

SCIENTIFUR  
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NOTES.  
 SCIENTIFUR  
 No. 2, May 1977.

To this issue of SCIENTIFUR, we have received a considerable number of contributions, and since January we can welcome a considerable number of new subscribers to SCIENTIFUR. The editor's heart, already lightened by the advent of spring, has been further uplifted by this response.

There are thus 106 registered subscribers to SCIENTIFUR and these are geographically distributed as follows:

Denmark	39	Belgium	3
Finland	17	Holland	3
Norway	11	Japan	3
USA	9	England	2
Sweden	5	China	1
Canada	4	East Germany	1
France	4	West Germany	1
Argentina	3		

It can be seen from this, that SCIENTIFUR is distributed among 15 producing countries, but we must admit that the highest concentration is in Scandinavia. This is rather unsatisfactory especially as we must evaluate our chances for receiving contributions to SCIENTIFUR on the basis of its distribution. Therefore we still hope that SCIENTIFUR will spread further, like ripples in the water, both for our own sakes and for the sake of the industry we serve.

Therefore, dear subscribers and colleagues, help us to make SCIENTIFUR known in all the relevant places so that we can get

the publication on its feet financially, and make it worthy to receive contributions from all researchers in all countries' which work with fur bearing animals.

We would like to thank these who sent us a friendly word or two after receiving SCIENTIFUR. We take this opportunity to mention that SCIENTIFUR is not limited to abstracts and reports but can also be used as a medium for discussion. There are many unsolved mysteries in fur animal production, and it seems to us that a dialogue in the pages of SCIENTIFUR on some of these mysteries could be worth while. In this way, some of the vast body of knowledge and experience which does not get published can come out to many. After all, it is only the tip of the research iceberg which gets published.

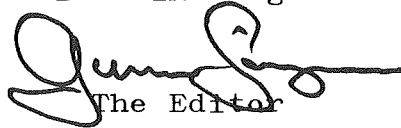
In the next issue of SCIENTIFUR I will set the causes of two very different fur abnormalities - metallic and matted fur - under debate. Nobody is sure of the causes, but there are many who know something. Let us pool our resources on these questions - maybe we can make some headway.

One always has visions when one is in the process of building something up. I think that the Czechoslovakian artist, Zdenka Rusova expresses something of these ideas in the picture shown below.



She shows that it is possible to achieve a harmonic and universal whole, regardless of form if only the foundation is good and solid. I think that researchers in the fur bearing animals' branch have a good, solid communications foundation in SCIENTIFUR. I will therefore finish these notes by expressing the hope that we, like Zdenka Rusova, in one way or another, can discern a global whole, which regardless of form, can serve fur bearing animal production.

With kind regards

  
The Editor

# SCIENTIFUR

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THE FIRST

MATION

THE BEST

IN FUR

ANIMATION

THE WORLD WIDE

COMMUNICATION

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ANNUAL CEMENTUM STRUCTURES IN CANINE TEETH IN ARCTIC FOXES  
(*ALOPEX LAGOPUS* (L.)) FROM GREENLAND AND DENMARK.

Helen Grue, Institute of Comparative Anatomy, Universitetsparken 15,  
2100 Copenhagen Ø, Denmark.

Birger Jensen, Game Biology Station, Kalø, 8410 Rønne, Denmark.

As part of a study of distinctness of cementum growth lines in Carnivores in relation to climate, histological sections of canines of 20 arctic foxes of known age (born and raised at a farm in Denmark) were investigated and compared with sections of 23 wild living arctic foxes from various localities in western Greenland.

For the danish farm foxes, number of growth lines corresponded exactly to the age of the animals in years. Most of the arctic foxes from Greenland showed somewhat more distinct lines in the cementum than did the danish, and the number of lines most probably corresponded to the age of the animals in years.

Before the preparation of sections, the canines were x-rayed and from the picture, pulp cavity width was calculated as a percentage of maximum tooth width. By comparing number of growth lines in the cementum and size of the pulp cavity, it was shown, that for the whole winter period, it is possible to separate young of the previous year from older foxes on the basis of pulp cavity size.

However, teeth having been broken to such an extent, that the pulp was exposed, not only showed a larger pulp cavity than expected from the size of the cavity in the other canines of the same individual, but in histological sections of the broken tooth, the cementum showed many thin lines, and it was not possible to count the number of lines present.

The canine teeth of farm foxes often get caught in the wire netting of the cages resulting in broken teeth. This possibility must be taken into consideration if farm-material is used as reference material for the age determination of animals in the wild.

4 Figures, 10 References.

Authors abstract.

ANNULAR STRUCTURES IN CANINE TOOTH CEMENTUM IN RED FOXES  
(VULPES VULPES L.) OF KNOWN AGE.

Helen Grue, Institute of Comparative Anatomy, Universitetsparken 15,  
2100 Copenhagen Ø, Denmark.

Birger Jensen, Game Biology Station, Kalø, 8410 Rønne, Denmark.

Age determination of mammals based on growth lines in rooth cementum is a commonly used method. However, material of wild living animals of known age, which could serve as a control of the method, is seldom available.

In connection with recovery of red foxes marked as cubs at various localities in Denmark, the opportunity was taken to test the method on a material comprising of 135 wild living animals of known age.

A canine from each animal was decalcified in 5 %  $\text{HNO}_3$ , and 30  $\mu$  thick longitudinal sections were made by means of a freezing microtome.

For an accurate determination of age, it is necessary to know, not only at which time of the year the annual growth lines are formed, but also at what age the first line will be visible. Based on 47 of the above mentioned foxes of known age and 150 of unknown age, it was revealed that from the age of one year, a growth line is formed every year between March and autumn.



Good agreement was found between the known age of the animals and the age assessed by means of growth lines in the cementum.

The method offers possibilities for absolute age determination, but accuracy very much depends on technically satisfactory sections, and skill and experience of the observer.

3 Tables, 2 Plates, 8 References.

Authors abstract.

EKSPERIMENTAL INVESTIGATION OF CEMENTUM ANNULI FORMATION IN MINKS, IN RELATION TO SEASONAL VARIATION IN AIR TEMPERATURE, PHOTOPERIOD AND COMPOSITION OF DIET.

Helen Grue, Institute of Comparative Anatomy, Universitetsparken 15, 2100 Copenhagen Ø, Denmark.

Investigation of the periodic development of growth lines (annuli) in teeth, today, provides the most accurate means available in establishing absolute age in mammals. Even though the method is used as a routine tool, practically nothing is known of the physiological processes leading to development of the annual growth lines. It is, however, generally believed, that natural fluctuations in the environment, to which an animal is exposed, somehow affects these processes.

On farm minks, an attempt was made to reveal, whether lack of fluctuations in either air temperature, length of day or variations in diet, during the period where growth lines normally are deposited, would affect the general pattern.

A pilot investigation of 87 minks of known age, raised under normal farm conditions proved, that the number of growth lines in the cementum corresponded exactly to the age of the animals in years, in spite of their artificial environment.

During the period January to September, in two succeeding years, 10 minks were kept under either constant temperature (22° C), or constant day length (5 hours light); but neither of these conditions had any visible effect on cementum growth, and all animals produced one growth line during each period.

The lack of seasonal variation in composition of the diet did not seem to influence the development of annual lines. Living on an unvaried diet from the time of weaning till the age of 1 year and 4 months, each of 4 animals still produced one annuli.

In order to demarcate the cementum developed during the experimental periods, chlor-tetracycline was administered orally, in a dosage of 25 mg per kg body weight, before and after each period.

2 Tables, 3 Fig. and 20 References.

Unpublished report.

Authors abstract.



## LICHTMIKROSKOPISCHE UNTERSUCHUNGEN AN DER HAUT DER KATZE.

VERTEILUNG: ANORDNUNG UND MORPHOLOGIE DER HAARE BZW. HAARFOLLIKEL.

Light microscopical examinations on the skin of the cat.

Distribution, grouping and morphology of the hairs and hair follicles.

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Veterinary Medicine, University of Pretoria, P.O.B. 12513,  
Onderstepoort 0110, Südafrika.

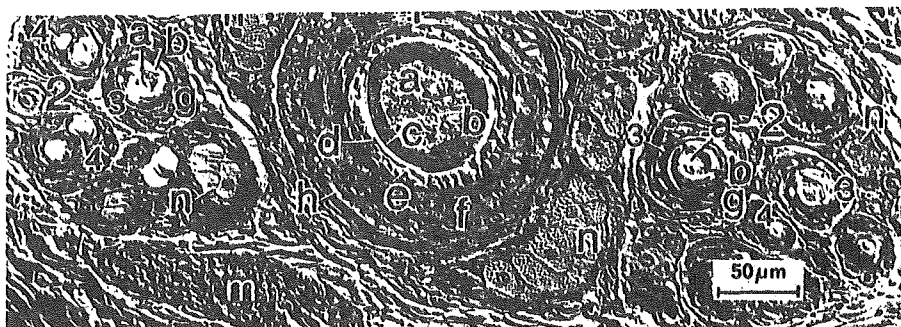
The intracutaneous grouping and the micromorphology of the various kinds of hairs and hair follicle were examined. Feline hairs and their follicles are arranged in groups as seen in all three levels of the skin that were studied. The large central primary hair follicle is in the center of a group. On each side of it are smaller bundles consisting of lateral primary follicles and secondary follicles.

Both functional (anagen) and resting (telogen) phases of the primary hairs and hair follicles were studied. All central primary hair follicles have their own, all lateral and accessory hair follicles as grouped fascicles have in common the following accessories, sebaceous glands, sweat glands, and arrector pilorum muscles.

Zbl. Vet. Med. C. Anat. Histol. Embryol. 5, 325-341, 1976.

11 Figures, 41 References.

Authors abstract.



## LYMPH NODES OF THE FOX.

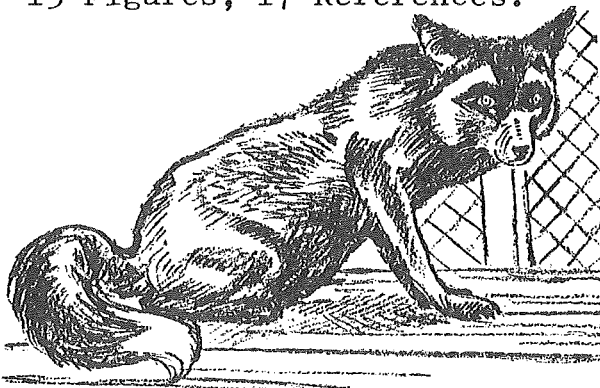
Zivka Miladinović, Olivera Jablan-Pantić, D. Drekić,  
Institut za morfologiju i fiziologiju, Veterinarski fakultet,  
11000 Beograd, Bulevar JNA 18, Jugoslavija.

Within the framework of an examination of the morphology and vascularization of organs of the thoracic and abdominal cavity in the fox (Pantić et al., 1973, 1974, 1975b; Miladinović et al., 1975 a, 1975b), studies were made on the localization of the lymph nodes of this animal. Thus there are no data from this field in the available literature and the lymph nodes are important in the diagnostics of many diseases. Few data have been found in the available literature on the morphology of the fox (Knasiecka, 1970, 1973; Wiland and Knasiecka, 1970a). Therefore we have compared our findings with data on the lymph nodes of other carnivores, mostly domestic (Freeman, 1942; Ellenberger and Baum 1943; Bradley and Graham, 1948; Kubik and Tömböl, 1958, Spira, 1962, Sugimura et al., 1958; Sisson and Grossman, 1962; Prier et al., 1962; Miller et al., 1969).

The anatomy of the lymph nodes in the fox has been investigated and compared with that in domestic carnivores. It has been found that in the thorax of the fox middle and caudal mediastinal lymph nodes are present unlike in the dog. In the abdominal cavity In. cecalis is developed, and gastric and omental lymph nodes are always present. In the pelvic cavity the sacral lymph nodes are paired.

Acta Vet. (Beograd), 1976, Vol. 26, no.4, 203-216.

15 Figures, 17 References.



Authors introduction and summary.

QUANTITATIVE INVESTIGATIONS ON BLOOD GROUPS OF SOME MINK VARIETIES  
BRED IN POLAND.

mgr. Wiesława Janicka-Mazur, Instytut Zootechniki, 32-083 Balice k.  
Krakowa.

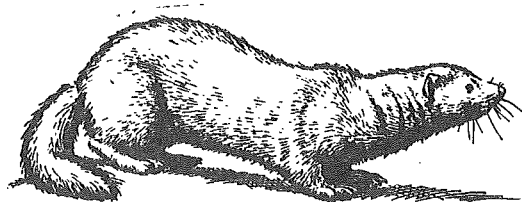
A preliminary quantitative characterization of mink of the Pearl, Topaz and Platinum varieties, on the basis of gene and genotype frequencies as well as homozygosity degree in the blood group system A is described. From among six genotypes occurring in this system i.e. AA, BB, CC, AB, AC and BC only the CC homozygote did not occur in Topaz and Platinum varieties. Frequencies of the remaining genotypes ranged within large limits, and the heterozygote AB occurred most frequently (above 50% in the Topaz - and about 40% in the Pearl and Platinum varieties).

Frequency differences of  $A^a$ ,  $A^b$  and  $A^c$  genes within varieties as also between individual varieties were considerable although only the differences between Pearl and Platinum varieties, as to the frequency of  $A^a$  and  $A^b$  genes, were statistically significant. The very high frequency of  $A^b$  gene in the Pearl variety (0,610), the highest in all three varieties examined is worth of notice. High differences in the degree of homozygosity between individual varieties were also observed.

Rocz. nauk. Zoot. II/I, 7-11, 1975.

2 Tables, 3 References.

Ref. Authors abstract.



PUBERTY AND SEASONAL SEXUAL CYCLE OF THE WILD MALE RED FOX  
(VULPES VULPES).

M. Joffre, Centre d'Etudes biologiques des Animaux sauvages  
(C.N.R.S.), et Faculté des Sciences de Poitiers,  
79360 Beauvoir-sur-Niort, France.

Spermatogenetic activity, weights of testis, testicular capsule, epididymis and prostate as well as prostate secretions and plasma testosterone levels, are compared in the wild or captive red fox. These criteria are studied during the impubertal and prepubertal periods of the cub and during the seasonal sexual cycle of the adult.

1. Puberty occurs in January in the cub born in March. Testicular weight increases slowly from March to October (impubertal period), then rapidly from October to January (prepubertal period). In the adult, spermatogenesis is plentiful from December to January (mating season), testis weight then decreases until May and remains in quiescence until September. During this period of rest, spermatogenetic activity decreases, only a few primary spermatocytes are present in the seminiferous tubules. From October to January, testicular weight increases together with spermatogenetic activity.

2. The weight of the cub testicular capsule increases slowly from March to October, and then quickly until January. During the regressive period in the adult, the capsule becomes thicker, while its weight decreases. Testicular capsule weight again augments during the period of testicle reactivation.

3. Plasma testosterone level is low throughout the impubertal period in the cub and during the resting period in the adult.

In November, plasma testosterone level increases in both groups. It reaches a maximum value in January, then diminishes from February to May. However, plasma testosterone peaks are observed in the resting adult.

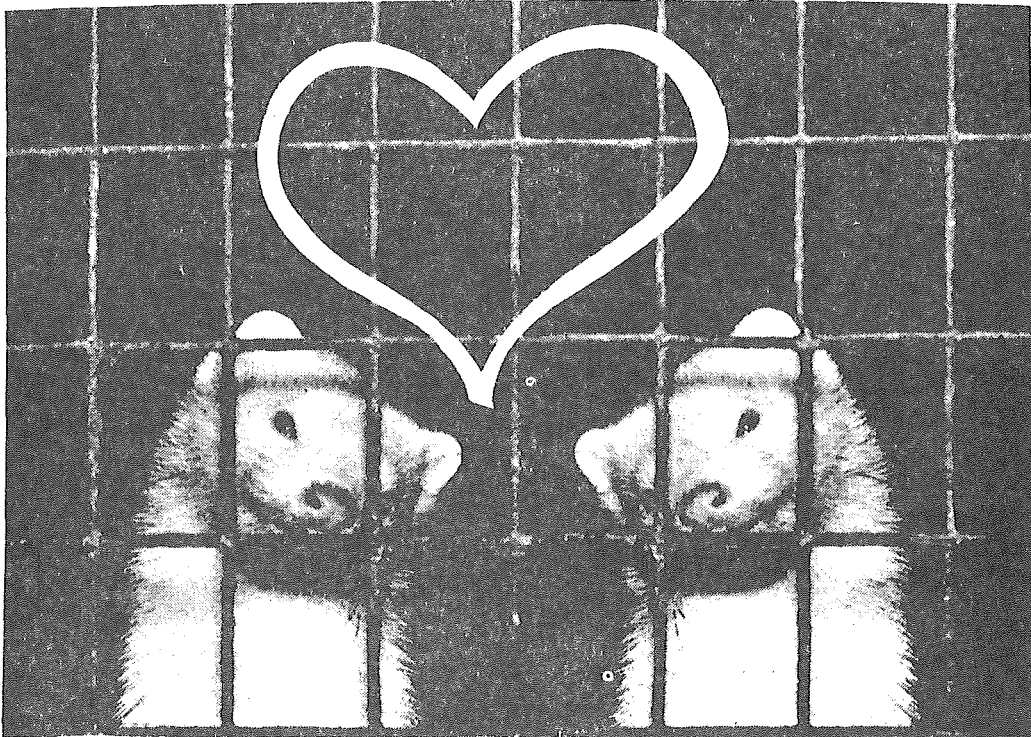
4. Cub epididymal and prostatic weights increase slowly until October, and then rapidly between October and January, both are lower from May to October in the adult. During this period, no spermatozoa are present in the epididymis. Finally, during the mating season fructose and glucose are found in the prostate, there is no citric acid and ergothionein.

The reactive period in the adult seems very similar to the prepubertal phase in the cub, the interval of adult rest appears very different from the impubertal period. On the other hand the weight of testis, capsule, epididymis and prostate, as well as plasma testosterone level, are lower in the pubescent than in the adult fox at mating time. Captivity seems to have no effect on the genital activity of the male red fox.

Ann. Biol. anim. Bioch. Biophys. 16, (4), 503-520, 1976.

3 Tables, 6 Figures, 52 References.

Authors abstract.



INVESTIGATIONS UPON THE QUALITY OF THE HAIR COAT OF YOUNG NUTRIAS  
FED WITH PELLETS.

Jadwiga Kawińska, Stanislaw Niedźwiadek, Zbigniew Rychlicki,  
Jan Wrona, Zakład Hodowli Drobnego Inwentarza Instytutu Zootechniki,  
Krakow.

Pellets prepared according to home made recipes have been used in the feeding of young nutrias destined for skin slaughter. Pellets of a protein level of 150 and 180 g/kg with a green forage supplement or without it have been applied. The weight gains obtained of animals and the laboratory analysis of furs indicate, that most advantageous effects are obtained feeding pellets of a 18 percent level of protein with a green forage supplement.

Rocz. nauk. Zoot. II/1, 35-43, 1975.

6 Tables, 7 References.

Authors abstract.

VITAMIN D CONTENT IN VARIOUS SPECIES OF FISH, AND ITS INFLUENCE ON  
VITAMIN D CONTENT OF MINK FEED.

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Fish silage, and mink feed which contained fish silage, was examined for vitamin D content. The fish silages examined contained from 7-17 IE D vitamin/g dry matter, and the mink feed contained 7-11 IE vitamin D/g dry matter.

The vitamin D concentrations found are approximately 10 times more than the requirement, and it must be assumed that this level is harmful, especially if the ratio Ca:P of the feed is not in the region of 1:1.



On the basis of these investigations, it is recommended that fur bearing animals should not be given supplementary vitamin D if the feed contains more than 10% flat fish or industry fish. It is further recommended that the Ca/P ratio should be as close to 1:1 as possible.

Table 1. Vitamin D content in several brands of fish silage.

Manufac- turer	Ingredients	% Dry matter	IE vit.D/g in	
			Fresh material	Dry matter
Hirtshals	ca. 70% Sand-Eel (Ammodytes lancea L) ca. 30% Mackerel (Scomber scombrus L)	30.3	3.0	9.8
Hvide Sande	Sprat (Sprattus sprattus)	31.4	5.2	16.6
Stårup	Herring (Clupea harengus L)	31.4	2.1	6.7
Superfos	ca. 67% Norway Pout (Boreogadus esmarki Nilsson) ca. 33% Sand-Eel (Ammodytes lancea L)	27.3	1.8	6.6

Table 2. Natural D vitamin content of feedstuffs in relation to the norms.

	IE vit.D/g in		IE vit.D/g feed		% feed- stuff in the feed to fulfil norm
	Fresh	Dry	for each % of	the feedstuff	
	material	matter	in the feed	in the feed	
			Raw	Dry	
			matter		
Cod and cod offal	0.5	2.5	0.005	0.025	70
Flatfish and flatfish offal	5	20	0.05	0.20	7
Silage and industry fish	5	16	0.05	0.16	7
Fish meal	6	7	0.06	0.07	6
Norm for fur bearing animals	-	-	0.35	1.0	-

Dansk Pelsdyravl, 40, no.4, April 1977.

2 Tables, 3 References.

Authors abstract.

## BREEDING RESULTS AFTER FEEDING WITH LARGE QUANTITIES OF FISH MEAL.

cand. biol. G.S. Taranov, USSR.

Russian research has shown that there are considerable possibilities for replacing large quantities of fresh feedstuffs with dried feedstuffs, without affecting either growth rate or skin quality.

Previous experiments have shown that the use of a high quality fish meal gives better results than the use of large quantities of frozen lean fish. The use of dried feedstuffs during pregnancy and lactation has, however, not been examined in sufficient detail.

The aim of the present experiment was to find out when it was most advantageous to replace fish offal with fish meal.

In an investigation carried out from 1968-1973, it was shown that, in the period June to November, female mink could be fed a diet in which 50% of digestible protein came from fish meal, without affecting the following year's breeding result. This result was put to test on a Russian farm, where 1017 standard kits were fed on a diet in which 42-50% of the digestible protein came from fishmeal. The feed was found to have the following composition per 100 kcal metabolizable energy:

9.6 g protein  
4.0 g fat  
4.6 g carbohydrate.

The average weight of the male kits at pelting was 2.5 kg. Average skin area was over 1000 cm<sup>2</sup>.

84 of the female kits were selected as breeding stock. In the winter they received normal farm feed and were mated with normally fed males.

Mating and breeding results showed that the experimental females did not deviate from the rest of the farm stock. These results are shown in Table 1.

Table 1. Breeding result of females fed with a high quantity of fishmeal from June to November the previous year.

	Young females		Older females
	Experimental	Control	Control
Number of animals	84	103	133
% Barren	15	16	6
Size of litter, including still born	6.08	6.09	6.36
Size of litter, surviving kits	4.90	4.97	5.82
Breeding results/ mated female	4.14	4.19	5.47

To examine how it would go if the females were fed a high fish meal diet the whole year round, four experimental groups were made. All the animals had received 50% of digestible protein from fish meal from June to November. From November the 4 groups were given the following treatment:

Group 1 Farm feed.

Group 2 50% fish meal + 66 mg methionine and 132 mg arginine per 100 kcal.

Group 3 50% fish meal.

Group 4 70% fish meal, treated with hydrochloric acid.

Composition of the experimental diets is given in Table 2.

Table 2. Composition of the experimental diets given in gm feed.

	Group 1	Group 2 and 3	Group 4
Mintaj ( <i>Theragra chalogrammus</i> )	21.0	11.0	-
Dab ( <i>Limanda limanda</i> L) or Greater Weever ( <i>Trachinus draco</i> L)	31.0	16.0	16.0
Fishmeal	-	9.0	12.0
Technical fat	3.5	3.6	3.4
Wheat	8.0	8.0	10.0
Vitamin mixture	2.0	2.0	2.0
	65.5	49.6	43.0

To the feed was added the following, per female: 1083 i.e. Vit. A, 217 i.e. Vit. D., 2.5 mg Vit. E, 0.3 mg Vit. K, 0.3 mg Vit. B, 0.5 mg Vit B<sub>2</sub>, 0.17 mg Vit. B<sub>6</sub>, 12-25 mg Vit. B<sub>12</sub>, 0.5 mg calcium pantothenate, 2.5 mg niacin, 0.05 mg folic acid. The following dosage of micro-minerals per female was given 4.0 microgram Mg, 7.0 microgram Fe, 2.5 microgram Zn, 0.5 microgram Cu, and 0.042 Microgram J.

Treatment of fish meal with hydrochloric acid was as follows: 1 kg fish meal was mixed with 2 litres water and 140 mg conc. hydrochloric acid.

After 24 hours the top layer was removed. A further 2 litres of water was added and after 24 hours the water was poured out and the fishmeal was ready for use. This treatment improves utilization of protein and also partly sterilizes the feed.

Addition of methionine and arginine raises the biological value of the protein.

During the winter period the groups consumed more or less the same amount of feed. In January to March this amount was 230-250 kcal per animal/day. After birth all groups were given normal farm feed.

Mating began in the beginning of March. The males used had all received normal farm feed throughout the winter. Mating readiness was the same for all groups, as was barrenness percent.

The lowest fertility rate was observed in group 2, which received a supplement of methionine and arginine.

Table 3. Breeding results in the 4 experimental groups.

	Group 1	Group 2	Group 3	Group 4
Number of females	33	32	31	16
% barren	24	25	23	25
No. of kits born, (incl. still-born)	144	112	125	73
Litter size (surviving kits)	5.2	4.0	4.8	5.2
Breeding result/ mated female	3.9	3.0	3.7	3.9

Group 4, which received 70% of protein from the acid-treated fish meal, had the same breeding result as the control group. Treatment with hydrochloric acid thus had a good effect on the biological value of the feed.

In order to examine the long term effect of such treatment, 45 standard females were examined over 2 years. In these two years, except during lactation, these animals had been fed a diet in which 50-60% of protein came from fish meal. In summer and autumn of the second year the feed contained 8.0-8.5 gm digestible protein, 4.0-4.5 gm fat and 5.0-5.5 gm carbohydrate/100 kcal.

In January to march the protein niveau was raised to 9.5-10.0 per 100 kcal.

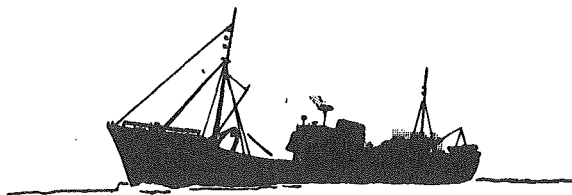
Mating was normal and breeding results showed a litter size of 5.8 and 5.15 kits per mated female.

Conclusion.

If fish meal of good quality is used, then 50-60% of digestible protein can come from fish meal without resulting in a deterioration in production.

When feeding with large quantities of fish meal it is important that the animals receive vitamin supplement, and have access to water at all times.

Original report in Kroliko Vodstvo i zverovodstvo, 1976, no.2, 23-24.  
Translated from russian to danish by Eugenie Joergensen and from danish to english by Margareth Andersen.



## GENETICALLY DETERMINED "UREMIA", DEATH IN SIX WEEKS OLD MINK.

K. Christensen, N. Glem Hansen, T. Møller & O. Venge,  
Department of Animal Genetic, Royal Veterinary and Agricultural  
College, Bülowsvej 13, DK 1870 Copenhagen V., Denmark.

During recent years a disease, whose characteristic symptoms are watery eyes which became sticky after a few days, has been observed on some mink farms in Denmark. The disease occurs in mink kits at 5-6 weeks of age and it always results in weight loss, and death within a few days. The health of the kits seems to be normal up to this stage.

Analysis showed that the content of urea in blood plasma from mink kits, which had the disease, was considerably higher (160-173 mg/100 ml) than in normal kits (63-76 mg/100 ml). Thus the disease was provisionally named "uræmia", although it is possible that the excess of urea is a secondary effect rather than the cause of the disease.

Cytological investigations showed no abnormalities in the chromosomes of the affected kits. Histological abnormalities of the kidneys were not found either.

The genealogical diagram in Fig. 1 shows that the disease is genetically determined and that the heredity follow a normal recessive heredity.

The plan shown in Fig. 2, which uses the laws of heredity, was recommended as a way out of the problem on farms which have the disease.

Fig. 1. Genealogical diagram of litters which have the disease. Squares symbolize males and circles females. Animals marked with an x's are breeding animals purchased from the same farm. Black squares and circles symbolize kits attached by the disease.

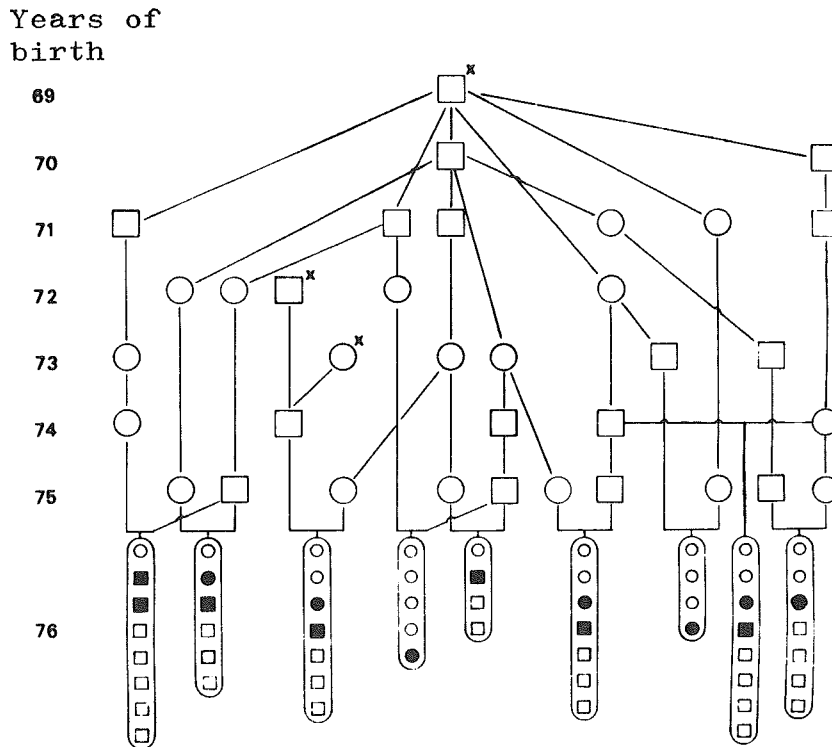


Fig. 2. Breeding methods which reduce the occurrence of the disease.

1. Breeding animals to be purchased from a farm free of the disease.

Expected result: The farm will be permanently cleared of the disease.

2. All males to be purchased from a farm free of the disease.

Expected result: The farm will be free of the disease the first year and the frequency will be



reduced to 1/4 of the original occurrence in the following years.

3. Use of breeding animals only from litters in which the disease has not been observed and where the male has not produced any sick kits by other females.

Expected results: The farm will as early as the first year, obtain a very small frequency of the disease and this frequency will be reduced even more during the years ahead.

Dansk Pelsdyravl 39, 334-336.

Dansk Veterinærtidsskrift 60, 405-408.

2 Tables, 2 Figures, 1 Picture.

Ref.: N. Glem Hansen.

#### SUSCEPTIBILITY OF FOXES TO CLOSTRIDIUM BOTULINUM TYPE C AND E TOXINS.

Magne Yndestad, Arne Helgebostad, Gudbrand Loftsgård, Dept. of Food Hygiene and the Research Station for Furbearing Animals, Veterinary Collega of Norway, Oslo.

Susceptibility of foxes to Clostridium botulinum type C and E toxins. Acta vet. scand. 1977, 18, 23-30. - Investigations were performed to determine the exact susceptibility of foxes to Clostridium botulinum type C and E toxins.

Doses of 5 mill. MLD type C toxin mixed with the feed did not cause symptoms of botulism in either cubs or adult foxes. Subcutaneous injections of 300,000 MLD or more were fatal to cubs, while 750,000 MLD caused the death of all adults.

Regarding type E toxin, doses of 1 mill. MLD affected neither cubs nor adults on oral administration. Subcutaneously injected doses of 5,000 MLD or more killed all cubs, while 10,000 MLD was required to produce lethal effect on adult animals.

The conclusion made is that foxes are highly resistant to both type C and E *Clostridium botulinum* toxins following oral application. It is further revealed that foxes are 60-70 times more susceptible to type E than to type C toxin when injected subcutaneously.

4 Tables, 19 References.

Authors abstract.

VIRULENCE OF *PSEUDOMONAS AERUGINOSA* AND SPONTANEOUS SPREAD OF *PSEUDOMONAS PNEUMONIA* IN A MINK RANCH.

Takeshi Shimizu, J. Yuzuru Homma, Tomozo Aoyama, Takashi Onodera, Hiroshi Noda, National Institute of Animal Health, Kodaira Tokyo 187, Institute of Medical Science, University of Tokyo, Shirokanedai, Tokyo 108, and Laboratory of Animal Breeding, Sapporo 060, Japan.

Comparative studies on the virulence of two strains of *Pseudomonas aeruginosa* isolated from otic pus and mink pneumonic lesion, respectively, were made by means of intranasal inoculation in mink. The minimal lethal dose of the former (strain NC-5, highly virulent for mice) was  $10^{10}$ , and that of the latter (strain No. 5, moderately virulent for mice) was  $5.5 \times 10^6$ . By planting droplets of *P. aeruginosa* suspension on the mink in the wire cages, and enzootic lethal pneumonia was brought about in a ranch. This disease spread to the neighboring 12 mink in turn, in one direction, with new cases occurring every day or every other day for 13 days.

Infection and Immunity, July 1974, p. 16-20.

2 Tables, 6 Figures, 11 References.

Authors summary.

EFFECT OF COMMON PROTECTIVE ANTIGEN VACCINATION TO PROTECT MINK  
FROM CHALLENGE EXPOSURE WITH PSEUDOMONAS AERUGINOSA.

T. Shimizu, J.Y. Homma, C. Abe, T. Tanamoto, Y. Aoyama, K. Okada,  
R. Yanagawa, Y. Fujimoto, H. Noda, I. Takashima, E. Honda,  
S. Minamide, National Institute of Animal Health, Kodaira, Tokyo 187,  
Japan.

The protein portion of endotoxin (OEP), or common antigen of  
*Pseudomonas aeruginosa* prepared from strain N10 of *P. aeruginosa*,  
was examined as a possible vaccine against this organism in mink.

Mink were given OEP vaccine and challenge exposed by instillation  
with the inoculum into the nostril. They survived after this  
exposure with 4 median lethal ( $LD_{50}$ ) doses of strain NC-5 (protease  
negative, elastase negative) or with 160  $LD_{50}$  doses of strain 5  
(protease positive, elastase positive). Strain NC-5 belonged to  
type 5 and strain 5 belonged to type 8 (according to the sero-  
typing method of Homma). Strain N10, the source of OEP, belonged  
to serotype 5. Thus, the mink vaccinated with OEP vaccine were  
able to stand challenge exposure to both homologous and heterologous  
serotype strains.

More mink given OEP vaccine survived the challenge exposure by  
intranasal spraying with virulent strain 5 than did those in the  
nonvaccinated control group, with a significant difference. When  
the surviving mink of the vaccinated group were rechallenged exposed  
with 300 or 3,000  $LD_{50}$  doses of the same strain a month later, most  
of them survived.

Am. J. Vet. Res., Vol. 37, no.12, December 1976.

3 Tables, 4 Pictures, 17 References.

Authors abstract.

## MERCURY POISONING IN A WILD MINK

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M. Swift, Department of Biology, University of Saskatchewan,  
Saskatoon, Saskatchewan S7N 0W0, Canada.

Mercury poisoning was diagnosed in a clinically-ill wild mink (*Mustela vison*) on the basis of clinical signs, histopathologic lesions and tissue mercury concentrations. The probable source of mercury was through ingestion of fish from the nearby South Saskatchewan River which is known to be contaminated with mercury. This is believed to be the first documented case of mercury intoxication of a wild animal in North America.

TABLE 1. Total mercury concentration (ppm) in tissues of a wild mink, and mean concentrations reported in cases of alkyl mercury poisoning in carnivorous animals.

Species	Type of Poisoning	Hg (ppm)					Authority
		Liver	Kidney	Muscle	Brain	Fur	
Mink	Natural	58.2	31.9	15.2	13.4	34.9	present case
	Experimental*	24.3 ± 6.0	23.1 ± 4.1	16.0 ± 7.1	11.9 ± 3.9	1.5 ± 0.4	20
Ferret	Experimental*	53.8 ± 10.6	69.0 ± 10.8	34.3 ± 12.4	26.8 ± 14.3	—————	11
Cat	Natural*	62.2 ± 21.6	19.8 ± 9.2	—————	9.2 ± 1.6	45.9 ± 8.6	14
	Experimental*	74.3 ± 32.0	20.1 ± 10.8	—————	12.8 ± 5.1	45.8 ± 34.3	14
	Experimental	39	31	27	18.0	—————**	1
	Experimental	74.5 ± 7.3	37.1 ± 4.1	22.0 ± 3.5	18.5 ± 0.8	—————	7
	Experimental	72.7 ± 12.0	27.0 ± 7.5	24.9 ± 6.1	17.4 ± 1.4	—————	7

\* mean and standard deviation calculated from published values

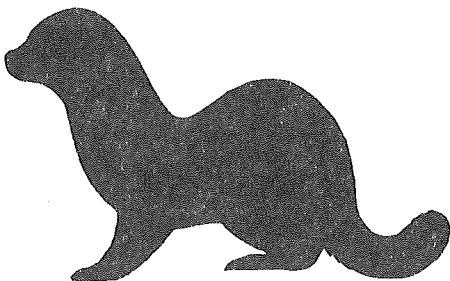
\*\* fur contained more than half of total body burden

*Journal of Wildlife Diseases* Vol. 12, July, 1976

*Journ. of Wildlife Diseases*, Vol. 12. July 1976.

1 Table, 4 Figs., 20 References.

Authors abstract.



DISTRIBUTION OF AFLATOXIN B<sub>1</sub> IN TISSUES OF MINK (*MUSTELA VISON*).

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

Seven female mink (*Mustela vison*) were injected intraperitoneally with a single dose of 100 µg aflatoxin B<sub>1</sub> (<sup>14</sup>C-labeled and unlabeled). They were sacrificed 1, 2, 4, and 24 h after dosing. Liver, intestines, stomach, lung, kidney, brain, pancreas, spleen, urinary bladder, uterus, and bile were removed and examined for the retained radioactivity. 1 h after dosing, intestines and their contents retained the largest amount of <sup>14</sup>C-radioactivity (18.9% of the amount that was administered) which was followed by liver (13.2%) and bile (10.8%). At this time all other tissues retained less than 1% of the administered radioactivity. Generally, the amount of radioactivity retained in all tissues declined with time. Only 1.2 and 0.6% of the administered radioactivity was found in intestines and bile, respectively, 24 h after dosing; however, the liver still contained 6.6% of the initial radioactivity. Examination of sub-cellular fractions of liver revealed that at all time intervals most of the radioactivity was associated with the microsomal supernatant fluid.

1 Table, 1 Figure, 15 References.

Published in: Toxicology, Volume 5, pages 351-358 (1976).

Authors abstract.

INCORPORATION OF [2-<sup>14</sup>C]ACETATE INTO LIPIDS OF MINK (*MUSTELA VISON*) LIVER AND INTESTINE DURING IN VITRO AND IN VIVO TREATMENT WITH AFLATOXIN B<sub>1</sub>.

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

The in vitro and in vivo incorporation of [2-<sup>14</sup>C]acetate into lipids of mink (*Mustela vison*) liver and intestines was studied. In vitro, a dose of aflatoxin B<sub>1</sub> as small as 7.5 µg/ml of medium reduced by 20% the amount of [2-<sup>14</sup>C]acetate incorporated into lipids of mink liver slices, whereas 180 µg caused 76% reduction in the synthesis of lipids from the radioactive precursor. Similar inhibition of lipid synthesis by aflatoxin also was observed with tissues from mink intestines and fatty liver. The degree of inhibition (19 to 84% for

tissue from intestines and 19 to 64% for tissue from fatty livers) depended on the amount of aflatoxin B<sub>1</sub> (7.5 to 180 µg) present in the medium. In vivo, a substantially increased amount of <sup>14</sup>C-labeled lipids was found in the livers of mink injected with 600 µg of aflatoxin B<sub>1</sub> per kg of body weight 20, 28, and 40 h earlier. However, no appreciable difference in incorporation of [2-<sup>14</sup>C] acetate into lipids was observed between toxin-treated and control animals when these animals were sacrificed and examined for <sup>14</sup>C-labeled lipids at 4 and 10 h after toxin was administered.

5 Tables, 14 References.

Published in: Applied Microbiology, Volume 30, pages 946-950 (1975).

Authors abstract.

#### EXPERIMENTAL ACUTE AFLATOXICOSIS IN MINK (*MUSTELA VISON*).

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

R. M. Shackelford, Department of Meat and Animal Science, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

Susceptibility of mink to intoxication by aflatoxins was studied by giving mink single doses (300, 600, and 900 µg of aflatoxins B<sub>1</sub> and G<sub>1</sub> (40:60)/kg of body weight) and observing them for 8 weeks. One, 2, and 4 of 5 mink in each group died within 4 days after ingesting the small, medium, and large doses, respectively. Enlarged liver with pale yellow to yellowish pink spots was the most consistent lesion observed in mink that died of acute aflatoxicosis. Some lobules of liver also appeared hemorrhagic and fragile, whereas others showed fatty metamorphosis. Histopathologic examination of the liver showed different degrees of fat infiltration, bile duct proliferation, and necrosis of liver cells. Hematologically, mink that survived were not appreciably different from control mink in terms of hemoglobin content, packed cell volume, and white blood cell count. Liver specimen from aflatoxin-treated mink contained more fat, was larger, and contained less protein, RNA, and DNA than did liver from control mink. Aflatoxin residue (only B<sub>1</sub>)

was recovered from liver of 6 mink and were between 0.1 and 7.6  $\mu\text{g}$  of the original dose.

7 Tables, 3 Figures, 27 References.

Published in: American Journal of Veterinary Research,  
Volume 37, pages 1227-1231 (1976).

Authors abstract.

MORTALITY AND SOME BIOCHEMICAL CHANGES IN MINK (*MUSTELA VISON*) GIVEN SUBLETHAL DOSES OF AFLATOXIN EACH DAY.

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

R. M. Shackelford, Department of Meat and Animal Science, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

Two feeding trials were done to study the susceptibility of mink (*Mustela vison*) to multiple sublethal doses of aflatoxins. In the 1st trial, twenty 3-month-old male mink were divided equally among groups. Each mink in groups 1, 2, 3, and 4 was given a meatball daily that contained 15, 30, 45, or 0  $\mu\text{g}$  of aflatoxins ( $B_1:G_1$ , 40:60), respectively. All mink in group 3 died between the 25th and the 30th days of the feeding trial. Each mink had ingested 1,035 to 1,480  $\mu\text{g}$  of aflatoxins. Four of the mink in group 2 died almost as soon as did mink in group 3. Four mink in group 1 died between 40 and 59 days after the start of the feeding trial. Generally, a marked increase in plasma cholesterol and alkaline phosphatase activity appeared before mink died. The liver from animals that died of aflatoxicosis showed prominent pathologic changes which included hemorrhages and appearance of pink-yellow spots. Histopathologic examination of liver from dead mink revealed fatty infiltration, bile duct proliferation, bile stasis, pseudotubular formation, congestion, and fibrosis. The feeding trial was repeated with 20 mink (8 males and 12 females) that were 1.5 to 2 years old. In this instance, 0, 20, 40, and 60  $\mu\text{g}$  of aflatoxins were administered each day. All treated animals, except 1, were dead within 37 days after the experiment started. The survivor was given the lowest dosage of toxins and died after 52 days by which time 960  $\mu\text{g}$  of aflatoxins were consumed.

Plasma cholesterol content and alkaline phosphatase activity generally were similar to those observed in younger mink of the 1st feeding trial.

5 Tables, 15 References.

Published in: American Journal of Veterinary Research,  
Volume 37, pages 1233-1236 (1976).

Authors abstract.

#### GROWTH OF MINK (*MUSTELA VISON*) KITS WHEN NURSING DAMS GIVEN AFLATOXIN B<sub>1</sub>.

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

R. M. Shackelford, Department of Meat and Animal Science, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

During lactation, 5 female mink (*Mustela vison*) were given 50 µg of aflatoxin B<sub>1</sub> orally twice, 2 weeks apart. Another group of 5 lactating mink were used as controls. Milk was collected 24 hours after each treatment with toxin. Aflatoxin B<sub>1</sub> and M<sub>1</sub> could not be detected in the milk. There was no appreciable difference in body weight among kits that nursed treated mink and those that nursed untreated mink.

1 Table, 12 References.

Published in: American Journal of Veterinary Research,  
Volume 37, pages 1353-1354 (1976).

Authors abstract.

#### RADIOACTIVITY IN URINE AND FECES OF MINK (*MUSTELA VISON*) TREATED WITH [<sup>14</sup>C]AFLATOXIN B<sub>1</sub>.

C. C. Chou and E. H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

Excretion of radioactivity by mink (*Mustela vison*) during 7 days after intraperitoneal injection of two different amounts of aflatoxin B<sub>1</sub> was studied. Male mink that received a single dose of 25 µg aflatoxin B<sub>1</sub>/kg body weight excreted an average of 89.5% of administered radioactivity (56.8% via feces,



32.7% via urine); whereas female mink excreted an average of 85% (63.6% via feces, 21.4% via urine) of administered radioactivity during the 7-day period. Male and female mink given 150  $\mu\text{g}$  aflatoxin B<sub>1</sub>/kg body weight excreted an average of 76.9-80.1% of administered radioactivity during the 7 days that followed treatment with toxin. These mink excreted somewhat more of the administered radioactivity in their urine than did the mink that received the lower dose of aflatoxin (37.2 vs. 32.7% for males and 32.7 vs. 21.4% for females). Regardless of sex and dosage of toxin, most of the radioactivity ultimately excreted either through feces or urine appeared in the first 24 h after toxin was administered to mink.

2 Tables, 17 References.

Published in: Archives of Toxicology, Volume 35, pages 75-81 (1976).

Authors abstract.

#### IMPACT ENERGY THRESHOLDS FOR ANESTHETIZED RACCOONS, MINK, MUSKRATS, AND BEAVERS.

Frederick F. Gilbert, Department of Zoology, University of Guelph, Guelph, Ontario N1G 2W1.

Impact energy values required to cause death of anesthetized furbearers by blows delivered to the neck or chest region were determined as an aid to the development of "humane" traps. Threshold values for neck blows were 575 cm kg for raccoons (*Procyon lotor*), 430 cm kg for mink (*Mustela vison*), 58-63 cm kg for muskrats (*Ondatra zibethicus*), and 805 cm kg for beavers (*Castor canadensis*). The threshold values for chest blows were 1,150, 520, 155, and 780 cm kg for raccoons, mink, muskrats, and beavers, respectively. Autopsy indicated severe internal damage occurred in all species well below threshold levels. EEG's and ECG's were taken. ECG's were not good indicators of terminal damage for beavers and muskrats, because the heart continued to beat beyond 10 minutes for most animals that could be considered clinically dead. Pelt damage occurred in muskrats at energy

levels only 30 percent above threshold.

J. Wildl. Manage, 40, (4): 669-676.

5 Tables, 3 Figures, 3 References.

Authors abstract.

Original paper.

THE "WET BELLY" DISEASE IN MINK (MUSTELA VISON).

Dr. med. Vet. Nicolac Pastirnac, J.A.S. Prejueer 2241, Med. Brosoy,  
R.S. Romania.

An important problem for the mink breeders is the prevention of the dermopathy called "wet belly", which is manifesting as an urinary incontinence. The disease determines great economical losses, as a consequence of the fall of the furs value with 10% to 30%.

The males are especially exposed to this disease, due to their anatomical peculiarities; the frequency of the affected males may rise to 30-40%, while the females are affected only above 1% (3;5).

The first symptoms of the diseases appear during the weaning of the kits, disappear after the separation of the kits in individual cages, and reappear at the time of the maturation of the fur. Sporadically the disease may affect the adult males after the period of the mating and the females during the pregnancy or the lactation.

The individuals which fall ill have frequent micturations; they eliminate small quantities of urine as drops reaching the belly and wetting the fur. Due to the irritation, the skin get a reddish nuance and suddenly become oedematiate. After a short time, small pustullae appear which burst and get the aspect of small ulcerous

points. At the level of affected zones, the hair suffer a de-colouration and thereafter great spots of depillation appear as a consequence of the fall or the rupture of the hair. The skin becomes rough and necrotic points diffuse through the surface of the belly from the prepuce.

Frequently, an inflamatory process occurs at the level of the prepucial epithelium, producing an obturation of the orifice and an urinary retention in the prepucial burse thereby.

In the areas in which the underfur is not lap over by the guard hair because of his fall, besides the necrotic points, the epidermis has a gross pellicle of fat, due to the secretion of sebaceous glands. The product of these glands cover the orifices of the bulbs, and it is assumed that this hypersecretion protects the organism against the penetration of the urine through the skin.

In the areas where the skin is wetted by the urine, the pH varies between 5,30-5,90, the same values of the normal skin of the mink (13). Therefore the fall of the hair is not determined by the change of pH. The analysis of the urine of the ill individuals shows a very low superficial tension, due to the presence of fatty acids, and these facilitate the wetting and the infiltration of the pelt by the urine.

The anatomo-pathological examination shows a good, or even very good condition of the dead-body. The underpart of the skin is white-cream-coloured, and the fur, in the affected areas, has a blue-dark colour, due to the high level of melanine. In the organs the changes are insignificant and they appear as circulatory disturbances. Quite seldom, degenerative microfocuses may appear at the level of the liver spleen or lungs. Sometimes the kidneys are enlarged and with small ekymosis which are yellow-grey coloured. The kidney-loge is also enlarged and the content is dirty-grey or even sanquineosus.

Many histological researches are made on individuals affected

by the wet belly disease, but no specific disturbances are observed, to be able to establish the action of a specific factor.

Generally, the epizootological, clinical and anatomo-pathological studies of the disease, as well as the experimental data do not succeed in giving a satisfactory explanation concerning the etiology of this disease.

Some of the factors incriminated in the etiology of the wet belly disease are the hyperexcitability of the mink, the stress the individuals have to undergo during the manipulations in the farms (11) the urolithiasis (14) the acidosis and the anaemia (6), pathogenous agents such as *Proteus mirabilis* from the avian by-products (5;9), the excess of male hormones (8), the excess of fats in feeding (2;8b), the sudden lowering of the temperature (5), the delay of the maturation of the fur in the affected area (1), the variation of the level of free calcium in the feedstuffs (12). This last hypothesis assumes the calcium has an important role in neutralization of the fatty acids in excess, so, the excess of calcium as well as the excess of fatty acids are eliminated as insoluble compounds.

On the other hand, some authors (1b) suppose, the change of the normal Ca/P ratio (1,2/1) due to the excess of calcium (for instance to 2/1) determines the disease as a consequence of acido-basic disequilibrium in the circulatory system.

Several authors (7;10) suppose the hereditary factors control and determine the appearance of this disease.

In this way, in 1968 several observations are made concerning the causes of the disease. An initial opinion was that the nutritional and pathogenic factors are decisive in the etiology of the wet belly disease, because the observations made on two groups of individuals affected by this disease lead to this conclusion. Therefore, 39 females and 15 males which had the symptoms of wet belly disease were mated, and 94 kits obtained were fed with

different rations, containing a moderate level of fats and minerals. From all these descendants only 19 had the same symptoms of the disease as their parents.

In order to verify these results, the next year the experience was repeated with another group of 41 females and 17 males, all of them affected by wet belly disease. The ill descendants obtained from them were fed with the same nutritional regime, to which antibiotics and vitamins (A, D<sub>3</sub>, E) were added. Only 13 individuals fell ill.

At first sight, it seemed the nutritional and pathologic factors are decisive in the etiology of the wet belly disease.

An accurate analysis revealed that all the affected individuals in both groups were descendants of parents belonging to a special line, whose characteristic was a large body size and a high incidence of the wet belly disease.

The third year, observations were made on this special line (let us call them line A) in comparison with another line (B) whose characteristics were a small body size and a much more dark colour. Both lines were fed usually, with the same rations, such as the whole livestock of our ranch. At the slaughter time, in winter, 46% of the individuals in line A had clear-cut symptoms of wet belly disease, while in the line B only 2% of individuals were affected. In the next year, the level of fats and minerals in the rations was reduced and, as a consequence, the frequency of the disease was very low.

Between the two lines, crosses were made, and, among the cross-products, the frequency of the affected individuals was varying from 17% to 21% from one year to another. These results reveal an intermediary frequency of the two crossed lines, in fact a little lower as the intermediary value expected (24%) and it may be explained by the improvement of the quality of the feed.

The ability to assimilate the feed, in this case some essential

nutrients, varies from an individual to another. This ability depend upon species, breed, line or family. By mink, such face of colour as the Jet black, Standard, Silverblue and Royal pastel seem to be more sensible to the wet belly disease.

According to our observations, there are groups of families or lines characterized by some peculiarities which determine a more strong reaction to the high level of metabolizable energy in the rations (large amounts of fats and low content of carbohydrates) and to a high content of minerals (excess of calcium to the detriment of phosphorus) than others groups, from others fases of colour.

Reconsidering our first opinion, we reached a new conclusion concerning the etiology of this disease. The wet belly is a very complex disease, in which the genetical factors have a determinant role, and the nutritional, patogenic and, generally, the environmental factors, accomplish the role of a favouring ones.

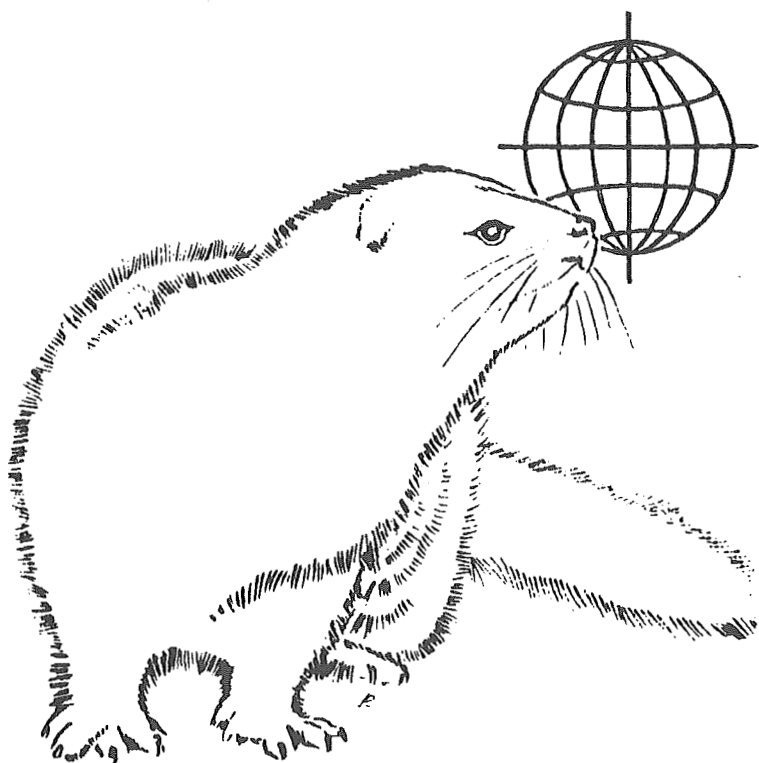
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# SCIENTIFUR

SCIENTIFIC NEWSLETTERS IN FUR ANIMAL PRODUCTION



The name in scientific  
fur animal communication.

Book review.

MINK DISEASES. Publication 1567, 1976, from Animal Pathology Division, Health of Animals Branch, Canada Department of Agriculture, Ottawa 1976.

In the preface the author remarks: "This publication has been prepared as a reference for mink ranchers, veterinarians and other concerned with the mink industry" and further "The booklet should not be considered a replacement for advice of a veterinarian".

For this purpose the booklet with this kind of information is very important for the veterinarian in practice. On 37 pages of text with 8 colorfotos the common diseases and general problems at a mink ranch are very well described. The subject index is clear and case histories give sufficient information to be a help in the daily work of diagnosing the mink ranchers' problems. It would be desirable with more information in the section "diseases related to nutrition" because the greatest loss of mink is often caused by nutritional defects or mistakes, especially caused by alternative raw products. Further the booklet is of great value for the mink rancher for education or private study, but it is too late to use the publication when the situation is acute. One recalls the scene from Jerome K. Jerome's, Three Men in a Boat, where the principal character is sick. He discovers, by using a home medical adviser, that he has all kind of diseases, except foot and mouth disease.

We must remember that the ranchers generally can register only the signs or symptoms and therefore are obliged to call a veterinarian, but it would be an advantage if such a booklet contained a summary of symptoms with reference to the possibility of different diseases.

The past years show that mink ranches have become bigger, the



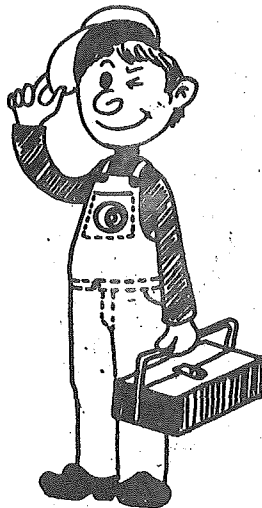
farmers are more competent and therefore they demand information like this, which I can recommend as a really instructive guide.

Copies of this publication may be obtained from  
INFORMATION DIVISION  
CANADA DEPARTMENT OF AGRICULTURE  
OTTAWA  
K1A 0C7

Mogens Hansen  
veterinarian  
Danish Fur Breeders Association.

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The veterinarian .



## NORDISKE JORDBRUGSFORSKERES FORENING

SCANDINAVIAN ASSOCIATION OF AGRICULTURAL SCIENTISTS - FUR ANIMAL  
DIVISION.

Preliminary program for meeting concerning fur animal production  
in Norway (Hurdalsjøen) the 27th and 28th of September 1977.

1. R. Sandø Lund: Experience from 4 years of using fish silage in Denmark.
2. J. Kangas: Finnish investigations with acid preserved fish silage.
3. Eva Aldén: Fresh water fish and Danish cooked fish silage in mink feed containing fish meal and soya meal respectively.
4. G. Jørgensen: Relationship between quantity of marine fat and vitamin E requirement.
5. N. Enggaard Hansen: Mineral balance and digestibility with regard to feeding with fish preserved with sulphuric acid.
6. J.S. Dirck Poulsen: Clinical chemical and pathological changes in mink fed with acid preserved fat fish species.
7. G. Jørgensen: Concluding remarks and review of current research an investigations into silage in Denmark.
8. N. Koppang: DMNA poisoning.
9. I. Ørberg: PCB and DDT poisoning.

10. K. Frøysedal: Single-cell protein and plasmacytosis.
11. M. Hansen: Plasmacytosis testing and production results.
- 12 a. A. Olavsson ) Heredity of some fur characteristics of mink.
- 12 b. J. Reiten )
- 13 a. B. Fjerdingby )
- 13 b. S.-O. Rosberg ) Economic importance of various
- 13 c. O. Lohi ) pelt characteristics of mink.
- 13 d. E. Hedegaard )
14. O. Venge: Uræmia in mink.
15. O. Møller: Can hormone treatment simplify mating procedure  
in mink.
16. R. Sandø Lund: Can feed influence pelt characteristics in  
mink.
17. E. Groot Rasmussen: The influence of pelt treatment on fur  
characteristics. (With reference to the economic importance).
18. H. Rimeslåtten: Utilization effect of the metabolizable energy  
from protein, fat and carbohydrates to arctic fox.
19. A. Skrede: Fat and carbohydrates as energy sources to mink.
20. A. Skrede: Experience from light regulation studies with mink.
21. G. Hillemann: Some considerations regarding the use of soya  
products to mink.
22. N. Glem Hansen: Lactation investigation. Methods and review of  
results.
23. T. Kiiskinen: Experiment with different fish species.

Detail program and enrolment forms can be obtained from:

Hans Rimeslåtten  
 Norges Landbrukshøgskole  
 Institut for Fjørfe og Pelsdyr  
 Boks 17, 1432 Ås-NLH, Norge  
 Telf.: Ås (02-940060).

