FUR ANIMAL RESEARCH

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BY J.E. OLDFIELD
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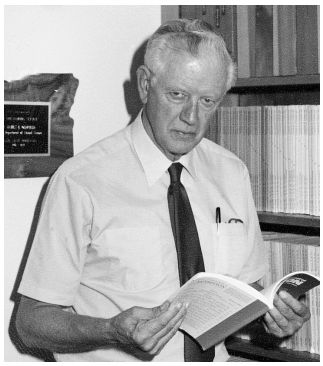

In our last issue of this newsletter, we recognized the ending of the 20th century by looking back over what had happened (and certainly a lot had happened) in our industry over the last millenium. This issue, I'd like to look ahead – to some of the things we may expect in the century ahead – and that's a bit more difficult.

Part of what's ahead is easy to predict because it will be some more of the same. We have some unfinished business, in the form of some old problems that continue to plague the mink business, that we need to clear up. Aleutian disease, for example, is still with us, even though we have sponsored a long-term research effort to resolve it. This is not a local problem – it's worldwide – and our Foundation's research is complimented by some very good programs overseas, particularly in the Scandinavian countries. Our own investigators, including Drs. Marshall Bloom and John Gorham are recognized as being the best in the business, so we should have effective means of control before too long. Intestinal problems – Enteritis – continue to cause losses, and we are finding that it can be caused by a number of different organisms. Sometimes it is useful, too, to know what organisms do NOT cause it, and Dr. Gorham has an interesting report in this issue showing that **Clostridium Perfringens** does not cause enteritis, although other types of Clostridia certainly cause problems.

We have come a long way in our understanding of mink nutrition in the last century – essentially making the change from thinking in terms of feeds to thinking in terms of nutrients. This is important because it means that if we know the mink's nutrient requirements we can balance them from a broad array of feeds available, and maybe make some economies in feeding in the process. Looking ahead, it seems that our nutrition research may focus on ways to use modern computer technology to make the calculations involved in diet formulation faster, and more accurate. We may end up with a computer program for ration formulation, similar to the program many of you now use for selecting breeding stock. I know that some of you already use ration formulation programs, but it would be nice if these could be standardized, so we are all working with similar data. This has already been accomplished in Denmark.

But the greatest change in our program of research with mink will almost certainly come in venturing into an entirely new area – that of environmental protection. Public concern is being voiced about the effects that domestic animals have upon the quality of the environment, particularly when the animals are concentrated in large numbers on a small land area. The problem comes when excreta (manure and urine) from animals carries excess nutrient materials into the soil – the most troublesome nutrients being nitrogen and phosphorus. Government agencies are already enforcing regulations limiting the numbers of animals that can be raised in a given land area and, in doing this, they tend to extrapolate from one species to another (e.g., one cow equals x number of mink). These extrapolations are often inaccurate and may lead to more severe restriction of animal numbers than is really justified. We need to work up our own set of data, with mink, and then do what we can to ensure that runoff from excreta is as minimal as possible. This will involve taking a close look at our mink diets and designing them not only to meet the animals' nutrient needs, but also to minimize nutrient excesses that may pollute soil and ground water. Dr. Aulerich, at Michigan State, is working on some such problems, and I have included in this newsletter a brief piece about "environmentally-friendly" rations.

Well, there's going to be lots to do, research-wise, that's for sure. I'd enjoy hearing from you about your thoughts on these and related matters.

I share your pleasure in the improved prices at spring sales. Kindest regards,

J. E. Oldfield

CAUSES OF MINK ENTERITIS

In addition to virus infection, several species of bacteria can be isolated from the digestive tracts of mink, and their role in causing enteritis is uncertain. Dr. Gorham has kindly provided a short article, which follows, on an investigation he made with one of these bacterial species; **Clostridium Perfringens**. The primary author of this paper, Kamala Venable, received MFRF funding, allowing her to study mink diseases with Dr. Gary Durrant. You will see her picture in last June's issue of the Newsletter.

An Attempt to Produce *Clostridium Perfringens* Enteritis in Mink

K. Venable, G. Haldorson,
T. Tesser, and J. R. Gorham
Department of Veterinary
Microbiology and Pathology
Washington State University
Pullman, Washington 99164 USA

The *Clostridium perfringens* bacteria is frequently isolated from the intestine of normal mink and mink with diarrhea and lesions of enteritis. Research by others (references not given here) did not shed light on the role of *C. perfringens* as a cause of enteritis. Outbreaks in which litigation was involved prompted us to experimentally dose mink by mouth with *C. perfringens* to determine its ability to produce enteritis.

There are several types of *C. perfringens*. We have isolated Type A from the feces and intestines of normal mink and also mink in which the cause of the disease was not related to the *C. perfringens* isolation, i.e., distemper.

In the present investigation, we used four types of *C. perfringens* (A, C, D, and E). Twenty-four standard dark female mink approximately six months of age were divided randomly into four groups of six mink. Each group of six was given one of the above types of *C. perfringens* bacteria. The mink were dosed directly into the stomach through the use of a plastic tube.

The results can be summed up as follows. Types A, C and E exposures produced a small amount of mucus in the feces on the third to sixth day after they were exposed. Some mucus with a trace of blood was observed on the third to tenth days after exposure with Type D. It is highly unlikely that these very minimal changes in the feces would have been noticed by a mink farmer. None of the mink showed any ill effects from the exposures; i.e., off feed, lassitude, or diarrhea. The autopsied mink showed no gross changes. Microscopically, the tissues of the exposed mink revealed no significant findings indicative of intestinal inflammation. There were also no kidney or brain lesions seen (as can occur in other species with some clostridial endotoxins).

Admittedly, this is a very cursory experiment in which standard dark mink of one age group were fed one ration throughout the trial period. There is always the possibility that other hosts, environmental influences or factors that increase the virulence of the *C. perfringens* could play a role in the production of disease on farms.

Soon after a mink dies, *C. perfringens* usually migrates from its normal habitat in the intestine and invades the tissues of the dead mink. The isolation of *C. perfringens* from the blood, liver, spleen and lungs should be viewed with caution unless the bacterial cultures were made within three or four hours after the death of the mink.

Clostridium botulinum is another member of the *Clostridia* family that produces a powerful toxin, which can put a mink farmer out of business in about 96 hours or less. In this intoxication, the feeding history and disease signs can almost always lead to a clear-cut diagnosis.

Mink food supplied by the Northwest Farm Food Cooperative
Research supported by the Mink Farmers Research Foundation

TESTING FOR BOVINE SPONGIFORM ENCEPHALOPATHY (BSE)

The Agricultural Research Service, of the U.S. Department of Agriculture, has announced the development of a laboratory assay method that they predict will lead to a test for BSE. This work was done at the National Animal Disease Center in Ames, Iowa, by chemist Mary Jo Schmerr. It works by detecting presence in the blood of animals of abnormal proteins called **prions**, which have been associated with transmissable spongiform encephalopathies, including BSE (from American Sheep Industry Weekly, October 22, 1999).

ENVIRONMENTALLY-FRIENDLY RATIONS

Our MFRF President, Bob Zimbal, tells me of the increasing pressures mink ranchers are feeling to ensure that their operations do not harm the environment. These concerns center on disposal of feed wastes and animal manure in ways that will not cause buildup in the soil of nutrient materials, particularly nitrogen and phosphorus. Already, some dairymen in environmentally-sensitive states are facing severe regulation and penalties if such buildups do occur, and they are being required to add to their land holdings to provide sufficient areas to absorb the wastes. This brings up the matter of designing rations for animals that keep such substances as nitrogen and phosphorus to a minimum. Because of their high protein levels, mink diets are particularly high in N and P. In the past, we have tended to overfeed on protein because many common mink diet ingredients (like meat, fish, cheese and eggs) are all protein-rich. In the future, we may have to put more restrictions on how much protein we feed. The good news is that if we lower diet protein – always ensuring that the animals' protein requirements are met – the resulting diet will probably be cheaper. Using dairy farms as an example, studies in Texas and Wisconsin have shown that on most dairy operations, phosphorus is being fed at levels of 15-30% above requirements. A further study at the University of Florida indicates that 68% of the excess phosphorus (above requirements) is excreted in the manure. Scientists at the universities of Virginia Tech and Maryland calculate that feeding a diet containing 0.4% phosphorus instead of 0.55% will cut feed bills about $3,600 a year in a 100-cow herd. Clearly, we need to keep these thoughts in mind as we design mink rations for the future (see **Hoard's Dairyman** supplement, 25 Sept. 1999, p. 19).

MORE ON THE ANTIBIOTIC ISSUE

Continuing concern is being expressed about the possibility that the use of antibiotics on a regular basis may lead to the emergence of bacterial species resistant to antibiotics. Last year an article published in the **New England Journal of Medicine** suggested a direct link between the use of antimicrobials in animals and the development of resistant bacteria in humans. The report was based on data collected by State Health Department workers in Minnesota that showed that Campylobacter bacteria commonly found in poultry became increasingly resistant to **fluoroquinolone** after that drug had been used with poultry. The suggestion has not been widely accepted, however, and Alex Matthews, the president of the Animal Health Institute, says it raises more questions than answers. Matthews said that the data are not new and have been widely discussed for over a year. He added that while the Animal Health Institute agreed with many of the findings in the Minnesota report, they did not agree with the conclusion. "The study fails to make a connection between human sickness and the use of fluoroquinolones in poultry," he said. This issue has important implications for the various animal industries and we will keep you informed (from **Large Animal Practice**, July-August 1999, p. 3).

CONTROLLING MINK MANURE ODOR WITH YUCCA

Neighbors of large mink ranches sometimes raise concerns about the odors produced by the mink manure and the residual feed that drops through the cage wire. One of the items contributing to these odors is ammonia, which is a volatile compound that easily escapes into the environment. Ammonia can also be converted into nitrates which then contaminate the soil. If concentrations of ammonia are high – say 100 parts per million (ppm) or more – in the droppings, they may adversely affect the animals, reducing daily feed intake and weight gains. Such high ammonia levels are most likely to occur in closed animal quarters like poultry or swine facilities, and less likely in open mink sheds.

Yucca extract is a product made by drying and grinding the stems of the Yucca plant (**Yucca shidigera**). It contains chemical compounds called **saponins** and a urease inhibitor, which slows ammonia production by stopping the urease enzyme from

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CONTROLLING MINK MANURE ODOR WITH YUCCA Cont.

breaking down urea into ammonia. Thus, yucca extracts have been suggested by some people as means of reducing ammonia-based odors and soil nitrate residue, and commercial yucca products have been used experimentally in both hog and poultry operations.

Finnish investigators have looked at the use of yucca preparations with mink at the Kannus Research Station. They involved 42 each, male and female mink kits, which were raised in traditional wire-mesh cages. The mink were divided equally into two groups, which were fed (1) a standard control diet, and (2) the same diet supplemented with 120 ppm of a commercial yucca extract. Animals were weighed monthly and feed intake was measured daily. Manure was collected and analyzed, see below:

Mink Manure Analyses from Finnish Yucca Extract Trial

Item	Control			Yucca Treated		
	Sept.	Oct.	Average	Sept.	Oct.	Average
Dry matter, %	29.1	28.3	28.7	28.7	28.2	28.4
pH	7.0	7.4	7.2	7.0	7.3	7.1
Total nitrogen*	5.57	4.22	4.89	5.27	3.96	4.62
Soluble nitrogen*	3.11	2.30	2.71	2.94	1.96	2.45
Ammonia N*	0.36	0.24	0.30	0.36	0.23	0.29
Nitrate N*	0.01	0.03	0.02	0.01	0.03	0.02

* Nitrogen Data are in % of dry matter

As noted, the effects of the yucca product on ammonia contents of the manure were small, and insignificant, statistically. There were significant differences in the various N components of the manure between months. These relate to the efficiency of conversion of feed nitrogen, which improves as the animals grow. The authors concluded that the use of yucca extract to prevent excessive ammonia and nitrogen releases from fur farm manure was of questionable value. They emphasize the difference in management of mink, in outdoor cages, from poultry and pigs in closed confinement. The latter appear to benefit more from use of yucca. (from Korhonen, K. and P. Niemela. 1999. Effect of yucca feed additive on manure nitrogen content and production performance in mink and blue foxes. **Scientifur** 23:179-185.)

CORONA VIRUS RESEARCH

(Dr. John Gorham has kindly provided some thoughts on corona virus research)
Coronavirus Research Presents Problems

John R. Gorham
Department of Veterinary Microbiology and Pathology
College of Veterinary Medicine
Washington State University
Pullman, WA 99164

History

Dr. Austin Larsen was the first veterinarian to see the disease that came to be known as "Utah enteritis." A new disease such as this, for want of a name, is often labeled for the location where it was first recognized. Some thought "Utah enteritis" was a new type of mink virus enteritis but it was not related to mink virus enteritis. This disease on farms where the mink were solidly vaccinated against mink virus enteritis and the new disease only caused a transient diarrhea. Huge death losses seen in kits that were susceptible to mink virus enteritis did not occur in "Utah enteritis." Dr. Mogens Hansen

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of the Danish Fur Breeders called the new disease "three-day disease," which designated the course of the disease.

Larsen and I renamed the disease epizootic catarrhal gastroenteritis (ECG) to be consistent with the description of the malady. Also, we felt it was not appropriate to call it "Utah enteritis" when the disease had a worldwide distribution in farm-raised mink.

Diagnosis

We thought that a virus might be the cause because the bacterial isolations were not significant. Later the feces of affected mink were examined by electron microscopy and Dr. James Evermann (Washington Animal Disease Diagnostic Laboratory) and I found a coronavirus. We cautiously said that other diseases are characterized by a transient diarrhea but a coronavirus must play a role in ECG. We agreed other viruses such as rotavirus, parvovirus and calicivirus could add to the severity of the new disease. We found that mink almost always survive an attack of ECG. However, there have been some outbreaks where deaths have been reported.

Electron microscopy gave us a way to diagnose the disease; however, electron microscopy is time consuming and takes highly trained people. Routine autopsy and microscopic findings of a catarrhal enteritis with feces that contain mucus are often recorded in other infectious and nutritional diseases of mink. Electron microscopy is a help in sorting these out and finding the cause.

An Outbreak at Washington State University

One particularly instructive ECG outbreak occurred on our Washington State University mink farm. One December 18th, we orally exposed five mink to the coronavirus. These mink were housed in a small building located about two miles from the sheds where stock mink were maintained (Figure 1). Five days after exposure, all five mink showed the characteristic signs of ECG – off feed and diarrhea.

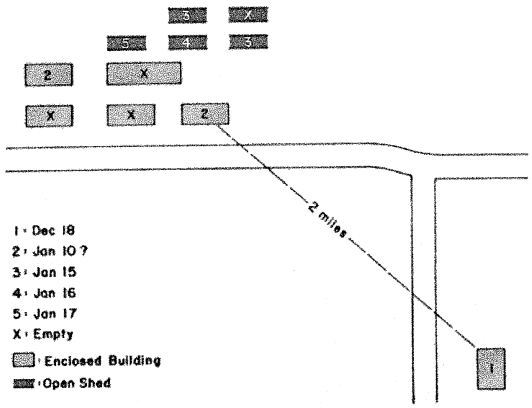

Figure 1. Mink were experimentally infected with coronavirus in a building located about two miles away from the stock mink on December 18. On January 15, the first cases were seen in the stock mink.

The veterinary student who cared for these mink observed the usual precautions to prevent disease transmission; i.e., changes of coveralls, disinfection of boots, etc. The student made daily trips to the feed room located at the main facility.

On January 15th, we observed cases of ECG in a shed at the main facility. We assumed from the initial outbreak of cases that exposure probably occurred around January 10th. New cases appeared almost daily throughout January. A peak of 60 new cases was observed on January 17 (day 3 of the outbreak).

The disease spread throughout 210 predominantly black mink; only four mink showed no signs of the disease. The explosive nature of the outbreak is shown in Figure 2. We believe that the immediate source of infection in this outbreak was the veterinary student who attended the experimentally infected mink.

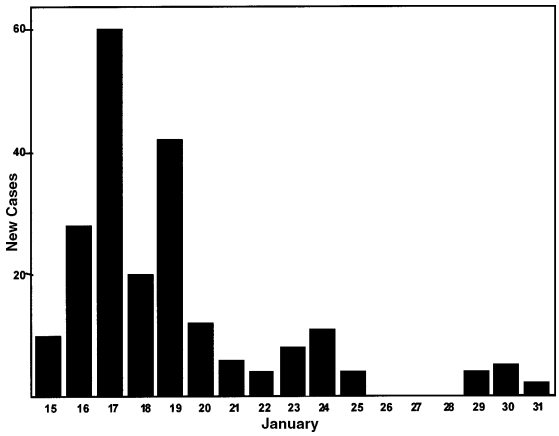

Figure 2. Distribution of new cases during a January outbreak of epizootic catarrhal gastroenteritis (coronavirus) on the Washington State University mink farm. A peak of 60 new cases was observed on the third day of the outbreak.

Although the virus swept through our farm, there have been instances where the coronavirus attacks sporadically on farms over months. The typical outbreaks usually occur in stress periods: in the fall when the mink are furring up or in the spring when the females are having their

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kits. In a Canadian outbreak, the sick females were not able to nurse their kits and the kit losses were very high. An outbreak among males in February and March has a marked effect on their ability to breed. Fall outbreaks often lead to losses in fur quality.

It is not known whether mink that have shown signs of ECG and recovered are immune or susceptible to further attacks. Farmers usually pelt mink with a history of ECG and there is little opportunity to check them at a later time. After the occurrence of an outbreak, the disease is likely to recur each year.

Outbreaks are Related to the Mink's Age

The occurrence is related to the age of the mink; adults are more likely to show clinical disease. In experiments relating age to disease, ECG spleen suspensions were injected into dark (AA, Aa) and violet (aa) mink that ranged in age from 3 months to 1.5 years. A few mink showed signs of the disease at 5 months of age whereas all mink 6 months of age and older showed signs. These trials were conducted by Dr. T. M. Schwartz of the American Scientific Laboratories.

Maternal immunity plays a major role in determining the susceptibility of young mink to distemper and mink virus enteritis (MVE). It is believed that, in both instances, passively conferred immunity declines sufficiently to allow infection with pathogenic virus by the time the kits are 10 weeks of age. However, outbreaks of coronavirus disease have not been reported in kits less than 4 months of age. The mechanism of age-related susceptibility has not been determined.

The Susceptibility of Dark Mink

While the disease almost invariably affects black mink, other genotypes can be experimentally infected. Outbreaks in Blue Iris mink are rarely reported.

Transmission

On fur farms where thousands of mink are raised on an acre of land, the chances of exposure to feces carrying the virus are greatly increased. The most important means of transmission between farms is by mink carrying the virus. When farmers purchase new breeding stock, they buy the disease as well. Virus-containing feces are probably the primary transmitter between mink. Because of the explosive nature of some outbreaks, airborne transmission might also be considered. Coronavirus are relatively fragile viruses but probably can survive for a couple of months in mink feces. No one knows how long naturally infected mink shed virus in their feces – probably for weeks or months.

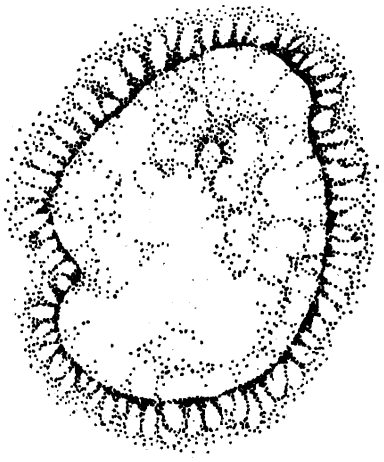
Treatment

There is no indication that any treatment is really effective. By the time therapy with sulfa drugs or antibiotics are included in the diet, most of the mink with a transient diarrhea are beginning to recover or have recovered.

Control

There is only one way to control the coronavirus infection and that is with an effective vaccine. There are three types of vaccines: (1) killed tissue vaccine treated with formalin made from tissues of a mink showing clinical disease. This type of vaccine should not be used because there is the possibility that it is contaminated with Aleutian disease virus. The older killed distemper vaccines were notorious for infecting mink with Aleutian disease. (2) The best approach is a vaccine made by growing live cells in a laboratory and then infecting them with the coronavirus for a vaccine. Unfortunately, many investigators have tried and failed to adapt the coronavirus to grow in live cells.

Presently, Dr. Linda Saif, a highly respected coronavirus researcher from the Food Animal Research Program, Ohio State University at Wooster, Ohio, is attempting to adapt the mink coronavirus to cell cultures. Dr. Saif's research is supported by the Canada Mink Breeders Association. (3) Finally, what we call a "stop gap" procedure would be to use a dog coronavirus vaccine and determine if it would cross-protect mink against mink coronavirus infection. Dr. Durrant of the Utah Fur Breeders Cooperative has preliminarily investigated this means of control.



Coronavirus particle

A crown of projections circles the coronavirus particle.

This research supported by the Mink Farmers Research Foundation

CONTROL OF AFLATOXICOSIS IN MINK

Aflatoxins, which sometimes contaminate grains or plant protein supplements (peanut meal) are the most dangerous of all feed toxins caused by fungi. There has been no method of avoiding problems with aflatoxin, other than removing the contaminated feed from the diet, but recent research has identified a compound which seems to be effective.

Hydrated sodium, calcium aluminosilicate (HSCAS) is produced from zeolite and has shown a strong ability to absorb mycotoxins, like aflatoxin. If this compound, HSCAS, is added to feeds it appears to protect animals against aflatoxin in their feed. It apparently works by combining with the mycotoxin, forming a compound large enough so that it cannot cross the intestinal membranes, and is therefore excreted (from Ramos, A.J. and E. Hernandez, 1997. Prevention of aflatoxicosis in farm animals by means of hydrated sodium, calcium aluminosilicate addition to feedstuffs: a review. **Animal Feed Science Technology** 65:197-206).

SELECTION OF MINK FOR BEHAVIOR

At the Danish Institute of Agricultural Sciences' research centre Foulum, mink have been selected for their reaction to humans, and three groups have been produced: (1) Curious, confident reactions, (2) timid reactions, and (3) selected without any attention to human reactions (control). When the three groups were exposed to mating one week earlier than usual, group 1 actually mated 1.7 – 2.1 days earlier than either groups 2 or 3. The length of gestation was shorter for group 1 than for the controls, but not different from the timid group (2). It was concluded that selection for behavioral habits led to the development of reproductive differences in time of mating readiness, but did not have an effect on early kit loss. (from Malmqvist, J., B. Houbak and S.W. Hansen. 1997. Mating time and litter size in farm mink selected for confident or timid behavior. **Animal Science** 65:521-525).

GROUP CAGING OF MINK

We have reported on this matter before, and a good deal of research has been done on it in Denmark. If mink are housed together, rather than singly, it of course lowers caging costs, but how do the mink react? Will they fight and cause pelt damage?

The Danes found that welfare of the females was improved by their being housed in 3-compartment cages during the nursing period, but if this group housing was long-continued it worked against the female, including stress caused by bites and pelt damage. Housing all kits in a litter together, or groups of five together in either 3-compartment in-line cages, or 2-compartment, vertical cages from weaning to pelting caused reduced body size and pelt damage, due to aggressive interactions. It was concluded that, overall, the traditional method of caging, singly, was preferred to group housing, because of elimination of pelt damage. More research is planned. (from Pederson, V. 1999. Alternative Burmiljoes til Mink - Hvad er Vore Erfaringer? In Annual Report of the Danish Fur Breeders Research Center for 1999, pages 17-23).

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Secretary: Dr. J. E. Oldfield
Dept. of Animal Sciences
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Corvallis, OR 97331-6702
(541) 737-1894
FAX: (541) 737-4174

DIRECTORS:

Kent Disse
Route 2, Box 94
Detroit Lakes, MN 56501
(218) 847-7424
FAX: (218) 847-8786

Dr. Gary Durrant
Utah Fur Breeders Co-Op
8700 South 700 West
Sandy, UT 84070
(801) 255-4228
FAX: (801) 255-4678

Jim Wachter
N5350 Country Aire Road
Plymouth, WI 53073
(920) 892-4287
Fax: (920) 892-4287

Ryan Holt
9762 S. Tayside Drive
South Jordan, UT 84095
(801) 280-1428
FAX: (801) 255-4678

Dr. Robert Westlake
701 Highway 10 East
PO Box 420
Detroit Lakes, MN 56502
(218) 847-5674
(218) 547-2533