Available from: www.cdc.gov/ncidod/EID/vol10no3/04-0045.htm

Encephalitis Surveillance Summary Year 2003

Bob Wright and Paul Innes, Veterinary Science, OMAF



West Nile Virus (WNv)

The greatest WNv activity in 2003 was in those states and provinces along the leading edge of the virus' range (Saskatchewan, Alberta and Colorado). WNv activity in Ontario was significantly less than last year. US states that experienced significant WNv activity in 2002 also shared this trend. Weather conditions, widespread equine vaccination and natural immunity in bird and mammal populations are all likely contributing to the reduction in virus activity. The greater incidence of WNv in western regions can also be attributed to the more aggressive feeding habits of *Culex tarsalis*, the mosquito more commonly found in western North America, versus *Culex pipiens and C. restuans* found in eastern North America. Current evidence suggests the virus has become established in Canada, and may remain endemic. The scientific knowledge and the biology of the virus in North America are still unfolding. It may not be possible to predict what the risk will be from year to year, but cases can be expected again in 2004.

Ontario in 2003

In 2003, there were 11 confirmed or probable equine cases of WNv in Ontario, compared to 107 in 2002. Their locations included: Durham (possibly an imported case from Western Canada), Eastern Ontario, Essex, Halton, Niagara, Peel, Perth and Peterborough. Cases were detected through voluntary submission of samples to veterinary diagnostic laboratories (Animal Health Laboratory (AHL), University of Guelph, and VitaTech). Diagnosis was based on a history of clinical signs consistent with WNv infection and a positive test result for either IgM capture ELISA or immunohistochemistry (IHC). Horses positive on IgG ELISA only were not classified as cases, because these results could have been due to exposure to WNv in 2002 or vaccination. In comparison, Health Canada (HC) reports all positive test results received from diagnostic laboratories as required under the *Health of Animals Act*, both confirmed and presumptive. Of the 42 positive results reported 1n 2003, most were on single IgG ELISA tests without a positive IgM ELISA or a history of clinical illness, and are classified by HC as presumptive. These are likely attributable to vaccination or exposure in 2002 and do not accurately reflect the number of clinical cases.

Eastern Equine Encephalitis (EEE)

Unexpectedly, compared to previous years, the incidence of EEE increased in 2003 in Ontario. In the southern US, EEE virus infections were detected earlier and in greater numbers than usual. There were 11 confirmed and probable cases of EEE in Ontario horses. The majority of cases occurred in Eastern Ontario (Lanark County and Ottawa-Carleton). Cases were also reported from Simcoe County, Northumberland and Manitoulin Island. A single case in an emu was also detected.

The number (11) and distribution (5 separate geographic areas) of cases of EEE in Ontario were unusual. The disease has previously been identified sporadically in mostly unvaccinated horses, either residing in Ontario or acquired while traveling through other areas of North America. From 1938 until the fall of 1992, there were no cases of EEE diagnosed in Ontario. Between 1992 and 2002, there were five sporadic EEE infections in Ontario. A single case was diagnosed in 1992. In the fall of 1994, EEE was diagnosed in two horses in the Bracebridge area. Five other equine deaths were attributed the 1994 outbreak but were not tested. A single case was

identified in the Orillia area in 1997. Two horses were diagnosed with EEE in 2001 and one in 2002.

Like WNv, mosquitoes that feed on both birds and horses spread the EEE virus. However, the mosquito (*Culliseta melanura*) is believed to be more restrictive in its range. *Culliseta melanura* is swamp specific; rarely occurs beyond 5 miles from foci. Horses are terminal hosts and are not involved in further transmission of the virus. People, horses, pigs and birds may become infected during periods of high mosquito populations. The EEE virus has a range from southeastern Canada to the southeastern United States as well as the Caribbean and South and Central America.

The clinical presentation of EEE is similar to other arboviral encephalitides and is difficult to distinguish from rabies or WNv. Fever and mild depression are typically observed initially, followed by signs of diffuse encephalitis (ataxia, erratic behavior, recumbency, cranial nerve deficits). The case fatality rate is 80-90% and there is no treatment beyond supportive care. Death often occurs within 48-72 hours. Survivors often have long lasting debilitating neurologic signs.

Diagnostic Testing for WNv and EEE
The Animal Health Laboratory, University of Guelph provides IgM ELISA serology, immunohistochemistry (IHC) and Polymerase Chain Reaction (PCR) testing for WNv. For EEE, the AHL provides PCR testing and will forward acute and convalescent sera to the Canadian Food Inspection Agency for testing.

Prevention of the Encephalitis Diseases
Vaccines are available for both WNv and EEE. It is highly recommended that horses traveling to affected areas in the United States be vaccinated against EEE in consultation with your veterinarian. The risk of EEE is low in Ontario, but vaccination should be considered. The EEE vaccines generally provide protective immunity for 4 - 6 months, so boosters should be administered in the spring, at the same time as the WNv vaccine.

The initial vaccination for WNv requires two injections 3 - 6 weeks apart, followed by an annual booster. For horses at higher risk, such as those traveling to areas where mosquitoes survive year-round and high performance horses, a booster every 4 - 6 months is recommended. For complete coverage, vaccinations should begin two months before mosquitoes are present. Full protection should be achieved before the start of the mosquito season. Incomplete vaccination during the season may not be protective.

To maximize the foal's protection to the common pathogens and especially WNv, mares should be vaccinated 4 - 6 weeks prior to foaling. Vaccination of the foal usually should not start until 6 months of age. Foal vaccination is delayed until 6 months of age when maternal antibody concentrations are waning and less likely to interfere with the foal's ability to produce active immunity to vaccines.

Vaccination recommendations for foals for Eastern Equine Encephalitis (EEE), West Nile virus (Wnv) and tetanus (tetanus toxoid) are as follows;

- Foals from non-vaccinated mares should receive their first vaccination between 3 and 4 months of age; the second between 4 and 5 months of age; a third between 5 and 6 months of age.

- Foals from vaccinated mares should receive their first vaccination at 6 months of age, followed by boosters at 4- to 6- week intervals, e.g., booster vaccinations at 7 and 8 to 9 months of age.

  All foals should be vaccinated annually thereafter.

Horse owners should be advised to take other steps to reduce the risk of these and other insect-borne diseases. DEET-based fly sprays approved for use on horses have limited duration repellant effect for mosquitoes (2 - 8 hours, depending on the concentration). It is important to reduce the number of mosquitoes around the home and stabling facility by reducing the amount of standing water available for mosquito breeding. Eliminate any area where water can pool, such as old tires, unused buckets, rain barrels or water troughs. The information sheet, *Controlling Mosquitoes on Horse Farms and Rural Properties*, will help in the planning of a mosquito control program. More information on WNv prevention is available from your local Public Health Unit, or from one of the following resources.

For more information on viral encephalitis in horses, refer to:
- the information sheet *Equine Viral Encephalitis* at www.gov.on.ca/OMAF/english/livestock/horses/ facts/info_equv.htm or contact the Agricultural Information Contact Centre, 1-877-424-1300.
- www.gov.on.ca/OMAF/english/livestock/horses/health.html
- WNv: www.gov.on.ca/OMAF/english/livestock/horses/westnile.htm

Surveillance and Reporting of WNv Cases

Bob Wright and Paul Innes, Veterinary Science, OMAF

It is essential to have a consistent case definition for West Nile virus and an accurate clinical, travel and vaccination history for each case.

The tracking of positive WNv equine cases is an important part of the public health surveillance program. Like humans, horses are dead-end hosts and indicate the presence of mosquito to mammal transmission of the virus. This information is of great importance to local public health officials, because the risks and distribution of WNv infection can be very localized.

OMAF is responsible for collecting equine surveillance data as part of the Ontario WNv control and prevention program, in co-operation with diagnostic laboratories, the Canadian Food Inspection Agency (CFIA), private veterinarians and their clients. This information is shared with the Ministry of Health and Long Term Care, and the affected Public Health Unit. **Personal client information is kept strictly confidential.** The township location of infected horses is required to determine if and where additional prevention efforts may be needed.

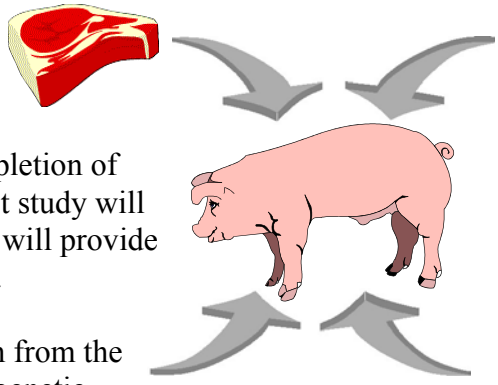
Under the newly amended *Health of Animals Act,* WNv is an Immediately Notifiable Disease. This requires diagnostic laboratories to report positive test results to the CFIA on a weekly basis. While private veterinarians are not obligated to report suspected cases in horses, they must be aware that, **if they use the services of a diagnostic laboratory, their case information will be forwarded to animal and public health authorities at the national, provincial and possibly local level**.

To improve the national surveillance for WNv, federal and provincial authorities are combining resources and sharing case data. It is essential, therefore, to have not only a consistent case definition for this disease, but also an accurate clinical, travel and vaccination history for each case. If this information is missing from the submission data collected by the reporting laboratory, the referring veterinarian will be contacted by the laboratory or a government animal health official. **Veterinarians submitting samples from horses for WNv testing should provide details about clinical signs, vaccination status, the location of the animal and travel history for the 14-day period preceding the onset of clinical signs, if possible.**

This information is also an invaluable part of the ongoing research into the epidemiology of WNv and its impact on the horse industries. Accurate case data are important to effectively allocate resources and plan for the following year. This information is also important for veterinarians to properly assess and communicate the risk to their clients.

Name That Pork on Your Fork…

Kathy Zurbrigg, Veterinary Science, OMAF



Maple Leaf Foods recently announced the successful completion of research into a DNA traceability program for pork. A pilot study will commence this spring at one of the Maple Leaf plants and will provide full traceability to the Japanese market by the end of 2004.

The system involves DNA typing of a blood sample drawn from the maternal sow. The test used identifies a specific panel of genetic markers. The information is then entered into a database linked to the farm of origin. Producers update the database with the birth dates of each litter. Cost for the program is estimated to be $40.00 per sow or $0.80 per market hog.

Maple Leaf plans to make the system available for use to the rest of the Canadian pork industry after completion of the pilot study. Although the system was designed specifically for the pork industry, it could be applicable to other species and discussion has begun on the feasibility of the program for the beef industry. Applications of the program in terms of food safety and export markets are great. Food safety tracebacks on fresh or frozen meat to the farm of origin could be done within hours instead of weeks. Suggested export possibilities include using the database information to help zone Canada into disease-status regions, theoretically allowing exports to continue from the disease-free zones in the event of a disease outbreak.

Induthol No Longer Available in Canada

Tim Blackwell, Veterinary Science, OMAF

Induthol

Veterinarians involved in the Canadian Quality Assurance (CQA) program should be aware that the only CQA approved product licensed for anesthesia in swine, Induthol (thiopentone sodium) is no longer available in Canada. No substitute products have been recommended by CQA at the time of this printing.

For further information, contact Tim Blackwell, Veterinary Science, (519) 846-3413, Fax: (519) 846-8101, tim.blackwell@omaf.gov.on.ca

Kneeling Cow Syndrome (KCS) – Electric Trainers and Other Causes

Neil Anderson, Veterinary Science, and Gerrit Rietveld, Animal Care Specialist, OMAF

Kneeling Cow Syndrome (KCS) describes dairy cows kneeling on their bent fore knees while standing upright on their hind legs. Caregivers dislike KCS because these cows defecate within the stall bed. Contaminated beds lead to dirty teats and udders, increased udder preparation time, risks of mastitis and to milk quality. For the most common causes and cures, look at the barn.

Cows adopt the kneeling posture to avoid or cope with challenges in their workplace. In tie stalls, cows kneel to avoid malpositioned electric trainers – trainers that are too close to their top line or forward of, and lower than, the withers. They also kneel to reach feed when the manger is at, or below, their foot height. In addition, cows kneel to get to feed beyond their reach while standing. Some spread their feet apart laterally to lower shoulder and head height. However, this stance stresses the inside claw of the front feet, contributes to sole ulcers and, in some cows, kneeling. Cows with laminitis may kneel while eating. In tie and free stalls, cows may kneel for extended times in response to obstructions to normal rising or lying. The obstructions are typically in their head bob and lunge space but also may include a malpositioned neck rail in free stalls. Injury, pain, fear, or frustration associated with stabling contributes to avoidance behaviour that results in KCS.

Producers report that many kneeling cows shed the behaviour when moved to bedded pack pens or pastures. Therefore, it appears that KCS is associated with inadequate stall features or misplacement of electric cow trainers.

Figure 1. In this new Ontario tie-stall barn, electric trainers position cows for stall cleanliness. The trainers are easily adjusted for height according to the variation in cow heights or the need for a trainer for an individual cow.

Recent visits to six tie-stall dairy barns found four of them with KCS. The four KCS farms shared a few common features. Manger platforms were level with or lower than stall beds. Electric cow trainers were at or forward of the withers. For many cows, the trainers were lower than the withers so those cows had to alter stance or position to avoid a shock when eating. The two farms without KCS complaints had manger platforms about four inches higher than the stall bed, cow trainers located two inches over the chime (48 inches forward of the rear curb), and higher tie rails.

Laura, a retired milkmaid, recently remarked that "cows cannot step forward and eat without defecating." Her observation may explain why trainers are located too far forward. Trainers should encourage cows to step back if they are too far forward when they arch their back to defecate. Since there is no back arch at or forward of the withers, the forward trainer location clearly aims to keep cows to the rear of the stall.

Manufacturers and dealers have been selling electric cow trainers without instructions or warnings about misuse. Dealers sell trainers for producers to install. When asked to install trainers, they seek the producers input for their preferred location.

A check with two of the largest distributors of trainers to Ontario dealers revealed that neither company includes instructions for installation with their product. "We haven't because we thought the installation was quite simple," confided one representative. Coincidentally, just an hour before our enquiry, they received a telephone call from a dealer looking for instructions.

Figure 2. The photograph shows a single wire used as an electric cow trainer. This application has several flaws. The wire is mounted 56 inches forward of the gutter curb and low enough that it rests on the taller cows in the row. The wire is strung between posts at every 3rd or 4th cow. There is no provision for easy vertical adjustment for individual cows. The milk and vacuum lines are about 48 inches forward of the gutter curb - the preferred location for the electric trainer.

The recommendation from European research is to place the trainer no closer than five cm (two inches) above the chime (**Figure 3**) for a 24-hour training period. After the 24-hour training period, raise the trainer to about 10 cm (4 inches) above the chime. The procedure is repeated when retraining is necessary. Producers at Alma and New Hamburg researched the best location for trainers to position cows for defecating or urinating in the gutter. The location was about 48 inches (range 47 - 49) forward of the gutter curb for their Holstein cows. Other producers across Ontario report very good results after choosing this location.

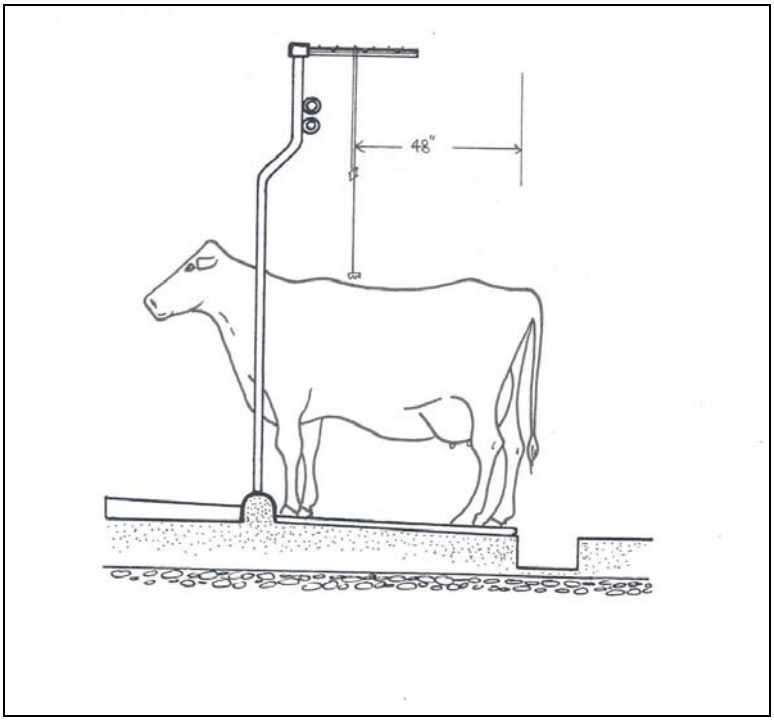


Figure 3. For Holsteins in stalls with 70 - 72-inch platforms, the trainer should be 48 inches (range 47 - 49) forward of the gutter curb. For Jerseys in stalls with 62 - 66-inch platforms, the forward location is 42 inches (range 41 - 43).

Thomas Oswald, a Swiss Researcher, showed tie stalls were not any dirtier with operation of trainers two days a week compared to 7 days a week. Oswald also showed that 90% of all contacts with the bow did not happen during urinating or defecating. He concluded that operation of trainers one or two

days per week should be a reasonable way of reducing the stress associated with the electric shocks.

The proper placement of trainers contributes to stall and cow cleanliness and better udder health. Another benefit relates to improved claw health from cleaner beds. The directions for installation should include the indications for use. For example, electric trainers will train cows to step back when arching their backs for defecation or urination. The purpose is to position cows so they defecate or urinate in the gutter rather than the stall bed. In addition, there are **contradictions for use**. Electric trainers are not to be used to restrict the normal eating, standing or lying behaviour of cows. Trainers must not restrict access to feed or water.

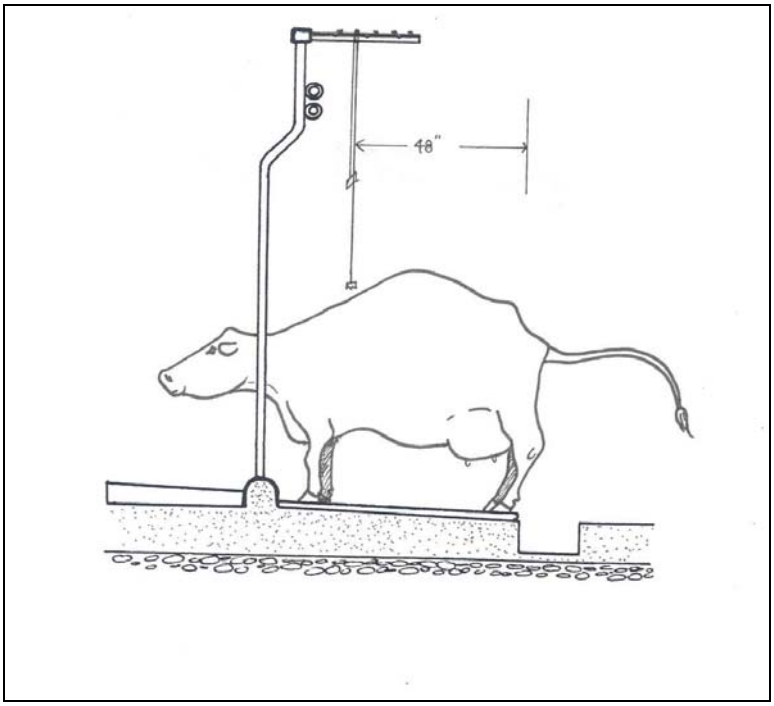


Figure 4. The trainer is located at the chime and slightly ahead of the point where the back begins to arch when a cow defecates or urinates. The trainers should be located 2 inches above the chime during a 24-hour training period and then raised to 4 inches the next day. If lowered for retraining, they must be raised again 24 hours later.

Since misuse of trainers can have harmful effects, a suitable warning should appear on trainer packaging and with instructions. For example, incorrectly positioned trainers may prevent cows from showing strong signs of heat, making heat detection difficult. This may contribute to poor reproductive performance. Reduced milk production may follow misuse of this product. Trainers must have secure attachment so they do not fall upon a cow and cause abusive damage. The cow trainer bow must be raised to a higher position when a cow is expected to be, or is, in heat. The distance between the trainer bow and the cow must be at least 5 cm (2 inches).

Kneeling Cow Syndrome can and should be eliminated. If the cause is laminitis, adjust the feeding program. If the cause is malpositioned electric trainers, move them. If the cause is manger height, raise it up. If the cause is reaching for feed, push it up or install a front curb (old technology). During a recent barn meeting, one producer summed up his recommendations for a KCS barn by saying, "It's glaringly obvious. These cows don't need more obstructions, they need less if you want them to stop kneeling." While the small 6-barn survey last week may not signal an epidemic of KCS, it should trigger an investigation and action.

Bergsten C, Pettersson B. The cleanliness of cows tied in stalls and the health of their hooves as influenced by the use of electric trainers. Prev Vet Med 1992; 13: 229-238.

Matzke P, Holzer A, Deneke J. The effect of environmental factors on the occurrence of udder diseases. Tierarztl Prax. 1992; Feb;20(1):21-32.

Oswald, Thomas. Der Kuhtrainer. Eidgenõssische Forschungsanstalt fûr Agrarwirtschaft und Landtechnik (FAT), CH-8356 Tänikon bei Aadorf TG. 1992

Oltenacu PA et al. Cow trainers increase disease risk. Prev Vet Med 1998; 37: 77.

Operation of Electric Fencers, Cow Trainers and Crowd Gates. Midwest Rural Energy Council. http://www.mrec.org/pubs/fencer.pdf http://www.wfec.org

And the Survey Says….
Cow Responses to Management Practices on Ontario Tie-stall Farms

Kathy Zurbrigg, Veterinary Science, OMAF

Injury, poor claw health, lameness and mastitis are all indicators of the challenges faced by dairy cows. These problems affect cattle welfare and increase the probability of premature culling, lost production and negative attitudes by the public toward the dairy industry. Animal-based parameters can be used to measure the cow's response to management practices and stabling features. This information can be used to evaluate husbandry choices and improve animal welfare and productivity.

A cross-sectional study was conducted on 317 Ontario tie-stall dairy farms to explore the prevalence of the following variables: hock and neck lesions, arched backs, outward rotation of the hind claws, cleanliness of the udder and hind limbs, teat injury and broken and docked tails. The lactating cattle on the study farms were scored for each of the variables.

Average herd size of the study farms was 56 lactating cows. Descriptive results are summarized in **Table 1**.

Table 1

Parameter Scored	% of Farms with No Affected Cows	% of Farms with 10% or More of Cows Affected
Arched back	47	8
Hindclaw rotated outwards	6	76
Neck abrasions	71	13
Hair loss from hocks	3	88
Open wounds on hocks	25	28
Significantly dirty udder	48	13
Dirty hindlimbs (manure up and over hock joint)	13	57
Docked tails	81	9
Broken tails	61	7

The average herd size of the study farms approximates the average lactating herd size of Ontario dairy farms. Lameness has previously been correlated with both arched backs while standing and rotated hind claws. The prevalence of lameness, cleanliness and injuries of cattle on Ontario tie-stall farms was not previously known. Benchmarking these values allows individual farms to assess their own herd scores and, thereby, to determine their farm's strengths and weaknesses.

The occurrence of several cows in a herd with the same types of injuries suggests a problem. Understanding the relationships between injuries is the first step to improving husbandry, cattle housing and ultimately productivity.

Machines to Clean Beds and Floors

Neil Anderson, Veterinary Science, OMAF

Mastitis and lameness are the two most common diseases of dairy cows. Both have environmental components. Therefore, prevention strategies include cleanliness of stalls and floors. Machines may help with environmental control measures for these diseases. Here are some to consider.

"Clean Girl" is a self-propelled machine for cleaning free stalls and slatted-floors. It is found on some farms in Europe and, most recently, in Western Canada. The rotating brush on "Clean Girl" cleans a generous portion of the entire width of each bed. Bedding discharges from a hopper onto the bed. Walk-behind versions and a self-loading, hydrostatic model of the equipment are also available.

For more details and a video showing "Clean Girl" in action, please check the web site at www.rmh.dk/index/produkter/renseogstroemaskiner

The Canadian distributor is Penner Farm Services, Blumenort, MB. Toll Free (in Canada): 1-800-461-9333, Telephone: (204) 326-3781, Fax: (204) 326-1411, E-mail: gmourant@pennerfarmservice.com, Web site: www.pennerfarmservice.com/index.htm

In Ontario: Avonbank Farm Equipment Ltd. Granton, ON, Telephone: (519) 225-2507, Fax: (519) 225-2506, E-mail: avonbank@quadro.net

Figures 1 and 2. "Clean Girl" sweeps stall beds, applies bedding, and scrapes or sweeps manure away from the stall curb while the operator drives the machine.

Scraping slatted floors is becoming more common. Scrapers remove manure built up at the curbs of stalls and upon the slats. The objective is to increase foot cleanliness, decrease contamination of beds and bedding in stalls, and decrease the risk of foot disease and mastitis. One research paper from the Netherlands showed better foot health for cows reared on slatted floors with scrapers than cows on slatted floors without scrapers.

weight of a skid steer or tractor. For safety, a lighter scraper would be more appropriate. Some producers use garden tractors with snow blades. Another option is the "Choremate," a scraper made in Ontario.

Figure 3. Cleaning slatted floors is a way to improve foot cleanliness and decrease contamination of beds. The photo shows an alley scraper in operation on slatted floors in a new Ontario dairy barn.

Figure 4. "Choremate" is a walk-behind, self-propelled scraper manufactured in Ingersol and sold by Performance Dairy Centre, Embro, ON, Telephone: 1-519-423-9119.

Veterinary Science Round-up

David Alves, Veterinary Science, OMAF

The Veterinary Science Unit has seen some organizational changes in recent months. Staff duties and locations have been renewed and updated to reflect the current needs of our stakeholders. A new Provincial Biosecurity position has been created. This will further the development of programs that address the many risks to the health and viability of Ontario's livestock industries, wildlife and the public from hazards of animal origin. Paul Innes moves from his position as Epidemiologist to take on this new challenge, located in Guelph.

The following is an updated list of Veterinary Science staff, job titles and contact information. Two positions will remain vacant due to the current hiring freeze across the Ontario Public Service.

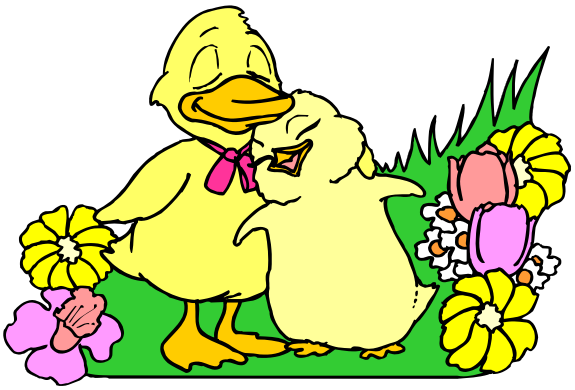
B B B

Veterinary Science, Ontario Ministry of Agriculture and Food

Position	Staff Person	Location	Telephone
Lead Veterinarian – Disease Prevention - Equine and Alternate Species	Dr. Bob Wright	Fergus	(519) 846-3412
Lead Veterinarian – Disease Prevention - Ruminants	Dr. Neil Anderson	Fergus	(519) 846-3410
Lead Veterinarian – Disease Prevention - Swine	Dr. Tim Blackwell	Fergus	(519) 846-3413
Lead Veterinarian – Disease Prevention - Poultry	Dr. Babak Sanei	Guelph	(519) 824-4120 ext. 54650
Veterinarian – Disease Prevention - Dairy and Beef Cattle	Dr. Ann Godkin	Fergus	(519) 846-3409
Veterinarian – Disease Prevention - Small Ruminants and Beef Cattle	Dr. Jocelyn Jansen	Fergus	(519) 846-3414
Veterinarian – Disease Prevention – Swine	Vacant	Fergus	
Lead Veterinarian – Epidemiology	Vacant	Guelph	
Lead Veterinarian – Provincial Biosecurity	Dr. Paul Innes	Guelph	(519) 826-4043
Surveillance Analyst	Kathy Zurbrigg	Fergus	(519) 846-3418
Manager, Provincial Veterinarian	Dr. David Alves	Guelph	(519) 826-3127

Continuing Education/Coming Events

April 6 - 7, 2004	Milking Centre Management Conference. The Atherton Hotel, State College, Pennsylvania http://conferences.cas.psu.edu/2004%20pdfs/mlkcntrmgmntconf04.fax.pdf
April 4 - 8, 2004	2004 National Institute for Animal Agriculture Annual Meeting, "Farmland Security: Ensuring our Future." The Marriott City Center, Salt Lake City, Utah. niaa@animalagriculture.org, (270) 782-9798, www.animalagriculture.org.
April 13 - 16, 2004	International Conference on the Control of Infectious Animal Diseases by Vaccination. Buenos Aires, Argentina. Contact Ms. Kokoé Sodji, Tel: (33) 01 44.45.18.88, Fax : (33) 01 42.67.09.87, www.oie.int
May 2 - 7, 2004	The Art of Veterinary Science, Australian Veterinary Association Annual Conference. National Convention Centre, Canberra, Australia. Tel: 1300-137-309, avacos@ava.com.au, http://www.ava.com.au/
May 13 - 15, 2004	Ontario Association of Poultry Practitioners 2004 Technical Symposium Ontario Veterinary College, University of Guelph, Guelph, Ontario Contact: Jill Taglietti, 1-800-265-5475 or jill_taglietti@elanco.com
June 4, 2004	Bovine Reproductive Ultrasound Classes for Veterinarians (Classroom discussion and Wet lab). Cortland, New York. Contact Jill Colloton (715) 352-2232, colloton@dwave.net, www.bovineservices.com
June 10 - 12, 2004	Western College of Veterinary Medicine and Saskatchewan Veterinary Medical Association Annual Conference 2004. Western Veterinary College, University of Saskatchewan. Contact: Anne Ruholl (306) 966-7267, anne.ruholl@usask.ca
July 7 - 10, 2004	The 56th Annual Canadian Veterinary Medical Association (CVMA) Convention. Quebec City Convention Centre, Quebec City, Quebec. Contact: Angie Herzog, Tel: 1-800-567-2862 ext. 12 or (613) 236-1162 ext. 12, aherzog@cvma-acmv.org, http://www.canadianveterinarians.net
July 11 - 16, 2004	23rd World Buiatrics Congress, Quebec City Convention Centre, Quebec City, Quebec. Tel: (418) 523-3010, Fax: (418) 523-1371, E-Mail: info@wbc2004.ca, www.wbc2004.ca
July 19 - 22, 2004	12th International Conference on Production Disease in Farm Animals. Kellogg Hotel and Conference Center, Michigan State University, East Lansing, Michigan. Contact Dr. Thomas Herdt, Tel: (517) 355-9593, Fax: (517) 432-1042, E-mail: lcs@cvm.msu.edu, http://12icpd.cvm.msu.edu



CEPTOR feedback form

Please add our clinic to your mailing list. ❑ Please change our clinic address. ❑

Our clinic has more than four practitioners and we would like to receive more than one copy of CEPTOR.

We have ____ practitioners in our clinic and would like to receive ___ copies of CEPTOR.
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Practitioners: . . . . . .

Mailing address: . . . . . .

Town/City . . . . . Postal Code. . . . . .

Tel.: . . . . . Fax: . . . . . E-mail: . . . . . .

Please return this form with your comments to:

Kathy Zurbrigg, Veterinary Science, Ontario Ministry of Agriculture and Food

Wellington Place, R.R. # 1, Fergus, Ontario N1M 2W3

Tel: (519) 846-3418 Fax: (519) 846-8101 E-mail: kathy.zurbrigg@omaf.gov.on.ca

Comments: . . . . . .

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Deadline for next issue: July 9, 2004

Ontario
Ministry of Agriculture
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