TITLE: FUR ANIMAL RESEARCH
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As I begin to put this issue together, it is the 6th of June, which will be remembered by some of the more mature among you as "D Day" in World War 11. It was a day of superlatives: the greatest armada ever assembled ferrying the largest number of troops ever involved in a beach head landing. But it also represented a time when our North American fur industry was just getting started. I recall knowing just one - a fox farmer - before I went off to war. When I returned, in 1946, it was a going concern and I became involved in research with mink when I returned to the University of B.C., in Vancouver, for my Master's degree. And that's where I first met John Gorham, who has been a good friend ever since.

Our group - the Mink Farmers' Research Foundation, will hold its annual meeting this month, at Dr. Gorham’s base of operations: Washington State University. Last year we met in Corvallis. We like to move around so that the Directors can see the various facilities that are (or have been, in my case) involved in fur animal research. It works both ways: the Directors become familiar with the scientists who do fur animal research, and often, as practicing mink producers, they can make helpful suggestions about the care and management of the experimental animals.

Regular readers of this newsletter, on seeing the picture of me in my office, sometimes ask: "Don’t you ever get out on the mink ranches?" Well, I do, but not as often as I would like. Last month I had the pleasure of attending a meeting of the Oregon State Fur Breeders' Association where I was able to renew some old friendships.

I continue to field some questions about vitamin supplementation and whether or not there is a need for it in various mink diets. There is no question that vitamins are essential nutrients and if they are not present in sufficient quanti- ty the animals will suffer from deficiency disease. The other side of the coin, however, is that if the diets contain such feeds as liver, or brewers yeast, they will probably supply all the vitamins the animals need.

The next question is "Should I add a little more of the vitamins, just in case?" I'm inclined to advise against adding supplementary vitamins in such cases unless the diet contains some stress factors that increase the animals' needs, such as unsaturated fats or oils. In the case of vitamin E, or chicken or turkey eggs, in the case of biotin.

In a few cases, excess amounts of the vitamins may be toxic, especially the fat-soluble vitamins, which are vitamins A, D, E and K. The best bet although it may be expensive, is to have your complete diets analyzed for the various vita- mins and then compare the results with the animals' vitamin requirements. You will find these requirements listed in the National Research Council publication, Nutrient Requirements of Mink and Foxes, or in the excellent Danish publication, Mink Production put out by SCIENTIFUR I send All good wishes to you for the summer months.

CATALOG OF NORDIC RESEARCH ON FUR ANIMALS

The Nordic Association of Animal Science has published, every two years, a catalog of Nordic research projects dealing with fur animals. The sixth volume of these catalogs will come out this year. The reviews are written in the Scandinavian language, however, each review has an English title and the address of the investigator. In future it is planned to use only the English language. You can reference this material on the Internet at: http://org.nlh.no/njf/pelsdyr/prosjekt/index.htmL

CARBOHYDRATES FOR MINK

As mink are carnivorous, their natural diets are low in carbohydrates and because of the very rapid time of passage of the feed through the digestive tract, the digestibility of the carbohydrates is low. Yet some carbohydrates (cereal feeds) are routinely fed to mink, which raises the question whether there are ways by which we can improve their digestibility. Fine grinding is one way, since smaller feed particles offer more surface area to the activity of digestive enzymes.

Danish studies showed that if barley was ground so that 93% passed through a 0.5 mm sieve it both improved digestibility of the barley and gave a good consistency to the wet feed. Similarly, with dried peas, 96% had to pass through a 0.5 mm sieve for best results (from Glem-Hanson & Sorensen. 1981. Bor hornet finformatis? Dansk Pelsdyravel 44:295-297). Various forms of cooking also help digestion of carbohydrates shown in Table 1.

Table 1: Digestibility of carbohydrates (%) in different starch sources.

Source of starch	Raw	Boiled @ 95°C	Autoclaved @ 110°C
Potatoes	2.1	77.3	79.9
Corn	63.1	80.7	84.2
Wheat	71.7	86.7	88.0

(from Jorgensen & Glem-Hansen. 1975. Report no. 422 from the National Institute of Animal Science Research Center, Foulum, Denmark, pp. 28-36).

FEEDING DURING LACTATION

It is generally believed that gestation and lactation are critical periods for the feeding of mink. Scandinavian research has recently looked into this with some interesting results. Two groups of standard, dark female mink were fed either free-choice (all they would eat) or restricted diets during gestation from March 25 to April 24. The restricted group were given 80% as much feed as the ad lib group. There were no significant differences in the numbers of kits born to the two groups, however significantly more kits died in the restricted-fed group during the first 28 days after birth. The kit weight was significantly higher at 28 days of age in the free choice-fed group as compared to the restricted group; however, this difference became non-significant at weaning (day 42). Weight data for the kits are shown below in Table 2. The authors concluded that the level of feeding of females during gestation was important for milk Production during the lactation period (from: Clausen, T.N. and C. Hejlesen. Ad libitum or restrictive feeding of scanblack mink females in the gestation period. In: Annual Report, 2000, pp. 51-54. Danish Fur Breeders Research Center, Hoistebro).

Table 2: Average kit weights at ages of 28 and 42 days

Feed Group	Mean Body Weight (g)			
	Age 28 days		Age 42 days	
	Males	Females	Males	Females
40 lb.	166*	150*	269	253
Restr.	154*	138*	259	239

*Difference between diet groups is significant.

DETECTING STRESS IN ANIMALS

Keeping animals from becoming stressed is a good husbandry practice that is followed by most mink ranchers. Current interest by animal welfare groups makes attention to stress removal even more important. But how can you determine when an animal is feeling stressed? Dr. Ted Elsasser of the U.S.D.A.'s Agricultural Research Service, at Beltsville, MD, thinks the presence of certain chemical "markers" in the bloodstream may be indicative of stress, and he proposes nitrated protein as one such marker. Protein nitrification is caused by the amino acid arginine. When the animal is stressed, excess arginine is transported into the cells. Then the arginine generates nitrous oxide, which reacts with oxygen to form peroxynitrite, and this forms nitrated protein with various amino acids.

Since this is an oxygenation process, it may be slowed or stopped by antioxidants. Dr. Elsasser is looking at preconditioning animals against expected stresses by giving them an antioxidant like vitamin E. Working with calves he said, "Our studies using vitamin E as a weapon against animal stress may give some relief" He gave six
calves vitamin E before challenging them with a bacterial toxin which caused the immune system to react as if an infection was present. The animals given vitamin E recovered more quickly from the effects of the toxin than did the untreated calves (from Durham, Sharon. 2002. Detecting stress in animals. Agricultural Research, U.S. Dept. of Agriculture, January, pp. IO, II).

RUSSIAN FUR FARMING

Most of the Russian fur industry is located in the northwest, central and eastern regions.
Russian fur farming began in the 1920's and involves mink, sable, fox, raccoons and nutria. All are farmed for their furs and in addition, nutria supply meat.

Mink are the dominant animals, providing about 90% of the total production. In the past, the U.S.S.R. was a world leader in fur animal production, generating some 17 million pelts annually, but the situation has changed dramatically due in large part to a lack of inexpensive feed.

A current research objective in Russia is to lower mink feed costs by 40-50%. Fur farming is licensed by the government and currently only 29 farms are federally licensed. Most of the fur industry is located in the northwest, central and eastern regions. Fur research is conducted at VNI102 in Kirov, the Institute of Biology in Karelin, the Institute of Cytology and Genetics of the Siberian Branch of the Academy of Sciences and the Moscow Academy of Veterinary Medicine. Fur production is encouraged as a means of attracting foreign currency (from SCIENTIFUR 25:7-10, 2002).

ANTIBIOTICS AGAIN

It is interesting to watch what is happening in Europe with the use of antibiotics in animal agriculture. On March 25th, the European Commission proposed changes in regulations that will end the use of nearly all antibiotics in animal feed by 2006. The proposed change will end the use of lavophospholipol, salinomycin, avilamycin and monensin, all of which are currently used to promote growth in livestock. The use of other antibiotics that are also used in human medicine (avoparcin, bacitracin, spiramycin, virginiamycin and tylosin) were already phased out in 1997-1998.

A study by the European Federation of Animal Health showed that Europe's livestock industry used 4,700 metric tons of antibiotics in 1999 - about a third of all the antibiotics used in the European Union. About

3,900 mg of this went to aid recovery of sick animals; about 786 or 6% of all antibiotics fed were used as growth promoters. The commission also said that the new rules will apply to imports, which raises questions as to whether animal products that have involved feeding of antibiotics will be allowed into the Union. (from Ian Elliot, in Feedstuffs 74:1-3, April 1, 2002).

HYDROCEPHALUS IN MINK

Hydrocephalus, also called water on the brain or big head (Figure 2), is a condition seen in mink soon after the kittens are born. It is characterized by a great distention of the part of the skull covering the brain. The malady appears to be widely, distributed on farms in the United States and Canada. There are many cases of hydrocephalus that never become apparent as the affected kitten dies soon after birth and is eaten by the female. When the condition establishes itself in the breeding stock, it can become serious and difficult to eliminate.

Cause

Hydrocephalus is non-contagious, and so far as is known, not caused by any nutritional imbalances. In rare cases it is caused by accidents in development during the gestation period, under which circumstances it is not inheritable.

Experimental work indicates that in mice hydrocephalus is hereditary, and that it is recessive; since it usually causes death shortly after birth it is classified as a lethal character. It occurs equally in both males and females.

Since the gene causing hydrocephalus is recessive, it should be especially noted that Al hydrocephalic animals possess two of these genes, one having come from each parent. Animals possessing one hydrocephalus gene and one normal gene are "carriers"; i.e., they are normal themselves, but pass a hydrocephalus gene to their offspring. Available evidence indicates that hydrocephalus in mink behaves in the same hereditary manner as in mice.

Symptoms and Lesions

The affected kitten is usually first seen when the litters are counted and examined after whelping. The greatly enlarged head, dullness, lack of size, and muscular incoordination are the predominating symptoms. When the individual is picked up and the head is examined more carefully, the part of the skull which houses the brain is greatly distended and fluctuates to the touch. The skull in this area is very soft and in places the bone is absent altogether.

The underlying cause is an accumulation of the fluid within the cavities (ventricles) of the brain. The resulting pressure forces the brain substance against the soft developing bones of the skull arching them outward. In

this process the pressure on the brain and the retention of fluid causes the dullness and muscle incoordination so often seen. If the skull is incised, much colorless fluid will escape and a large cavity will be noted (Figure 3).

Control Measures

Assuming that hydrocephalus in mink is a heritable lethal character produced by recessive genes, it may appear on your ranch as suddenly as a new color phase mutation. just as a recessive may remain hidden for several generations, hydrocephalus may remain hidden, and only become apparent when both the male and female parents carry the hydrocephalus genes and transmit to their offspring together.

If the condition appears, the affected kitten should be destroyed for it will only take nourishment from the female and die in a short time. Next the sire, the dam, and the litter mates to the hydrocephalic kitten should be pelted since both the sire and the dam will carry the gene, and all or most of the litter mates may carry it. The foregoing practical measure, if followed each year, should provide maximum control which is possible under practical conditions.

Hydrocephalus in Mink
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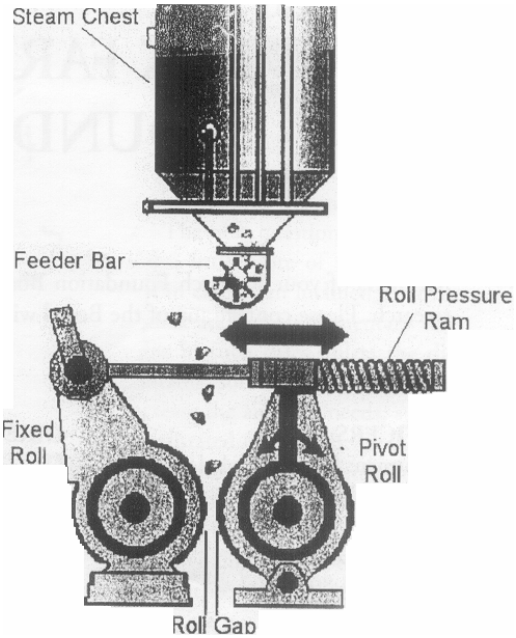
FLAKED CORN

Mink ranchers are confronted with many different forms of cereal grain products as potential ingredients in their animal diets and it may be useful to comment on these from time to time. One such item is flaked corn (not corn flakes) which is a steam-rolled product. Steam-flaking is known to increase the digestibility of corn, and since mink have some difficulty in digesting carbohydrates, this may be a useful mink diet ingredient, if the price is right. Steam flaking is done with the kind of equipment illustrated (Figure 1). Significant differences have been found in the digestibility of different types of corn with other farm animals, for example, an advantage of 12.6% in the release of Metabolizable Energy from steam-flaked, as compared with dry-rolled corn in cattle diets was found over 236 trials (see: Zinn et al., journal of Animal Science 80:1145-1156, 2002). The digestion process is, of course, different in mink than in the ruminant animals, but it is possible that the product may be useful for mink, too. Most of the starch in corn grain is in the form of granules, which are broken up by the flaking process. This allows some gelatinization to take place, which

improves digestibility.



TOO MUCH OF A GOOD THING?

Earlier in this newsletter, I wrote about the possibility that sometimes oversupply of essential nutrients, like vitamins, could cause problems. I can now give you a specific example, thanks to information kindly provided by Dr. Bob Westlake and by Mark Michels, of National Fur Foods.

Dr. Westlake reported that a number of kits had been lost on one ranch this spring, which when autopsied showed their body cavities to be filled with blood, suggesting hemorrhaging. Then Mark Michels told me of a reference that proposed that excess vitamin E might be a cause of the problem. I quote from the reference: 'A (human) patient with arteriosclerotic heart disease was prescribed warfarin sodium (which is a blood thinner). On his own accord
this patient was taking large doses of vitamin E (up to 1200 I.U. per day). Severe reduction of the vitamin K-dependent coagulation factors during vitamin E ingestion was noted. These levels returned to the warfarin-induced baseline levels after the patient ceased taking vitamin E... It was concluded from this report that (excess) vitamin E caused an increase in the dietary requirement for vitamin K." Vitamin K is essential for clotting of blood, and it appears from this work that excessive amounts of vitamin E might interfere with vitamin K's blood clotting function.

Now, getting back to mink, it appears that on the ranch involved in this problem, an unusually high level of liver was being fed in the diet which was also supplemented with vitamin E. Since liver is one of the best dietary sources of vitamin E, it is easy to see how an excessive level may have occurred. This, then, may have interfered with the normal action of vitamin K, thus allowing the young mink to hemorrhage and die

(see: "Megavitamin E supplementation and vitamin K-dependent carboxylation. Nutrition Reviews 41(9):268-279. 1983).