FUR ANIMAL RESEARCH

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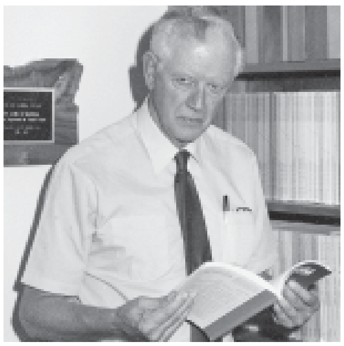
BY J.E. OLDFIELD
ELAINE SCHEFF, EDITOR



Since our last issue, the Mink Farmers' Research Foundation Board has held its annual meeting – this year at Oregon State University in Corvallis. I am sure you can imagine some of my thoughts as I welcomed the Board back to a setting we had used many times in the past when we were still operating the Experimental Fur Farm, which at the time was the largest mink research facility in America. As a bit of nostalgia, I'm including, below, pictures of the Board "then" and "now." See how many in the old picture you can recognize – many of them are no longer in the mink business.

The last couple of years we have invited participation in these meetings from the major auction houses, and this year we were pleased to be joined by **John Perrin** of the Seattle Fur Exchange and **Dennis Schmitt** of North American Fur Auction. Both of them entered into the Board's discussions and we appreciated their input. **Chris Engh** represented Canada Mink Breeders and brought us up to date on their research program.

One of our practices at these meetings is to review research priorities and try to identify research topics that will be important to the industry and you will find this year's priorities listed later in this newsletter. It is interesting to follow changes that have occurred over the years. We still have problems in the traditional areas of breeding, feeding and disease control, but we recognize a number of new ones, particularly in the area of maintaining environmental quality in areas adjacent to mink operations. Government agencies are regulating what can and cannot be done with increasing strictness and we think we need to investigate how best to meet these regulations. What do you think? As I have done in the past, I invite your input. Are these the areas of research interest most important to you? Are there others we should add? Let's hear from you. In this way we can make the mink research program truly representative of your needs.

We learned at our meeting of the retirement of **Dr. Dick Aulerich**, of Michigan State University.

Dick Aulerich began his career in fur animal research in 1962, as a research technician in the MSU

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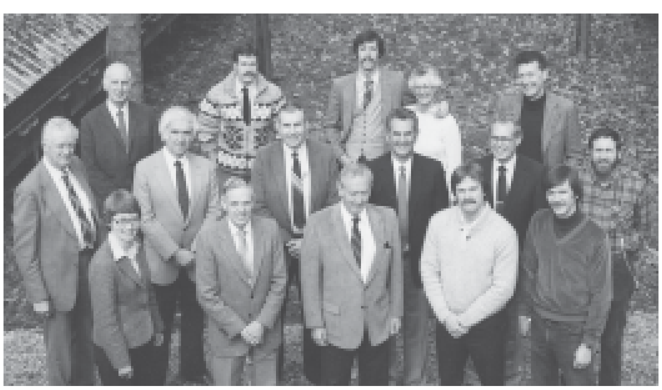
MINK FARMERS' RESEARCH FOUNDATION BOARD OF DIRECTORS MEETING

THEN



Mink Farmers' Research Foundation Board at OSU Experimental Fur Farm, 1984

NOW

MFRF Board meeting at OSU, 2001, in Withycombe Hall, Oregon State University

Fur Animal Project which was then in the Poultry Department, directed by Dr. Philip Schaible. Dr. Aulerich's doctoral thesis was on "wet belly disease" in mink and on Dr. Schaible's retirement, Dick took over the program and has headed it ever since. Dick was Dr. R.A. Aulerich promoted to full professor in 1979 and has served as Associate Chairman of the Animal Sciences Department since 1992.

When Dr. Aulerich took over the Fur Animal Research Program, the facilities for fur animal research consisted of a small service building and about 200 outdoor mink cages. In 1968, the Fur Animal Project was relocated about two miles south of the main campus and expanded. Following additions and renovations over the years, the present Experimental Fur Farm consists of a service building (office, laboratory, workshop, feed mixing room, storage area, and walk-in freezers and cooler), four mink sheds, two indoor animal rooms, and two containment rooms (designed for conducting studies involving toxic or hazardous substances). The present facilities can accommodate over 1,000 research animals.

In February, 1992, an animal rights activist attempted to burn the offices of fur animal researchers in Anthony Hall, destroy equipment and facilities, and release research animals at the Experimental Fur Farm. The person responsible for the arson and vandalism was apprehended and imprisoned. The damage was repaired and the research program was restored.

Early mink research conducted by Dr. Aulerich and his associates consisted primarily of nutritional studies focusing on the nutrient requirements of mink and development of dry diets for mink. Research was also conducted on the application of controlled photoperiodicity on the regulation of reproduction and furring cycles in mink. While investigating problems of impaired reproduction in mink fed certain Great Lakes fish, it was found that mink were extremely sensitive to many environmental contaminants, especially PCBs, PBBs, and dioxins. The use of mink as an animal model for investigating the mechanisms of toxicity and in characterizing the effects of these and other chemicals on animals has led to recognition of the mink as a preferred animal model for toxicological testing by the U.S. EPA and the National Academy of Sciences. The results of these toxicological studies with mink by Dr. Aulerich and his colleagues have been instrumental in establishing water quality standards in the U.S. and other countries, as well as in determining residue tolerance levels for many environmental contaminants.

More recent studies have examined the effects of mycotoxins (metabolites of molds that can contaminate mink feed ingredients) on mink production, methods (such as composting) for disposal of mink wastes, chemical preservation of mink feed and feed ingredients, and processing techniques for animal products used for feeding mink. Many of these studies have been supported by the Mink Farmers Research Foundation, and Dr. Aulerich is recognized as one of the most productive scientists involved in fur animal research.

Over the years, mink, fox, chinchilla, ferrets, skunk and river otter have been used in nutrition, physiology, pathology, management and toxicology studies conducted by researchers at the MSU Experimental Fur Farm. Dr. Aulerich has served as the major professor for 14 M.S. and five Ph.D. students and has helped guide the research of 26 other graduate students who conducted experiments with furbearers at the fur farm.

In his career at MSU, Dick has served as the University Coordinator for Animal Research and was the chair of the All University Committee on Animal Use and Care for several years. For his research accomplishments, he received the "Excellence Award for Interdisciplinary Scholarship" from the Honor Society of Phi Kappa Phi, in 1995, and was presented the "Senior Meritorious Faculty Award" from the Michigan Chapter of Sigma Xi, the Research Society, in 1999. The Michigan State Rabbit Breeders Association recently recognized his many contributions to the rabbit industry by awarding him their "Distinguished Service Award."

Dr. Aulerich is the author or co-author of 126 abstracts, 114 technical reports, and 289 publications pertaining to fur bearing animals (180 published in refereed, professional scientific journals), as well as the presenter or co-presenter of 77 oral and 57 poster presentations at scientific meetings.

Following his retirement in May, 2001, the MSU Fur Animal Research Program will be under the direction of Dr. Steven Bursian, an experienced fur animal researcher and long-time colleague of Dr. Aulerich.

We thank Dr. Aulerich for his many research contributions to the fur industry, and wish him well in his retirement.

J. E. Oldfield

SELECTING FOR FEED EFFICIENCY

It is obvious that improved feed efficiency (i.e., lowered feed consumption per unit of weight gain) could improve the economics of a mink ranch operation. But measurement of feed efficiency is a time-consuming and expensive process, entailing weighing all feed and feed waste and the animals themselves at intervals. Danish investigators looked for something easier to measure that might serve as an indicator of feed conversion efficiency. At the Research Center at Holstebro, in Denmark, they assembled two groups of mink varying in their feed efficiency: a high efficiency group and a low efficiency group. They found that the high efficiency mink were less active (hence used up less energy in daily activities) than the low efficiency group, and suggested that activity level could be an easier thing to select for than feed efficiency **per se** (from Overgaarde, L., K. Sorensen and L. Jeppesen. 1999. Activity level in mink selected for high or low feed efficiency. Annual Report, Danish Fur Breeders' Research Center, pp. 7-9).

PRICE OF BIOTIN MAY INCREASE

Many mink diets are supplemented with biotin to prevent the "graying" of pelts caused by avidin, which interferes with the normal activity of biotin. Avidin is found in eggs – particularly turkey eggs, but also chicken eggs and the heavy feeding of chicken eggs during the last few years, in some areas, has increased the use of biotin. This increased biotin use is not confined to the mink industry and feed manufacturers warn that the demand for biotin may outstrip the supply. Roche Vitamins, Inc., in New Jersey, is a major producer of biotin and they say that the chief cause of increased biotin usage relates to the dairy industry. In the U.S., it is estimated that about 10% of all the dairy cows are being supplemented with 20 mg of biotin a day to prevent hoof problems and increase milk production. This has caused the price of biotin to more than double in the past year. In such a situation, it is well to know what levels of biotin are required by mink so that overfeeding and extra costs are avoided. In 1969, Dr. Floyd Stout at the Oregon Experimental Fur Farm worked intensively with the biotin/avidin situation with the following results:

Test Diet	Percent Fur Loss	Incidence of Fur Graying	Exudates (eye, nose)
10% turkey eggs	90	100	100
15% turkey eggs	100	100	100
15% turkey eggs + biotin[1]	0	0	0
10% chicken eggs	0	0	0
15% chicken eggs	0	60	0
20% chicken eggs	0	100	60

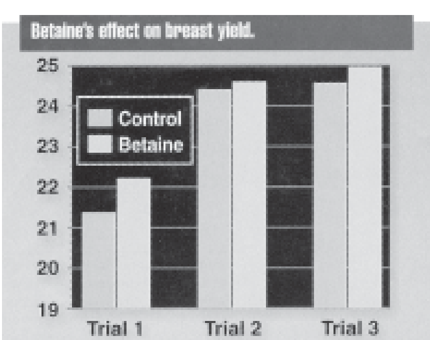
[1] This diet contained 0.22 mg biotin per pound as fed (from Stout, F.M. and John Adair. 1969. Biotin deficiency in mink fed poultry by-products. Am. Fur Breeder, June 1969).

TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHIES

The continued concern about Bovine Spongiform Encephalopathy (BSE), or "Mad Cow Disease" in Europe justifies mention here in relation to other, similar conditions, one of which occurs in mink. Transmissible Mink Encephalopathy (TME) was studied in depth by Dr. Richard Marsh, at the University of Wisconsin. It was first noted, in Wisconsin, in 1947 and subsequently identified in 1961, 1963, 1964 and most recently in 1985 at Stetsonville, Wisconsin. It has also been reported in Canada, Finland, Germany and Russia. The clinical symptoms of TME include alterations in normal behavior patterns, cleanliness and eating. As the disease progresses, the mink show incoordinated movements (atoxia). Outbreaks of TME have usually been traced to consumption of contaminated feedstuffs such as beef carcasses unfit for human consumption ("downer" cows). This sheep disease "scrapie" has been linked to BSE, but it has not proven possible experimentally to transmit scrapie to mink. Occurrence of TME in the U.S. is difficult to explain, since BSE has not occurred in this country (from: Bartz, J.C. and D. Olander. 2000. Transmissible Mink Encephalopathy. In: Transmissible Spongiform Encephalopathies in the United States. Task Force Report 136. Council for Agricultural Science and Technology, Ames, IA. pp. 16, 17).

SPARING METHIONINE AND CHOLINE

The amino acid, Methionine, and the B vitamin, Choline, both contain what are called "labile methyl (CH_3) groups," that is, methyl groups that can be transferred to other compounds. Methionine is sometimes a limiting amino acid in mink diets which means that ways of conserving it may be useful. Studies in Sweden have shown that methionine and choline may be spared by feeding another labile-methyl compound, **betaine**, the formula for which is $(CH_3)_3NCH_2COO$. Commercially, betaine is prepared from the by-products of beet-sugar molasses. In feeding trials with poultry, betaine added as 0.03% of the diet resulted in greater white meat production (improved growth) and improved feed conversion efficiency (Figure 2). We have no data on the use of betaine with mink, but the possibility of benefits from it are worth considering. (from Lob, P. 1999. Betaine's benefits in poultry production. **Feed Management** 50(10:13-16).



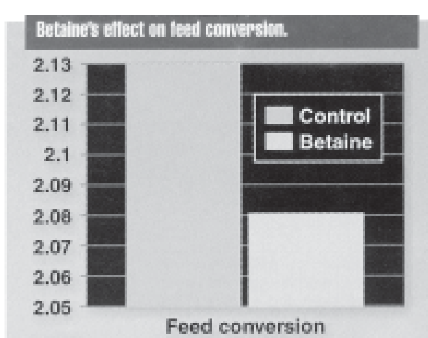


Figure 2. Betaine's Benefits in Poultry Production

AMMONIUM CHLORIDE SUPPLEMENTATION TO REDUCE URINARY pH

Various means have been tried to reduce mink urinary pH and prevent formation of bladder stones (calculi). Danish investigators at Holstebro added 0.35% ammonium chloride to diets for mink kits in the early post-weaning period (July 10 – July 26). Two groups of 18 mink litters each were used and fed the same basic diet, except the second group received 0.35% ammonium chloride, in addition. The use of ammonium chloride did, in fact, reduce urinary pH, however unfortunately it had a negative effect on the growth of the kits and is therefore not recommended in ranch practice. (from: Clausen, T.N. 1999. Ammonium chloride fed to mink kits. Ann. Rept. Danish Fur Breeders Research Center, Holstebro, pp. 89-92).

ALEUTIAN DISEASE: BREEDING FOR ANTIBODY RESPONSE

It has been found possible to breed animals that will show a high antibody response, and Danish veterinarians have tried this as a possible means of developing resistance to Aleutian disease (AD). They immunized 95 male and 158 healthy female pastel mink with 1 mg of bovine serum albumin (BSA); then bred the 22 males and 45 females with the highest antibody titers and similar numbers of the lowest-titer mink. The procedure was repeated for five generations. The mink were then challenged with AD virus and responses showed that breeding mink for high or low antibody reactions to a model antigen like BSA did not produce mink that were more, or less, resistant to the AD virus complex (from Aasted, B., N. Therkildsen and H.H. Dietz. 2000. Mink bred for high and low antibody response to BSA develop Aleutian disease at equal rates. **SCIENTIFUR** 24(2):97-102).

WATER SUPPLY TO LACTATING FEMALES

We have written previously about the occurrence of dehydration in the "nursing sickness" syndrome of female mink and of the importance of a good supply of fresh water. Anne-Helen Tauson at the Swedish Agricultural University, has made a careful study of the situation. Outdoor temperature and the amount of water available were variables investigated. Prolonged periods of higher-than-usual temperatures were found to be hazardous to lactating females and water lost in milk increased from 118 g/day at low temperatures, to 134 g/day at higher ones. Temperature seemed to be more of a problem than the amount of water supplied, however, potassium losses in urine were significantly affected by water supply (from: Tauson, A.-H. 1998. Water intake and excretion, urinary solute excretion and stress indicators in mink: Effect of ambient temperature and quantitative water supply to lactating females. Brit. J. Nutrition 80:555-564.)

OUTBREAKS OF PSEUDOMONAS PNEUMONIA IN UNVACCINATED MINK

Dr. John Gorham has provided the following interesting historic perspective of the early investigations of pseudomonas pneumonia:

Much has been written about pseudomonas or, as it is frequently called, hemorrhagic pneumonia. The cause, source of the disease, transmission, preventive vaccination and treatment are fairly well established. I thought it would be interesting to turn back the pages for present day mink farmers and describe the first United States outbreaks that occurred on farms before there was a vaccine.

The 1954 Minnesota Outbreak

Dr. Seth Osborn, a mink rancher from Waterville, Minnesota, reported a "mysterious mink disease" that appeared on his farm (American Fur Breeder, 1954). He said that he lost 85-90 mink that looked healthy in the evening and were found dead the following morning with blood coming out their noses. He took some of the dead mink to the Diagnostic Laboratory at the University of Minnesota and *Pseudomonas aeruginosa* bacteria was found to be the cause of death.

The 1955 Washington Outbreak

In early September of 1955, a mink farmer brought 13 dead pastel kits to our laboratory for diagnosis. They were in good flesh with normal fur growth. The owner said that the mink usually refused their food in the evening and would be found either severely affected or dead the following morning. Affected kittens were stretched flat on the pen floor with their necks extended. Rapid, shallow breathing accompanied by the expulsion of frothy fluid fro the nose was commonly observed. Death occurred within a few hours after the onset of symptoms. Entire litters were affected. A history of all losses recorded by the owner is found in Fig. 1.

Gross lesions. The most significant finding at necropsy was a hemorrhagic pneumonia (Fig. 2). The lungs were heavy and a bloody fluid poured from the cut surface. The inner surfaces of the bronchi and trachea were bright red in color and contained pink, frothy fluid. The lymph nodes were enlarged, moist and red. The lung cavity was filled with blood.

Bacteriologic findings. Bacteria were scattered throughout the lungs

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(Fig. 3). *P. aeruginosa* was cultured from the spleen, liver, heart, blood, lungs, kidneys, lymph nodes, bone marrow, peritoneal fluid, pleural exudates and brain. Intraperitoneal injections of cultures of this isolate caused the rapid death of guinea pigs, chinchillas and mice. Bacteriological examination of the water cups revealed them to be contaminated with *Pseudomonas aeruginosa*. The rancher was feeding chicken scrap at the time of the outbreak. No isolates were made from the scrap, but positive isolations were made from the chickens on the broiler farm where the scrap was obtained.

Treatment. The susceptibility of this isolate of *P. aeruginosa* to antibiotics and sulfas was tested in the laboratory. Streptomycin exhibited a slight zone of inhibition, and sulfathiazole showed a zone size of a centimeter or less. Accordingly, individual mink were injected with streptomycin twice each day and sulfathiazole was added to the diet. Sulfathiazole was an effective drug for the control of outbreaks. Unfortunately, it is no longer available for use. A sanitation program was instituted that included pen cleaning and disinfection, isolation of litters in which an individual kit had succumbed, and the addition of a dilute hypochlorite solution to each water cup.

The 1997 Minnesota Outbreak

Dr. Gary Durrant of the Utah Fur Breeders Agricultural Cooperative described a recent outbreak in unvaccinated mink in which an estimated 6,000 mink died of pseudomonas pneumonia. The losses started in late July and continued into the fall. The deaths were in large sheds which were poorly ventilated and contained several rows of mink cages. Since the pseudomonas bacteria is mainly spread through the air after an outbreak starts, it was an excellent situation for mink-to-mink transmission.

Because 4-way vaccines were not available, the farmer used a 3-way vaccine (distemper, botulism and mink virus enteritis) for his summer vaccination. Since this vaccine did not contain the pseudomonas vaccine component, his mink were not protected. Unfortunately, the outbreak was well underway when the pseudomonas vaccine was used in an attempt to control the devastating disease losses.

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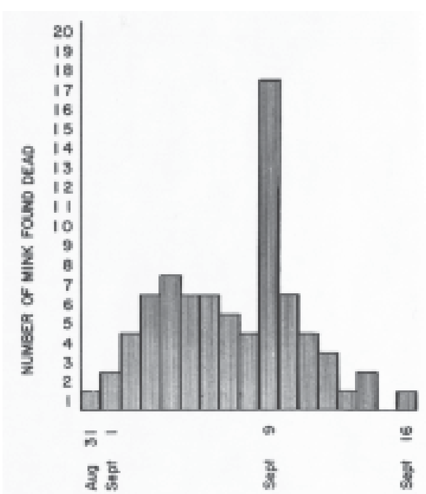

Figure 3. The number of mink found dead in a small outbreak of pseudomonas pneumonia.

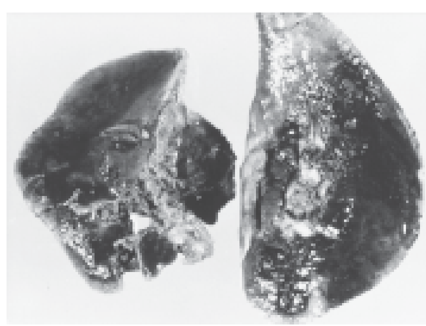

Figure 4. The disease is called hemorrhagic pneumonia because the lungs are full of blood.

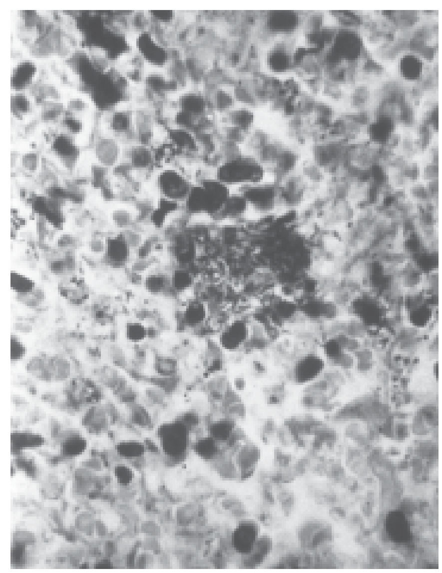

Figure 5. The small worm-like rods in the center of the photograph are pseudomonas Bacteria in the lung of a dead mink.

THE MINK FARMERS' RESEARCH FOUNDATION: RESEARCH PRIORITIES

Revised 31 March, 2001

AREA OF RESEARCH	DISEASE	FEEDS/NUTRITION	PHYSIOLOGY/MANAGE-MENT ENVIRONMENT
PRIORITY RATING I	**Antigen/Vaccine Studies:** Identify sources of vaccines and antigens against AD. **Viral Diseases (AD and Distemper)**: Continue studies to identify new virus strains and develop means of control **Enteritis/Septicemia**: Identify and isolate various bacterial and viral strains and develop control methods.	**Feed Processing**: Investigate methods of preserving fresh feeds, including acidification, irradiation, ensiling, and use of preservatives (Cu, formaldehyde). **Feed Additives**: Test usefulness of feed additives against specific problems, e.g. electrolytes in times of heat stress, enzyme 'cocktails,' probiotics, and DL methionine as a cannibalism-preventer.	**Early Kit Loss**: Continue studies to identify causes and prevention of losses of neo-natal kits. Investigate lactobacillus spray products as preventatives. **Environmental Problems**: Investigate and develop practical, cost-effective ways of lowering volume of excreta and disposing of mink farm wastes, including composting, and fly and odor control. Determine nutrient and fertilizer values for mink manure. Develop uses for it.
II	**Blue Mink Problems**: Investigate boils, pussy lungs and various problems occurring predominantly in blue mink.	**Alternate Feeds**: Identify and analyze various potential feeds for mink, including spent hens. Compile tables of nutrient values. Compare acceptability and nutrient value of fresh and frozen feeds.	**Water Studies**: Survey effects of mink production on ground water quality and develop means of improving it.
III	**Nursing Sickness**: Identify physiological basis for nursing sickness and study relationship to management practices.	**Food Poisons**: Continue investigation of toxins that may occur in, or contaminate, mink feeds. **Nutrient Requirements**: Assemble data on nutrient needs of mink at different stages of the life cycle. Combine these with data on feed nutrients in a form suitable for computer formulation of diets.	**Housing**: Develop recommendations on multiple caging of mink, consistent with the welfare of the animals. Investigate means of measuring stress in mink. Find optimum light exposure for mink. Investigate open vs. solid pen dividers. **Hormone Studies**: Investigate effects of lighting on mink life processes. Continue investigation of ways in which hormones influence basic processes of growth, reproduction, lactation, and fur production. Study possible involvement of melatonin in immunity with specific types of mink.

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