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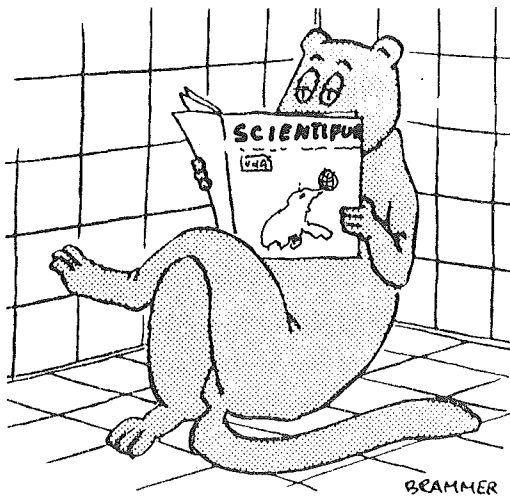
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"I've been trying to trace my roots, but after a couple of generations, they go off into a different species."



The scientific information regarding fur animal production has multiplied during the years. - Do you receive this information ? Do you receive SCIENTIFUR regularly?

#### NOTES

SCIENTIFUR, VOL. 9, NO. 3, 1985.

We hope you enjoy SCIENTIFUR and it is of help for you in your profession. We do hope that, because the production of SCIENTIFUR takes more and more time - of course mainly during the nights and the week ends. If you were sitting at your garden terrace a nice evening after a splendid dinner prepared by your understanding wife, like I do today the 13th of August 1985, putting your last hand on the editorial work of SCIENTIFUR Vol. 9, No. 3, I am sure that you during the work would hope that everybody else but yourself will be enjoyed by the work. I am very sure that Synnøve - my wife - who just now is cutting the lawn - would appreciate that I had made the grass cutting. But, of course, my wife asked me - very sweaty - to give you her regards too.

It is very difficult such a wonderful sunny evening to discuss the negative matters. Therefore, why not start with the positive. In this issue of SCIENTIFUR we bring 5 original reports. If our friend and printer, Mr. Jack Petersen from the Royal Danish Agricultural Society has not been so busy because of holiday we would have been able to bring 7 original reports. But anyway, we appreciate the number of reports received and shall bring the remaining part in the November issue.

Yes, I wrote the November issue, and are still hoping that it will be the truth. But at the same time we must realize that the expected months are to short time for puzzling SCIENTIFUR together and get it printed. Hopefully, you will think as many others: "Better to wait and get the best." Or, as my father - who came from the very west coast of Denmark would have said: "I has to wait, because it is the only thing to do."

As I use to tell to Ellen - the grey lady behind SCIENTIFUR - every-time she is frustrated over the delay: "Don't worry, Ellen, I am sure that SCIENTIFUR will be welcomed when it arrive."

Sorry, that we not until this issue are able to present the program for the annual Scandinavian scientific meeting which is going on in Ålborg, Denmark, the 3.-5. September this year. Under communication you will see my translation of the program, and if you find anything of interest, I am sure that you will be welcome to contact the authors. You will sure find the authors addresses in this or former issues of SCIENTIFUR.

On the other hand it is facinating to realize that a - ok primitive journal - which at the start was intended to be at least a good message medium between the Scandinavian countries, bringing little news from the outside, has been just the opposite. Thank you, everybody, for your help in doing SCIENTIFUR to what it should be - a international highway for scientific communication regarding all aspects in fur animal production.

As you will see under communication, the day for MINK PRODUCTION in English translation will be the 15th of November. We thanks for all orders received until now, but still hope for a lot more, because we need more than 1,000 orders for reaching the economical zero point of this production. But we are optimistic. We know that we have many friends around the world, and we hope that a lot of associations will help their members to the book, when they have seen it. You has still to remember that the price is 60.- US Dollars per copy, and only 45.- US Dollars per copy if you order more than 10 copies. The price policy is based on the cooperative idea: Do it together - it's cheaper and more effective.

Thank you for your attention.

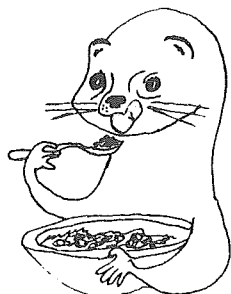
Best regards



Gunnar Jørgensen

Your editor

**Good Appetite!**



# Behavioural and eosinophil leukocyte responses to single and repeated immobility stress in mink

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## Summary

Male mink showed marked decreases in circulating eosinophil levels in response to a single 1 h session of immobility stress. Repeated stress sessions had the opposite effect on circulation eosinophils. Motor activity (ambulation) increased after a single stress session, but decreased after repeated stress; and the propensity to respond to a novel stimulus decreased after stress repetition. It is suggested that reliable behavioural measures could be developed for assessing stress in mink under conventional production conditions.

## Introduction

During the last decade, much has been learned about the physiological and behavioural responses to stress in common laboratory rodents. It has been shown that stress-induced changes in physiology and behaviour are almost independent of the type of stress experienced, but very much affected by temporal characteristics of the stress (Heller, 1985).

Short-term stress is followed by increases in pituitary-adrenocortical secretion and by concomitant increases in motor activity and general behavioural responsiveness to novel stimuli. Long-term stress leads to further increases in adrenocortical secretion and motor activity, whereas the general propensity to respond to novel stimuli is markedly reduced (Heller, 1985).

The increases in motor activity and general responsiveness after short-term stress appear mediated by stress-induced increases in corticosteroid secretion; and corticosteroids seem also important to the additional increases in motor activity after long-term stress (Heller, 1985).

The nature of the relationships between hormonal and behavioural responses to stress has been extensively studied in rodents, and a rather detailed picture is emerging which includes the involvement of several central nervous transmitter systems as »targets« for the hormones action on behaviour (Brain, 1980; Daruna, 1978; Heller, 1985; Leshner, 1980).

A similar detailed picture of the physiological and behavioural stress responses does not exist for fur animals, despite that stress is generally believed to be of

particular relevance in modern fur animal production. Housing conditions, veterinary prophylaxis, transfers, weaning, and other procedures related to modern fur animal production are suspected of being stressful and presumed to contribute to such problems as reduced lactation, lowered disease resistance, retarded growth, and deteriorated fur quality (Kozhevnikova *et al.*, 1984).

The present study was designed to investigate physiological and behavioural responses to short-term and long-term stress in mink under conventional production conditions. It was of particular interest to test whether stress affects mink behaviour in the same general manner as known from laboratory rodents. If so, behavioural measures alone could be used in the development of methods for easily assessing levels of stress in mink under normal farm conditions. Based on the knowledge of the effects of stress on behaviour in rodents, motor activity and responsiveness in a novel stimulus situation were chosen as the behavioural parameters in the present study. Circulation eosinophil leukocyte levels were used as an estimation of changes in adrenocortical secretion activity in response to short-term stress (Zarrow *et al.*, 1964).

## Materials and methods

### Animals and design

The animals of this study were 48 male and 24 female mink born in May 1984 and raised mostly in pairs under conventional farm conditions at Natl. Inst. of Animal Science, Dept. of Fur Bearing Animals, DK3400 Hillerød, Denmark.

At the age of 5 months, all animals were separated and housed singly in standard wire cages (30 × 45 × 90 cm) for a minimum of one week prior to experiments.

The 48 males were randomly assigned to three experimental groups (n = 12), and one control group (n = 12). Males in the experimental groups were individually subjected to sessions of immobility stress in mink traps (I), bloodsampling (B), and behavioural tests (A and R) according to the time schedule shown in Table 1. One h immobilizations were performed 10.00-

Table 1. Time schedule of experiment.

	Group 1	Group 2	Group 3	Group 4
Day 1	A	A	A	A
Day 4	A	A	A	A
Day 5	B-I-A B-I-A	A B-I-A	A B-I-A	A A
Day 6	I-A I	A	I-A I	A
Day 7	I-A I	A	I-A I	A
Day 8	B-I I	I B	I I	
Day 9	I I		I I	
Day 10	I I		I I	
Day 11	I-A I	A	I-A I	A
Day 12	I I		I I	
Day 13	I I-R	R	I I	
Day 14	B		I-R B	R
Day 15	A R	A I-R*	A R	A R
Day 16	B	B	B	B
Day 17	A	A	A	A

B: Bloodsampling; I: Immobility session; A: Activity test; and R: Reactivity test.

\* Immobility session 16.00-17.00

11.00, 13.00-14.00 or 16.00-17.00. Bloodsampling was carried out 10.00 or 13.00, and behavioural tests were conducted 12.00-13.00 or 15.00-16.00. Males in the control group were subjected to the same behavioural tests as males in the experimental groups, and to a single bloodsampling as illustrated in Table 1.

The 24 females were subjected to a single bloodsampling on day 18 in order to assess sexual differences in basic eosinophil leukocyte levels.

#### Behavioural tests

One h scanning observations for general activity determination were performed throughout the experiment (A in Table 1). Each animal was observed 30 times with 2 min. intervals, during the 1 h observation period, and activity versus non-activity was recorded.

Responsiveness to a novel stimulus was tested 2 h and 2 days after the last immobility session in Group 1 and 3 with the remaining groups serving as controls (R in Table 1). A wooden stick was placed in the center of the cage, and each animal was observed 6 times, with 10 sec. intervals, during a 1 min. period. Biting versus non-biting was recorded.

#### Eosinophil leukocyte measurements

Fifty  $\mu$ l bloodsamples were collected and individual eosinophil leukocyte levels were determined according to the method described by Zarroue *et al.* (1964).

#### Results

The effects of immobility stress on mean eosinophil leukocyte levels are shown in Table 2.

Wilcoxon tests, two-tailed, (Siegel, 1956) applied on the male data revealed that (1) a single stress session decreased circulating eosinophil levels when measured 3 h after termination of the stress, whereas increases occurred when measured 21 h after onset of the stress; (2) six repeated stress sessions were followed by increased eosinophil levels 21 h after the last session; and (3) eighteen repeated stress sessions lead to eosinophil increases 3 h, 21 h, 2 days, and 3 days after the last session, although the levels appeared to return to normal values with time after stress termination.

Mann-Whitney U-tests (Siegel, 1956) applied on the male and female data revealed no sexual differences in circulating eosinophil levels under control conditions.

Due to marked general variations in activity levels with time of day and from day to day depending on extraneous disturbances, ratios of activity scores between experimental and control groups were calculated. In this manner ratios greater than 1 expressed relatively higher activity scores in experimental animals compared to controls. Fig. 1 shows the ratios calculated on basis of activity scores obtained 2 h after 1, 2, 3, 4-5 or 12-13 immobility sessions in the three experimental groups.

Table 2. Effects of repeated immobility stress on mean leukocyte levels ( $no/mm^3$ ).

Number of immobility sessions	0							
	1		6		18			
Intervals following last session	3 h	21 h	21 h	3 h	21 h	2 days	3 days	
Group 1 (n = 12)	173.9	73.9**		353.2**		309.3**		212.5*
Group 2 (n = 12)	174.0	62.5**	309.3**					
Group 3 (n = 12)	166.6			272.9**		262.5**		
Group 4 (n = 12)	173.9							

\*\* P < 0.001, \* P < 0.02, Wilcoxon tests, two-tailed.

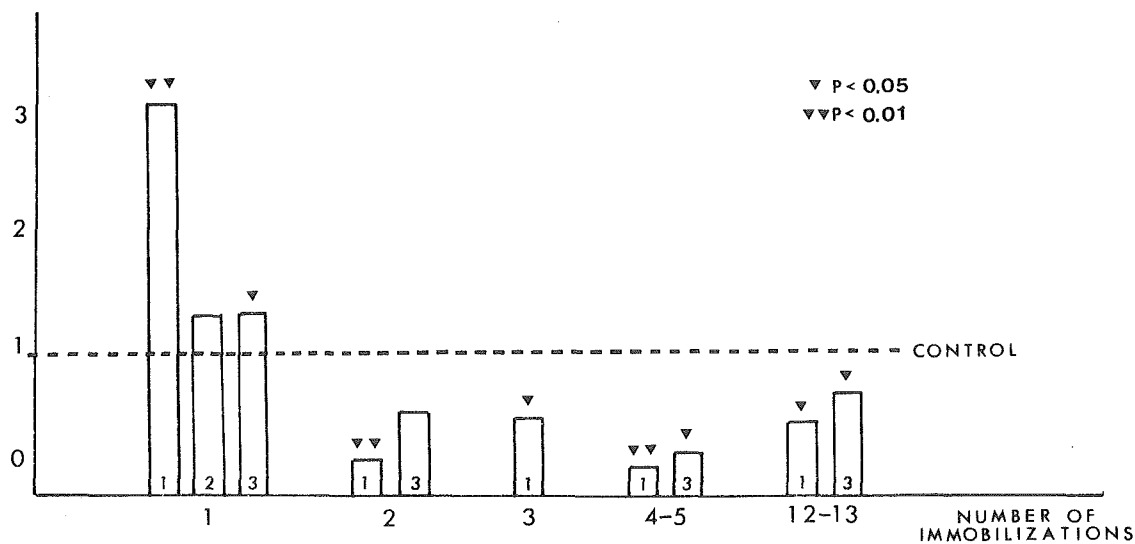


Fig. 1. Ratios of activity scores between experimental males in the groups 1-3 and control males.

Mann-Whitney U-tests (Siegel, 1956) applied on individual activity scores revealed that the activity level increased 2 h after the first immobility stress session, but decreased 2 h after the following stress sessions. Initially, and 2-4 days after the last stress session, there were no significant differences in activity levels between experimental and control animals.

Biting responses to a novel stimulus were examined 2 h and 2 days after the last stress session (Fig. 2). At the 2 h interval, the biting response of the immobilized groups was lower than controls, fewer immobilized animals bit at the beginning of the test, the mean latency to bite was longer in these animals, and the mean duration of biting tended to be shorter ( $p < 0.08$  Mann-Whitney U-test, Siegel, 1956). At the 2 days interval, there were no differences in the biting response between experimental and control animals.

### Discussion

The study reported here shows that immobility stress leads to marked changes in circulating eosinophil levels and behaviour in male mink under conventional production conditions. A single stress session is followed by acute decreases in circulating eosinophils, whereas repeated stress has the opposite effect. Motor activity increases after a single stress session, but decreases after repeated stress; and the propensity to respond to a novel stimulus decreases after stress repetition. The repeated stress affects on eosinophils are still apparent 3 days after stress termination, whereas the changes in behaviour disappear within 2 days after the end of treatment.

The eosinophil response to short-term stress revealed in mink in the present study is identical to that previously found in laboratory rodents (Zarrow *et al.*, 1964). The drop in circulating eosinophils after short-term stress in these animals is due to cell migration from blood into tissues, and this migration is mediated by stress-induced corticosteroid secretion. It is most

likely, therefore, that mink experience increased corticosteroid secretion after short-term stress. The marked increases in eosinophil levels observed after repeated stress could be explained by stress-induced stimulation of eosinophil production in the bone marrow as an adjustment to prolonged requirement of eosinophils in the tissues. Apparently, corticosteroids are not the mediating factors involved in this reaction, in that decreases in eosinophil levels are well documented effects of repeated corticosteroid treatment in mammals (Denison and Zarrow, 1954).

Although the physiological responses to stress in mink appear similar to those in laboratory rodents, there seems to be qualitative cross-specific differences with respect to the behavioural stress responses. Laboratory rodents show increased motor activity after repeated stress (Heller, 1985), whereas mink show decreased activity. Several methodological differences between the rodent studies and the present study could, however, account for this discrepancy. Most importantly, in the present study activity tests were conducted in home cages with free access to nest sites, whereas activity tests in the rodent studies were carried out in neutral arenas without access to retreats. The increases in motor activity observed in rodents after repeated stress under these testing conditions parallel increases in fear responses, and it is very likely that the presence of retreats would reduce activity levels as seen in mink in the present study, or that mink would show increased activity when tested without access to retreats. This has, however, to be confirmed in future studies.

The marked decreases in responsiveness in a novel stimulus situation observed here after repeated stress also occur in rodents (Heller, 1985), and as in these animals the changes may reflect stress-induced elevations in fear.

Summarizing the present results, there appear no substantial deviations from the results obtained in



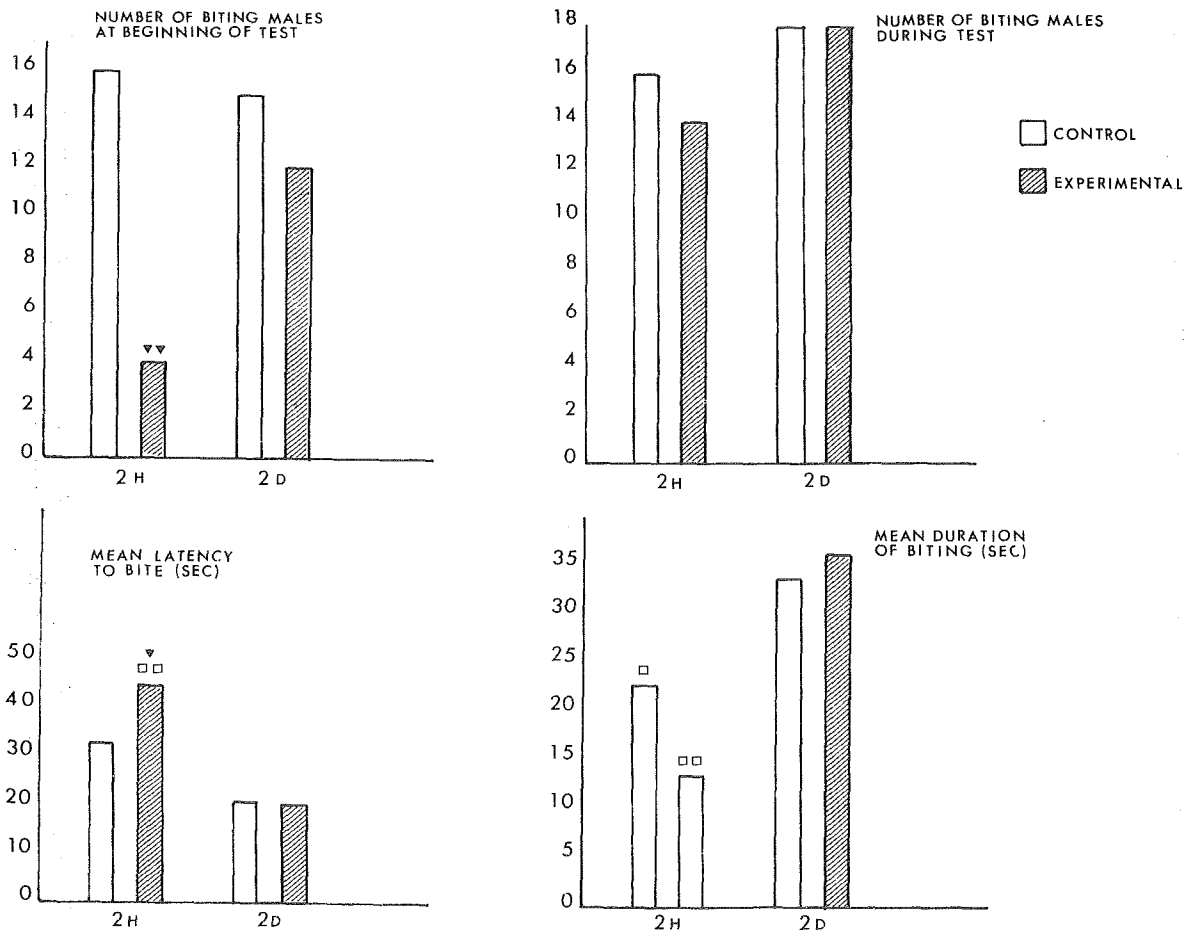


Fig. 2. Effects of repeated immobility stress on subsequent biting response in a novel stimulus situation 2 hours (2 H) and 2 days (2 D) after the last stress session.

▼  $p < 0.05$ , ▼▼  $p < 0.01$ , Stress/Control comparisons  
 □  $p < 0.05$ , □□  $p < 0.01$ , 2 H/2 D comparisons.

previous rodent studies, and it may therefore be concluded that mink show the same physiological and behavioural changes in response to stress as common laboratory rodents.

The clear effects of stress on circulating eosinophil levels in the present study suggest that determining levels of eosinophils could be used as a practical method for assessing stress in mink and perhaps in other animals as well. Stress is assessed most directly by measuring corticosteroid secretion, in that increased pituitary-adrenocortical activity is the defining aspect of the stress condition (Selye, 1936). Corticosteroid measurement is, however, a relative expensive and difficult procedure. The short (few minutes) latency between a stressful stimulation and the pituitary-adrenocortical response as well as the short biologic half-time ( $\frac{1}{2}$  h) of the corticosteroids make corticosteroid determination practically useless under conventional production conditions. The stressful experience of handling and bloodsampling of one individual may affect corticosteroid secretion of that individual and of neighbouring individuals as well due to disturbances. Corticosteroid secretion is increased only for a limited period after

short-term stress, and there is no simple relation between corticosteroid levels and the severity and duration of the stress.

Determination of circulating eosinophils is a more indirect assay of stress, but it is cheap and easy, and more importantly, this procedure is free of the short-lived lability problems connected with corticosteroid determination. The initial eosinophil depletion following a stressful experience can be recognized from a few to several hours after stress stimulation, and the subsequent increase in eosinophil levels is shown here to be stable for several days after stress termination.

The marked and relatively stable changes in eosinophil levels in response to stress seem to make eosinophil determination useful as a practical method for assessing stress in mink. It must be emphasized, however, that the relationships between stress and eosinophil levels observed here are based on experiments using immobility stress as the stressful experience, and we do not know whether more »natural« stressful experiences have the same effects on circulating eosinophils as found in the present study.

Even though eosinophil determination may be

proven useful for the assessment of stress, the procedure still requires direct interference with the animals as well as laboratory analyses. These practical disadvantages do not exist to the same degree if stress is assessed at the behavioural level. The present study strongly suggest that reliable behavioural tests could be developed for stress assessment in mink; especially with respect to the long-term stress condition.

Repeated sessions of immobility stress markedly reduce responsiveness to a novel stimulus in an uncomplicated procedure involving no direct interference with the animals and with a minimum of datacollecting difficulties.

If the stress effects on the responsiveness to a novel stimulus observed here will be shown to be the same in a variety of different long-term stress situations, behavioural observations may very well become a valuable tool to evaluate stress in future fur animal production. Further studies are needed, of course, to deduce whether other behavioural parameters reflect experienced stress with the same reliability as did responsiveness to novel stimulus in the present study.

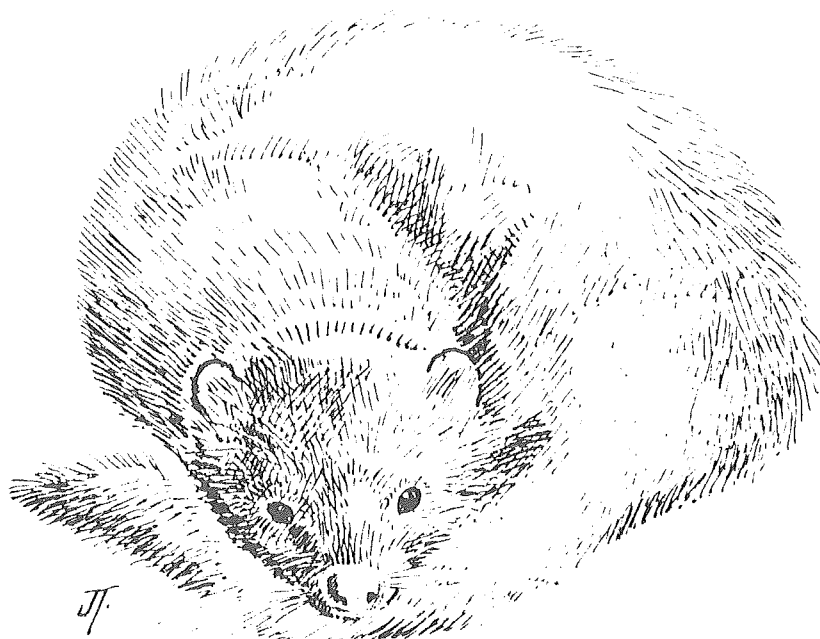
#### Acknowledgement

Thanks to the Natl. Inst. of Animal Science, Dept. of Fur Bearing Animals, DK-3400 Hillerød, Denmark, for the opportunity to do experiments with mink at Trollesminde research farm.

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# The Activity of Farm Silver Fox (*Vulpes vulpes*) in Summer

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## Summary

Five farm silver foxes were »non-stop« observed in order to examine their 24-hours activity. The separate forms of behaviour were classified and time of activity was recorded. The animals turned out to be active, particularly in the evening. Their cycle of summer activity resembled of wild foxes and the distribution of particular kinds of behaviour was varied.

## Introduction

Some previous studies about the life of the red fox under natural conditions concerned distribution of its activity in 24-hours period (Tembrock, 1958; Ables, 1975). They showed that this distribution is varied in the seasons of the year. It's due to the fact that fox social life changes during the year, approximately from solitude in autumn and winter to the mating period in spring and family life in summer. Our previous work showed that as regards some kinds of behaviour farm silver fox resembled the wild one (Kaleta, 1983). It's interesting to examine if this similarity concern the distribution of activity also. The authors pursued this end.

## Material and method

The investigations were carried out in state farm Witkowizna (near Minsk Maz.) in July, 1984. Five 2-

year of age males silver foxes were selected by chance to this end. Research work consisted of continuous »in-cage« observations of these animals. Four foxes were observed for 72 hours and one for 48. The technique of observations excluded possibility of disturbing foxes behaviour and a farm work. Per cent of activity in every hour, all forms of behaviour possible to observe (their frequency in an hour) were recorded and the remarks about the weather and the other circumstances were noted.

## Results

### 1. General remarks

During the research period the weather was constant (18-20° C, breeze and variable clouds). The animals were fed between 3 and 4 p.m. The foxes turned out to be active animals: cases when activity reached level zero % were very rare. Their behaviour comprised some interesting forms from an ethologic point of view, for example vacuum, replacement and redirected activity.

### 2. Activity

The distribution of examined foxes activity shows Fig. 1. There were four distinctive periods in this case:

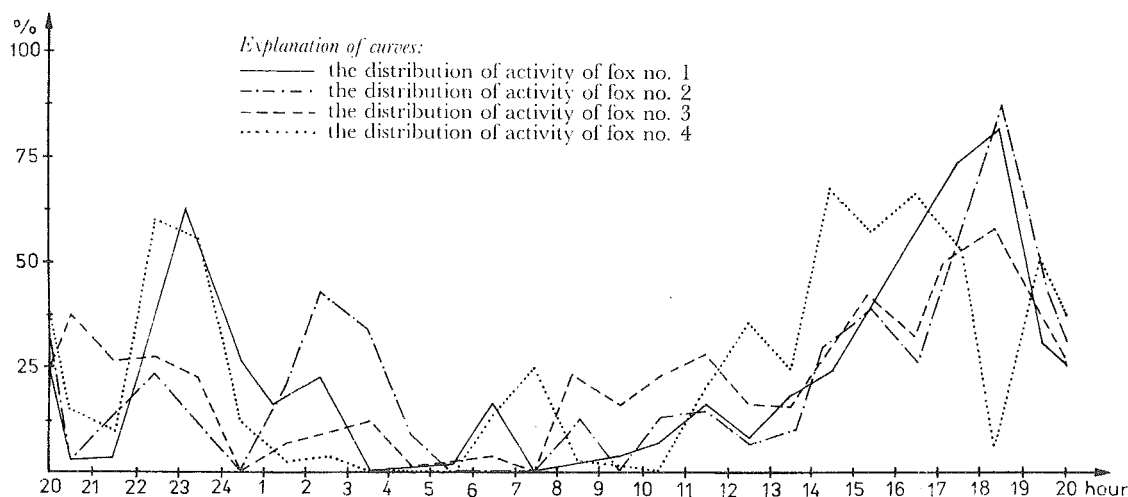


Figure 1. The distribution of foxes activity in 24-hours period.

1. The night activity from 9 p.m. to 1 a.m.
2. The low-day activity from 1 a.m. to 10 a.m.
3. The increasing activity from 10 a.m. to 6 p.m.
4. Sharp decreasing of activity from 6 p.m. to 9 p.m.

As concern difference among animals, the standard deviation was calculated. The difference turned out to be low during 2) and the highest during 3). In the evening and by night the activity was also highly varied. Each animal showed the highest activity between 6 and 7 p.m. The lowest activity (sleeping or laying motionless) took place approximately between 4 and 8 a.m.

### 3. Analyse of behaviour

Using traditional classification, four types of observable behaviour were recorded: ingestive, eliminative, comfort-seeking (scratching self, biting, pulling and licking own fur) and investigatory (walking, running, jumping, gnawing objects, playing with pan and an attempt to play with neighbours).

High frequency of eating and drinking was confined to 2-3 hours (usually in the evening) in observation period. Eliminative behaviour was distributed evenly and its level was very low (1-2 times in an hour). The frequency of comfort-seeking behaviour was rather high. Particulary this type of behaviour evoked the high level of activity in 3) period. Investigatory behaviour fluctuated as regard time and animals, but in this case too, remarkable increasing took place in evening hours (15-16 times in an hour).

### Discussion and conclusions

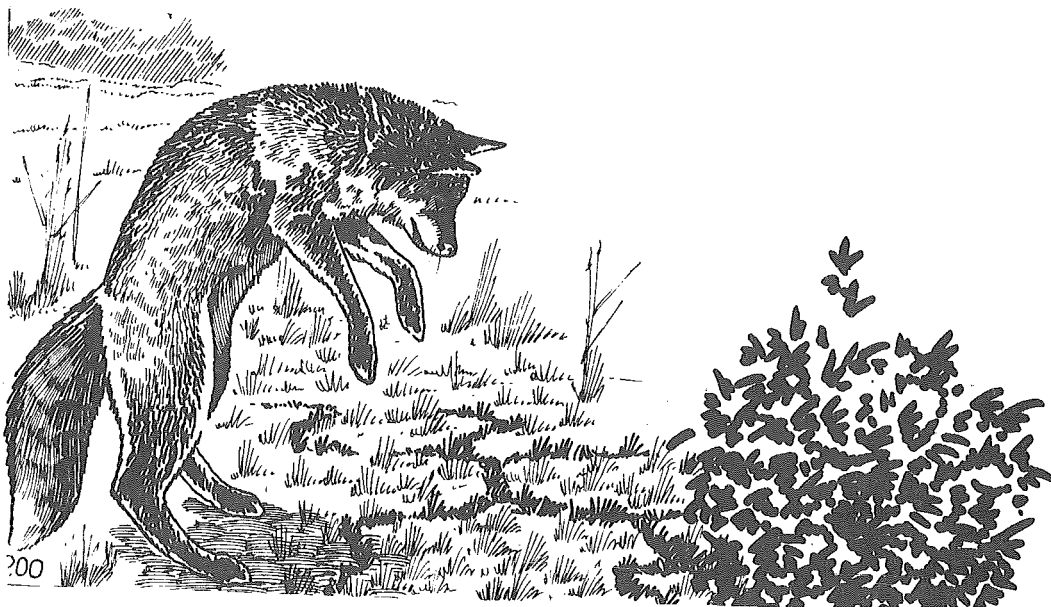
The cycle of foxes summer activity in a farm as a whole resembled the activity of wild red fox, examined by Tembrock (1958). Particulary increasing of activity in the evening is significant, taking into account that hunting behaviour in foxes takes place at that time (Österholm, 1964). However, the feeding time in the farm perhaps had an effect on the occurrence higher level of activity. As concern the type of behaviour, comfort-seeking and investigatory prevailed. Great number of comfort seeking acts probably is due to the fact that they occurred partly as replacement activity. Investigate behaviour consisted of many forms, acting partly as vacuum activity (»mouse jump«-display of hunting behaviour), partly as redirected activity (playing with pan as with prey).

Hence, occurrence of these all displays seems to be also the response to keeping after all non-domesticated foxes under farm conditions. If this interpretation would be justified, it would be also the evidence that process of domestication in silver foxes goes on.

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SCIENTIFUR, VOL 9, No. 3, 1985.



# The Activity of Farm Raccoon-dog (*Nyctereutes procyonoides*) in Summer

M. Brzozowski, T. Kaleta, Instytut Hodowli i Technologii Produkcji Zwierzecej,  
ul. Przejazd 4. 05-840 Brwinów, Poland

## Summary

The knowledge about biology and the behaviour of raccoon-dog is limited. The aim of this study was to observe daily and nocturnal activity of 3 ranch bred males of *Nyctereutes procyonoides* taking into account separate forms of behaviour. The results showed that this behaviour is rather scanty as regards the repertoire and indicated that the raccoon-dog under farm conditions remains nocturnal animal.

## Introduction

Although the breeding of raccoon-dog lasts for over fifty years, its biology and behaviour aren't studied entirely. For example as to the manner of life under natural conditions, the raccoon-dog is described as nocturnal animal (Nowikow, 1956, Muller-Usig, 1975). Since there is not detailed informations however about its activity, the authors of this study supposed that it's worth investigating it. They intended to initial observations of the raccoon-dog in captivity.

## Material and method

The investigations were carried out in state farm Witkowizna in July, 1984. Each of three 2-years old males was observed for 72 hours. Per cent of activity in

every hour and behaviour were recorded. During observations period as regards possibility of disturbing behaviour precautions were taken and the weather was noted.

## Results

The distribution of activity (see Fig. 1) showed that it's possible to separate two periods from 24 hours:

1. The lack of activity from 1 a.m. to 8 a.m. (usually sleeping).
2. The activity with peak between 6 and 11 p.m. (usually sitting or slow walking).

The difference among animals was low during first period and the highest during »peak period« (standard deviation was calculated).

As a whole behaviour of farm raccoon-dog was rather scanty. Except play jumps there were no observable displays, described by ethology in family Canidae. Hence, ordinary forms of behaviour were analysed. Raccoon-dogs were fed every other day between 3 and 4 p.m. Their ingestive activity was constant and low between 3 and 10 p.m. The frequency of daefecation and urination was also very low (1-2 times in an hour)

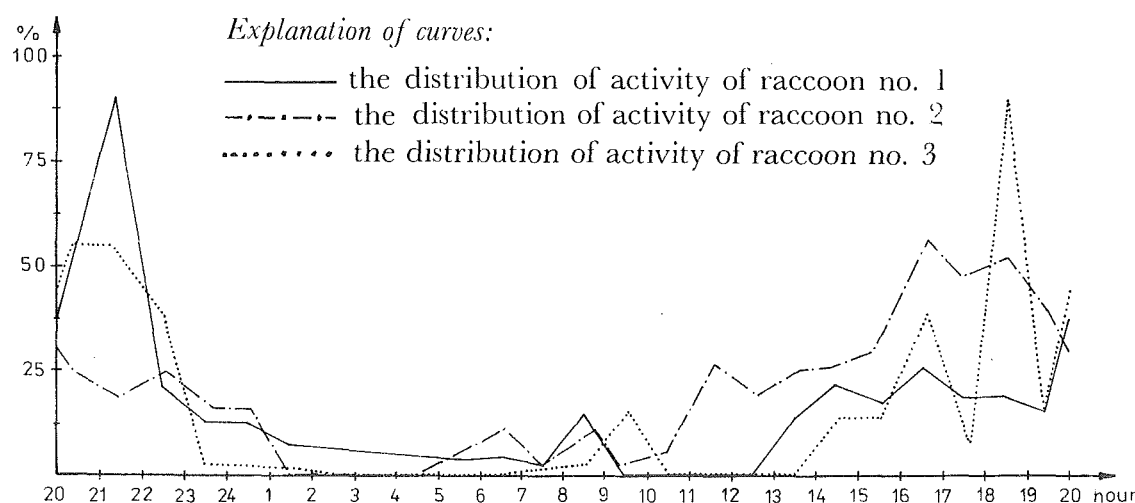


Figure 1. The distribution of raccoon-dog activity in 24-hours period.

during 24-hours period. The comfort-seeking behaviour reached higher level approximately 6 acts of scratching self and biting own fur in an hour were observed. The raccoon-dog usually revealed this activity in the afternoon and in the evening. The signs of investigatory behaviour, except walking were in fact very rare.

#### Discussion and conclusions

Small number of animals examined in this study doesn't allow to draw general conclusions. It seems that activity of the farm raccoon-dog may be qualified as nocturnal (like a wild one). The observations of behaviour showed that these animals deserved the name of the most primitive in family Canidae (*Frechkop*, 1959). Even artificial farm environment didn't elicit as so far new forms of behaviour as it may be observable in the other species.

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SCIENTIFUR, VOL. 9, No. 3, 1985.



**ABSTRACTS FROM THE BOOK  
MECHANISM OF ADAPTIVE RESPONSES IN FUR BEARING ANIMALS.**

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**DIGESTIVE ENZYME ACTIVITY IN ANIMALS WITH DIFFERENT CHARACTER  
OF NUTRITION.**

V.M. Oleinik.

Results of the comparative study of protease and alfa-amylase activity in the main parts of alimentary canal of caged mink and polar fox, laboratory rats and rabbits are present. The following characteristic features of carnivorous digestion as high pepsin activity in the stomach content and mucosa, large concentration of pancreatic protease proenzymes and comparatively low alfa-amylase activity in the pancreatic gland tissue, low amylolytic and moderate proteolytic activity in small intestine are revealed. Effect of diet content on the digestive enzyme activity is shown. The ratio of the enzymes studied is different both in the comparison of carnivorous, omnivorous and vegetarians and in the comparison of two carnivorous species - mink and polar fox - and reflects food specialization of these species.

Petrozavodsk, Academy of Sciences of the USSR, Karelian Branch, 1984, 5-20,

48 references

Author's abstract.

**FORMATION OF ENZYME ACTIVITY IN MINK AND POLAR FOX  
ALIMENTARY CANAL DURING POSTNATAL ONTOGENY.**

V.M. Oleinik.

Changes of protease and alfa-amylase activities in the main parts of alimentary canal of caged mink and polar fox during lactic rearing, mixed and definitive feeding were studied. It was found that the level of enzyme activity increases much after the transition on definitive feeding. The ratio of alfa-amylase and protease activity unequally changes with age in various species of fur-bearing animals. During definitive feeding enzyme ratio depends on the diet content.

Ibid., p. 20-40. 51 references.

Author's abstract.

### ENZYME CHARACTERISTICS OF DIGESTIVE-TRANSPORT SURFACE OF SMALL INTESTINE IN MINK:

V.A. Tsvetkova, V.M. Oleinik, V.A. Berestov, A.M. Ugolev.

In this work some characteristics of enzyme system in mink and laboratory animals were obtained with the help of preparatory isolation method. It is shown that enzymatic spectrum varies as a function of animal species. These specific features significantly depend on the feeding type. Systems, providing membranous digestion in mink, possess not only enzymes responsible for protein and fat hydrolysis but also carbohydrates, so a certain part of calorific demand of fur-bearing animals may be satisfied at the expense of cheap carbohydrate feeds.

Ibid., p. 40-47. 19 references.

Authors' abstract.

### ADAPTIVE FEATURES OF SERUM LACTATE-DEHYDROGENASE ISOENZYMIC PROFILE IN THE ONTOGENY OF FUR-BEARING ANIMALS.

L.K. Kozhevnikova, v.V. Ostashkova, H.I. Meldo.

Formation of LDG isoenzymic profile of blood serum in the ontogeny of farm mink and polar fox was observed. It was found that the prevalence of enzyme M-subunits in LDG molecular profile of the blood serum is characteristic of early ontogeny. Increase in N-subunits share was observed with animal age. It was revealed that the relative LDG-5 content in the blood-serum of mink was always higher than that of polar fox.

Ibid., p. 47-55, 27 references.

Authors' abstract.

### HORMONAL FUNCTION OF TESTIS AND OVARY IN MINK AND POLAR FOX.

L.N. Strunnikova, O.N. Savchenko, N.N. Tyutyunnik, V.A. Berestov.

Data on the gonad hormonal function of various stages of reproductive cycle in females and males of standard mink (200 animals) and veil fox (100 animals) are present. It was determined that progesterone content increases in the blood of mink and polar fox females during the first 1-2 months and falls in the following periods of their development. Testosterone content is low during the first months and from 4-5 months some activation of testis hormonal function was observed. The maximum



concentration of gonadal hormones in blood of mink and polar fox (testosterone in males and estradiole in females) takes place during the rut. (February-March). During the rut progesterone content in blood is not changed. Hormonal functions of the yellow body activates with pregnancy.

Ibid., p. 55-61, 10 references, 1 picture. Authors' abstract.

#### **MINERAL COMPOSITION OF HAIR AS EVALUATION TEST OF FULL-VALUE FEEDING.**

N.V. Tyurnina.

This paper presents some data on the calcium, magnesium, zinc, copper, and iron content in the hair of healthy standard mink and veil fox, which can be used for the investigation of the effect of feeding conditions on the hair mineral content. The possibility of using the hair analysis to reveal the reasons of fur disturbances is shown with the help of "cotton-fur" defect.

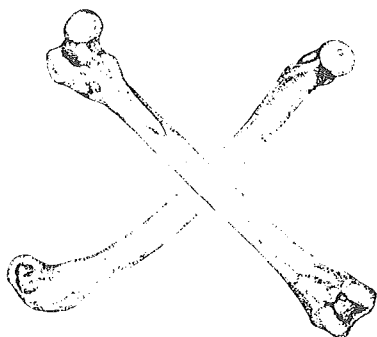
Ibid., p. 61-69. 60 references. Author's abstract.

#### **MORPHO-ADAPTIVE CHANGES IN THE OSTEOAL SYSTEM OF FUR-BEARING ANIMALS IN CONDITIONS OF CAGE REARING.**

N.A. Slesarenko.

Morphological bone study of the cage animals was accomplished in the comparison with that of wild ones. It was determined that in cage fur-bearing animals the process of morpho-adaptive reconstructions of the form, contours, structure takes place. This fact should be taken into account by practical fur-breeders.

Ibid., p. 69-77, 5 pictures, 20 references. Author's abstract.



**THIAMINE VALUES IN THE FEEDING OF FUR-BEARING ANIMALS.**

G.G. Petrova, S.P. Izotova.

In this paper physiological role of thiamine in organism and effect of its deficiency particularly as a result of thiaminase-containing feeding are observed. Thiamin-destructive features of some feed types and influence of their storage and treatment on the thiaminase activity are characterized. Some materials showing negative influence of hypovitaminosis on the reproduction of fur-bearing animals are given. The present methods of evaluation of thiamine supply are revealed.

Ibid., p. 77-90, 62 references.

Authors' abstract.

**USE OF ERYTHROCYTIC TRANSKETOLASE AND THIAMINDIPHOSPHATE-EFFECT FOR THE EVALUATION OF THIAMIN SUPPLY IN FUR-BEARING ANIMALS.**

S.P. Izotova, G.G. Petrova.

Preliminary data on the possibility of usage of erythrocyte transketolase and its stimulation by exogenous TDP-effect for in vivo evaluation of the latent thiamine deficiency in fur-bearing animals are given in this paper. Method of enzyme determination is described, calculation formular and first results of definition of transketolase activity and TDP-effect in impotent males are given.

Ibid., p. 90-95, 14 references.

Authors' abstract.

**MINK RESPONSES ON THE CHANGE OF NUTRIENT RATIO IN DIETS.**

B.A. Isupov.

The possibility of reduction of meat-fish food at the expense of increasing the portion of grain food and adding synthetic nitrogen substances in the mink diets is shown.

Ibid., p. 95-104. 14 references.

Author's abstract.

**PHYSIOLOGICAL STATE OF MINK YOUNG STOCK AND PELT QUALITY  
WHEN SOME NONPROTEIN NITROGEN SUBSTANCES WERE ADDED TO  
THE DIETS.**

B.A. Isupov, I.N. Gamulinskaya.

Additions of nonprotein nitrogen sources (ammonium sulphate) to the typical mink diet do not deteriorate feed eating degree, favour the physiological state of animal, growth and development of young stock, pelt quality decreasing its cost.

Ibid., p. 104-112. 11 references.

Authors' abstract.

**CHANGE IN MINK ENZYMIC STATUS UNDER THE INFLUENCE OF DIFFERENT  
CHEMCOCCID DOSES.**

L.K. Kozhevnikova, A.E. Hovanskih, V.V. Ostashkova, V.M. Oleinik, H.I. Meldo.

Influence of different doses of anticoccid preparation chemcoccid-7 (1,3-bis-(n-chlorobenzilidenamino)guanidin) on the activity of some blood serum enzyme, pancreatic gland homogenates, mucosa and content of stomach and small intestine was studied in caged mink. Low toxicity of this preparation is shown. It was revealed, that the therapeutic dose of this preparation (30 mg/kg of vital mass) increases alkaline phosphatase, blood amylase activity, decreases activity of proteolytic and amylolytic enzymes in the pancreatic gland homogenates, stomach and small intestine mucosa, enhancing their activity in the chyme of these organs.

Ibid., p. 112-121. 20 references.

Authors' abstract.

**CHEMCOCCID INFLUENCE ON THE ACETYLCHOLINESTERASE AND MONO-  
AMINOCOCCIDASE ACTIVITY IN MINK ORGANS AND TISSUES.**

A.M. Malov, G.M. Grigorieva, A.E. Hovanskih, V.A. Berestov, A.D. Antipov, T.I. Krasnova.

In vivo effect of antiprotozoan chemcoccid preparation (1,3-bis-(n-chlorbenzilidenamino)guanidine) on the acetylcholinesterase - ACE - activity

of brain and on the monoaminoxidase - MAO - activity of mink brain, liver and intestine, when the doses are 15 and 30 mg/kg of animal mass. Chemcoccid at such doses was found not to affect the MAO activity of mink brain but it results in a small decrease of ACE activity at a dose of 15 mg/kg and a dose of 30 mg/kg significantly lowers the activity on the 15-25th day.

Increase in MAO activity of intestine and decrease in MAO activity of liver are observed under the influence of this preparation.

The results obtained may be used in practical fur-farming.

Ibid., p. 122-128. 6 pictures, 9 references. Authors' abstract.

#### **EFFECT OF ANTIPROTOZOAN CHEMCOCCID PREPARATION ON MINK BLOOD SERUM ESTERASE.**

R.I. Volkova, T.N. Nozhko, E.V. Titova, A.E. Hovanskih.

Effect of chemcoccid (1,3-bis-(n-chlorbenzilidenamino)guanidin) on mink blood serum cholinesterase and purified preparations of man erythrocyte acetylcholinesterase (ACE) and horse serum butyrylcholinesterase (BCE) as well as the effect of different chemcoccid doses (15-60 mg/kg of animal mass) on the cholinesterase and mink blood serum nonspecific esterase activity were investigated in vitro. It was assessed, that chemcoccid is the inversive inhibitor of mink blood serum cholinesterase, ACE and BCE ( $K_i$   $10^{-4}$  M). Chemcoccid derivatives - diamino - and triaminoguanidin - show more feeble inversive cholinesterase inhibition ( $K_i$   $10^{-3}$  -  $10^{-2}$  M). High cholinesterase activation (in 2-3 times) and low nonspecific esterase activation are observed in blood serum of mink, receiving chemcoccid. The degree of cholinesterase activity in serum enhances with the increasing of chemcoccid dose and duration of its reception.

Ibid., p. 128-136. 2 pictures, 15 references. Authors' abstract.

### STUDY OF CHEMCOCCID EFFECT ON THE INDICES OF CYCLIC NUCLEOTID SYSTEM IN MINK TISSUES.

M.N. Pertzeva, L.A. Knuznetzova, S.A. Plesneva.

Study of chemcoccid effect on the cyclic AMP, cGMP and PDE - cAMP activity in liver and brain mink tissues showed that chemcoccid doses of 15 and 30 mg per 1 kg of vital mass during 2-15 days do not influence the investigated indices. When the action of these doses is more long (25 days) some increase in PDE-cAMP activity with high affinity to cAMP in liver and cGMP level in brain are observed.

Studies on the state of cyclic nucleotide system suggest that chemcoccid doses within 15-30 mg per 1 kg of mink vital mass are not toxic and they are recommended to be used for not longer than 15 days.

Ibid. p. 136-140, 4 pictures, 6 references. Authors' abstract.

### EFFECT OF DIFFERENT CONDITIONS OF FEEDING ON THE MINK PHYSIOLOGICAL STATE AND PRODUCTIVITY.

N.M. Tyutyunnik, G.A. Petrova.

The results of keeping mink of different genotypes in closed conditions during their growth, development and reproduction are present in this paper. These data show high adaptive abilities of mink to the change of environmental factors.

Ibid., p. 140-148, 4 pictures, 1 reference. Authors' abstract.

### NUMBER AND STRUCTURE OF TOXASCARIS LEONINA POPULATION AT VARIOUS LEVELS OF HOST INFECTION.

L.V. Anikieva, V.S. Anikanova.

It was determined that the mean and high (100 and 1000 larvae) infection doses decrease the number of larvae of IV stage. Subsequently stabilization of *T. leonina* number occurs via complication of pupulation structure, lability of sexual composition, size and productivity.

Ibid., p. 148-155. 5 pictures, 26 references. Authors' abstract.

## RESULTS OF TRIALS IN 1983.

(Resultat av 1983 års försöksverksamhet).

Liisa Tång.

For pastel mink females (50-100 per group) fed during the mating season on a Danish diet, offal preserved with lactic acid, or boiled offal, the percentage of infertile females was 18.4, 15.3, and 12.1 resp., the number of kits per female whelping 4.6, 4.5, and 5.2, and the number of kits per mated female 3.8, 3.8, and 4.6. Of 34 dark mink fed a pelleted diet without or with the addition of formic acid, the percentage of infertile females was 20.6 and 10.6 resp., the number of kits per female whelping averaged 4.3 and 4.4, and that per mated female 3.8 and 4.0. Of 39 blue fox females fed a standard diet with 0.5% formic acid, 49 females fed offal preserved with lactic acid, and 49 females fed boiled offal, 35.5, 39.5, and 13.6% resp. were infertile, the number of kits per female whelping averaged 9.7, 10.5 and 9.1, and that per female mated 6.2, 6.4 and 7.9.

Finsk Pälstidskrift, 18, 5, 269-273, 1984.

7 tables.

CAB-abstract.

In SWED.

**HOW HAVE MINK IMPORTED FROM THE USA AFFECTED PELT QUALITY?****(Hur påverkar importminkar från Amerika farmens skinnkvalitet?)**

Paavo Niemelä.

Of 266 pelts from imported dark mink female and 798 pelts from imported mink crossed with Finnish mink, 9.4 and 5.5% resp. were extra large and 51.5 and 39.1% large (class 1) vs. 12.7% extra large and 47.1% large for Finnish Dark pelts. Of 258 pelts from imported female and 306 pelts from crossbred female, 15.1 and 9.5% resp. were class 2 and 55.0 and 58.5% class 3 vs. 3.8% class 2 and 47.1% class 3 for Finnish Dark pelts. Pelt quality and colour were slightly better in the American and crossbred mink than in the Finnish mink, but a higher percentage of

imported pelts than Finnish pelts were affected by metallic sheen.

Finsk Pälstidskrift, 18, 7-8, 399-400, 1984.

5 tables, 1 reference.

CAB-abstract.

In SWED.

#### **DYNAMICS OF GROWTH IN CUBS AND YOUNG SILVER FOXES.**

**(Cercetari privind dinamica cresterii si dezvoltarii puilor si tineretului de vulpe argintie).**

L. Rebreanu, M. Bura, St. Crisan.

Data are tabulated on the body weight of 50 cubs from birth (92.5 g) to 186 days of age (4732.2 g). Over the same period, chest circumference increased from 9.25 to 38.04 cm, head length from 5.37 to 17.50 cm, neck + trunk length from 11.25 to 48.90 cm, and tail length from 6.50 to 39.60 cm.

Lucrari Stiintifice, Inst. Agron. Timisoara, Zootehnie, 18, 238-242, 1981, (publ. 1983).

1 table, 4 references.

CAB-abstract.

In ROMN. Summary in ENGL.

#### **DYNAMICS OF COAT DEVELOPMENT IN CUBS AND YOUNG SILVER FOXES.**

**(Cercetari privind dinamica invelisului tegumentar la pui si tineretul de vulpe argintie).**

L. Rebreau, M. Bura, St. Crisan, D. Tosca.

Data on the diameter of the guard and undercoat hairs are tabulated for 25 male and 25 female at 11 ages between birth and 186 days. Overall, the diameter of the guard hairs increased from 24.14 to 77.46 microm, and that of the undercoat hairs from 14.63 to 23.45 microm.

Lucrari Stiintifice, Inst. Agron. Timisoara, Zootehnie, 18, 243-248, 1981, (Publ. 1983).

2 tables, 2 references.

CAB-abstract.

In ROMN. Summary in ENGL.

**METABOLIC PROFILE OF THE BLOOD PLASMA OF ADULT MALE  
NUTRIAS (MYOCASTOR COYPUS M.).**

P. Jelínek, J. Illek.

The values of basic biochemical data (total protein, percent portion of albumin, alpha, beta and gamma globulin, urea, AST and ALT activities, alkaline phosphatase, glucose concentration, total calcium, inorganic phosphorus, magnesium, manganese, zinc and copper) determined in the blood plasma of 22 adult clinically healthy male nutrias during the summer season are given. The blood for analysis was obtained by heart puncture.

Acta Vet. Brno. 3, 49-55, 1984.

1 table, 25 references.

Authors' summary.

In CZEC. Summary in ENGL and RUSS.

**TISSUE COMPOSITION OF THE BODY AND CARCASS YIELD  
OF STANDARD NUTRIAS.**

**(Tkanivové zloženie tela a jatocna vytaznost standardnych nutrii).**

Milan Barta, Olga Palanská, Imrich Tocka.

The objective of the work was to characterize the meat yield of nutrias and to evaluate the carcass yield and composition of the carcass body of standard nutrias according to sex at the age of 8 months and 3 years. The carcass yield as the main indicator of meat efficiency was highest in 8-month old males, then in 3-year old females and 3-year-old males and lowest in 8-year old females. The values determined of carcass yield ranged from 51.12-55.64%. A very favourable percentage was found by carcass analysis of pelvic and chest limbs the percentage of which froms 52% of the carcass body in the groups followed. In following the percentage of pelvic and chest limbs a moderate drop was registered in older animals.

Polnohospodarstvo (Czechoslovakia), 30, 11, 1036-1042, 1984.

4 tables, 4 references.

Authors' summary.

In CZEC. Summary in ENGL, RUSS.



Moribund dark mink kits were found to have high body levels of  $\beta$ -endorphin and high head levels of  $\beta$ -lipotropin suggestive of a genetic mechanism for increased  $\beta$ -lipotropin secretion and a conversion to  $\beta$ -endorphin in the body. The cause of the death of the mink kits was believed to be due to increased  $\beta$ -endorphin and ACTH secretion that brought about a concomitant depletion of energy stores with hypothermia, dehydration and loss of appetite.

Plasma  $\beta$ -endorphin and  $\beta$ -lipotropin levels were inversely related to each other.  $\beta$ -endorphin was high in the fall and spring while  $\beta$ -lipotropin was low during the corresponding period, but high in the winter months. These results indicated that there was differential processing of  $\beta$ -lipotropin into  $\beta$ -endorphin in the body.  $\alpha$ -MSH and  $\beta$ -endorphin levels were low prior to and during the breeding season. Parallel secretion of ACTH and  $\beta$ -endorphin was observed with seasonal differences.

The purpose of this study was to determine seasonal patterns of five hormones in male mink of three different color phases during a year long observation period. Four statistically significant pulses of cortisol were observed on November 4, February 3, April 28 and June 9. These adrenocorticoid peaks of activity corresponded with similar peaks of plasma ACTH. Concomitant with the fall and spring pelage changes (moult),  $\alpha$ -MSH secretion was high from September through November and from May through June, but was reduced during the winter months except for a small secondary rise in January and February. Cortisol, ACTH and  $\alpha$ -MSH levels correlated very strongly with the autumnal and spring moults. Pastel mink had lower  $\alpha$ -MSH levels than did opal or dark mink.

Robert Wesley McMullen.

**SEASONAL PATTERNS OF  $\beta$ -ENDORPHIN,  $\beta$ -LIPOTROPIN, ACTH,  $\alpha$ -MSH AND CORTISOL AND DIURNAL RHYTHMS OF SERUM MELANIN, PINEAL NAT ACTIVITY AND HYPOTHALAMIC MAO ACTIVITY AS RELATED TO THE ANNUAL FURRING CYCLES IN MINK (MUSTELA VISON).**

Chediak-Higashi was first reported in humans by *Bequez-Cesar*, who in 1943 examined blood samples of a Cuban family and discovered enlarged granules in leucocytes of some of the children. These granules are abnormal lysosomes. Individuals with the syndrome have light coloured hair and eyes due to uneven distribution of pigment and a limited number of large and irregular melanin granules. In humans the defect is associated with increased sensitiveness to bacterial and viral diseases. Most of the children die before they reach the age of 10 years. The bleeding tendency is believed to, at least partly, be a consequence of reduced content of serotonin, ADP (adenosin-diphosphate) and ATP (adenosin-triphosphate) in patients' blood. Des-regarding the lack of sensitiveness to infections, all other symptoms have been found in Omberg pearl: Bleeding tendency, enlarged granules in neutrophile and eosinophile leucocytes, enlarged but sparse and irregular melanine granules in the hair and extremely low concentration of serotonin and reduced amounts of ADP and ATP in the blood platelets.

#### The mode of inheritance

The bluish grey colour of Omberg pearl is a part of Chediak Higashi syndrome and due to the same genetic factor. The gene thus has a pleiotropic effect causing both the hair colour and bleeding tendency etc. The mode of inheritance in the killer whale has not been investigated but in all other species CHS has been found to be dependent upon a single recessive autosomal factor. This was also the case with Omberg pearl (*Ves et al.* 1985). The first mutant was a male which in 1985 was used to mate several silver females. Most of them had only silver pups, carriers for pearl. Nevertheless, one female which was related to the male, gave birth to 4 pearls and one silver.

#### Comparative studies

The colour type as well as the bleeding tendency are features in common to the Omberg pearl and Mansfield pearl. Whether the underlying mechanisms for the Mansfield pearl and Omberg pearl are identical has earlier not been studied. Another symptom of CHS is the clumping of hair pigment. *Shackelford* found such clumping of pigment in a pearl fox in 1948. The phenomenon has now also been demonstrated in the Omberg pearl. In eastern pearl, however, a normal distribution of pigment has been demonstrated. On this basis a working hypothesis was framed that the pearl fox in *Shackelford's* investigation also was a bleeder and identical to Mansfield pearl. Further we assumed that the bleeding tendency in Mansfield pearl is of the same type as in Omberg pearl which involves reduced concentration of serotonin, ADP and ATP in the blood platelets.

Since a true Mansfield pearl was unavailable to us we did our observations on a combination type, sapphire,

imported to Finland from the USA to test our hypothesis.

The study was done at two different farms. The sapphires at the first farm were imported as Pavek sapphire with information of including eastern pearl and »Pavek pearl«. The sapphire fox on the other farm originated from *J. Richmond* and should include eastern pearl and Mansfield pearl. On both farms the sapphire foxes examined showed a prolonged bleeding time. Further serotonin could not be detected in blood platelets and they contained reduced concentration of ADP and ATP. Enlarged leucocyte granules and enlarged but sparse and irregular melanine granules in the hair were also demonstrated - all these finding being typical for the Chediak-Higashi syndrome.

#### Discussion and conclusion

A Chediak-Higashi like syndrome has now been demonstrated in three silver fox types: Omberg pearl, Richmond sapphire and Pavek sapphire. Both the bleeding tendency and the light colour are part of the CHS syndrome. In all three pearl types the CHS is caused by a single recessive autosomal gene. Therefore, it seems most likely that the genes are identical. They may have occurred by repeated mutations in the same locus, but it is also possible they can be traced back to the same mutation e.g. to the pearl fox investigated by *Shackelford* already in 1948. This was most likely the one called pearl 2 by *Johansson* (1947).

*Shackelford* (1948) demonstrated a clumping of hair pigment in a pearl fox. Since clumping of hair pigment is a part of CHS syndrome it is most probable that the pearl fox examined by *Shackelford* (1948) also was a bleeder.

Considering the colour type and the CHS characteristics the pearl types included in the above mentioned foxes seem to be both genotypically and phenotypically identical. This means that pearl 2 = Mansfield pearl = Omberg pearl and that both sapphire types contain Mansfield pearl.

The genetical relationship between other pearl types and these have not been examined, but considering the result of previous investigations it would not be surprising if only two genetically different pearl types, pearl 1 and pearl 2, would exist, like it was assumed in the 1940's.

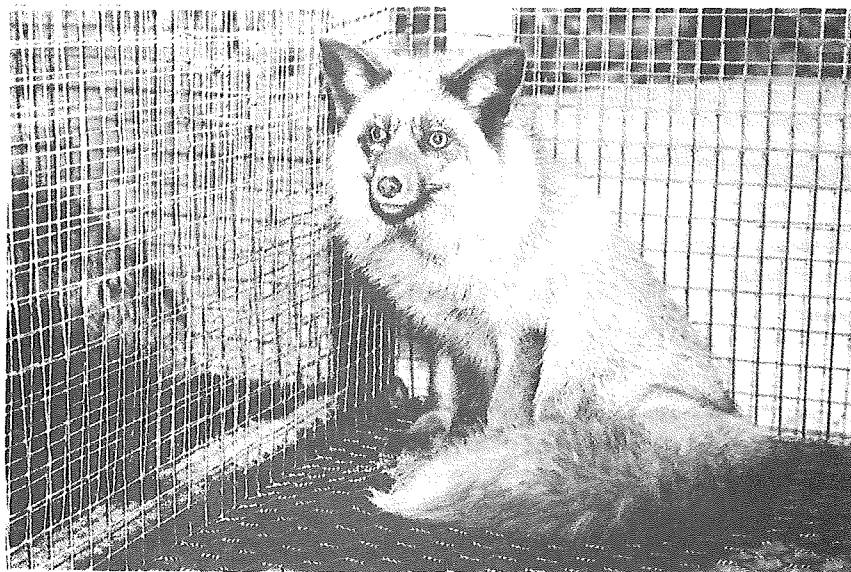
Considering the exchange of breeding stock it is desirable to do more investigations on both sides of the Atlantic. An accurate and reliable information of the genetical background by purchase is important for further breeding plans, specially when the mutation type is used for making combination types as e.g. the pearls.

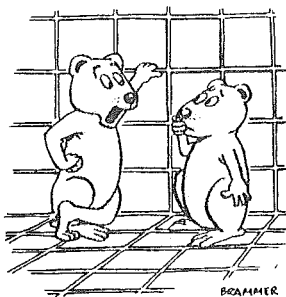
In this connection one should notice that the investigation of hair samples is a simple and reliable method of distinguishing between pearl 1 and pearl 2.

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- Shackelford, R. M.* (1984). Personal information.

**SCIENTIFUR, VOL. 9, No. 3, 1985.**





First tell me  
what allotypes you have?

## IMMUNOGENETICS OF IMMUNOGLOBULINS IN AMERICAN MINK.

### I. IDENTIFICATION AND POPULATION-GENETIC ANALYSIS OF SIX (L1A, H2, H3, H4, H6 and 5) ALLOTYPES OF IgG.

#### ИММУНОГЕНЕТИКА ИММУНОГЛОБУЛИНОВ АМЕРИКАНСКОЙ ПОРКИ

##### СООБЩЕНИЕ I. ИДЕНТИФИКАЦИЯ И ПОПУЛЯЦИОННО-ГЕНЕТИЧЕСКИЙ АНАЛИЗ ШЕСТИ (L1A, H2, H3, H4, H6 и 5) АЛЛОТИПОВ IgG

D.K. Belyaev, I.I. Fomicheva, O.K. Baranov.

Six allotypes of IgG in domestic mink are identified. Among them, L1A belongs to the light chains and H2, H3, H4 and H6 - to the heavy chains of the molecule. The localization of marker 5 is still unknown. IN the population, the frequency of H6 allotype is the highest (0.90), that of the allotype 5 being rather rare (0.12) and the frequency of other markers ranges from 0.21 to 0.53.

A population-genetic analysis revealed independent inheritance of allotypes of the heavy chains and the absence of any allogroups.

Genetika, USSR, 20, 3, 478-488, 1984.

5 figs., 5 tables, 23 references.

Authors' summary.

In RUSS. Summary in ENGL.

## IMMUNOGENETICS OF IMMUNOGLOBULINS IN AMERICAN MINK.

### III. TWO NOVEL ALLOTYPES OF THE HEAVY CHAINS IgG-H7 AND H8..

#### ИММУНОГЕНЕТИКА ИММУНОГЛОБУЛИНОВ АМЕРИКАНСКОЙ ПОРКИ

##### СООБЩЕНИЕ III. ДВА НОВЫХ АЛЛОТИПА ТЯЖЕЛЫХ ЦЕПЕЙ IgG-H7 И H8

D.K. Belyaev, I.I. Fomicheva, A.V. Taranin, O.K. Baranov.

Data on identification, distribution in a population and hybridological analysis of two novel allotypes (H7 and H8) of the heavy chains of IgG molecules in domestic mink are given. Together with the previously described L1A and H6, they form a group of allotypes which are strictly

inherited according to Mendelian laws. On the contrary, in inheritance of allotypes H2, H3, H4 and 5 significant deviations are observed. These deviations seem to be due to non-expression in the progeny of respective genes having presumably a latent mode of expression in the ontogenesis.

Additional inclusion of two new markers into the population and the hybridological analysis did not permit to find either closely linked or allelic relationships between the allotypes studied.

A question has arisen, why do the genetic relationships of mink  $\gamma$ -allotypes differ from those known for man, rabbit and mouse.

Genetika, USSR, 20, 4, 682-690, 1984.

1 fig., 5 tables, 13 references.

Authors' summary

In RUSS. Summary in ENGL.

**DOES THE CHROMOSOME NUMBER (KARYOTYPE) OF BLUE FOXES HAVE ANY IMPORTANCE FOR LITTER SIZE IN CROSSINGS WITH SILVER FOXES.**

**(Har blårevartens varierende kromosomtall (karyotype) noen betydning for valpresultatet ved artskrysning med sølvrev?).**

Jan A. Fougner, Andris Haugen, Norodd Nes.

When 211 blue fox female with a diploid chromosome number of 48, 49 or 50 were inseminated with silver fox semen, the percentage of infertile female was 55.9, 42.0 and 31.4 resp., and the number of female producing litters 15 of 34, 62 of 107, and 48 of 70; litter size at birth averaged 9.3, 8.8 and 8.3, litters size on 1. Sep. 7.2, 6.4 and 5.8, and the number of cubs per inseminated female on 1 Sep. 3.2, 3.7 and 4.0. When 175 blue fox female of the 3 karyotypes were inseminated with semen from blue or Shadow foxes, the percentage of infertile female was 15.9, 25.3 and 28.3 resp., and the number of female producing litters 17 of 20, 71 of 95, and 43 of 60; litter size at birth averaged 9.5, 9.1 and 10.1, litter size on 1 Sep. 8.2, 7.6 and 8.6, and the number of cubs per mated female on 1 Sep. 7.2, 5.7 and 6.2. The difference between the karyotype groups were not significant.

Norsk Pelsdyrblad, 58, 11, 453-454, 1984.

1 Table.

CAB-abstract.

In NORG.

**TWO WHITE MUTANTS IN THE BLUE FOX:**

**To white mutanter hos blårev)**

Norodd Nes, Jan A. Fougner.

An account is given of 2 white mutants in the progeny of blue fox parents (1 male born in 1980 and 1 female born in 1981 at 2 farms in Norway). Mating experiments revealed that in both animals the white colour was due to a dominant gene which is lethal in a double dose, and which is identical, or practically identical, with the Blue Shadow gene (S). The new type has been named *Aspas White*, with the gene symbol  $S^A$ .

Norsk Pelsdyrblad, 58, 10, 413-415, 1984.

In NORG.

CAB-abstract.

**STANDARDIZED NAMES OF NUTRIA COLOUR VARIETIES.**

**(Einheitliche Bezeichnungen für Sumpfbiberfarben).**

Anomynous.

The following standard names of nutria colour varieties have been adopted by the German Association of Fur Breeders: Standard (brown), Black, Beige, Greenland (beige with greyish beige underfur), White, Silver (from White x Standard), Greenland-Silver, Pastel (pale brown) and Gold.

Deutsche Pelztierzuchter, 58, 5, 80, 1984.

In GERM.

CAB-abstract.



## BREEDING COLOURED FOXES.

## Разведение, цветных лисиц

L.A. Abramova.

The coat colour of progeny of silver-black, "bastard red" (silver x red, with black markings), snowwhite, whitefaced platinum and golden/platinum animals mated in various combinations is tabulated. The largest litters at weaning (4.2 kits) were obtained from matings of silver-black with snowwhite or bastard red foxes, and the smallest (2.0) for bastard reds.

Krolikovodstvo i Zverovodstvo, 3, 22-23, 1980.

2 Tables.

CAB-abstract.

In RUSS.

## BREEDING RACCOON DOGS.

## Возвращаясь к енотовидной собаке

R.L. Akkuratov, E.P. Tret'yakova, A.M. Boitsov.

For 300 adult female and 100 adult male, body weight averaged 6412 and 6710 g resp. in Jan., 6191 and 6333 g in Feb., 5892 and 5927 g in July, 6955 and 7250 g in Aug., 6709 and 7405 g in Sep., 7644 and 8518 g in Oct., 8231 and 8603 g in Nov., and 7613 and 8431 g in Dec. Data are also giving for growing animals.

Krolikovodstvo i Zverovodstvo, 5, 24-25, 1980.

2 tables.

CAB-abstract.

In RUSS.





## REPRODUCTION

**PLASMA CONCENTRATION OF OESTRADIOL AND OESTRONE DURING  
PERINATAL DEVELOPMENT IN MALE AND FEMALE FERRETS.**

M.S. Erskine, M.J. Baum.

The concentrations of oestradiol and oestrone in peripheral plasma of male and female ferrets 5 days before and 7, 15 and 30 days after birth were measured. Both steroids were present in high concentrations prenatally. Much lower levels were found in samples collected on day 7 and later, when the concentrations were similar to those of adult gonadectomized animals. No significant sex difference was seen for the concentration of either steroid at any age studied. These results, and those previously reported showing the absence of a circulating binding protein and the presence of oestradiol receptors in the hypothalamus in the perinatal period in this species, suggest that brains of both males and females are exposed to significant amounts of oestrogen during development. These findings lend support to the possibility that prenatal exposure to oestrogen plays a role in organizing the potential for female behaviour in male and female ferrets.

J. Endocr. 100, 161-166, 1984.

1 fig., 2 tables, 31 references.

Authors' abstract.

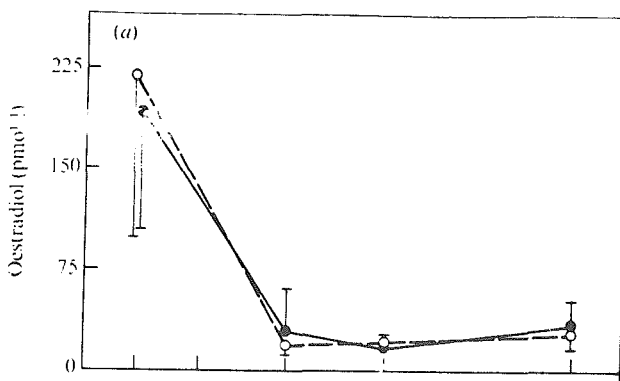
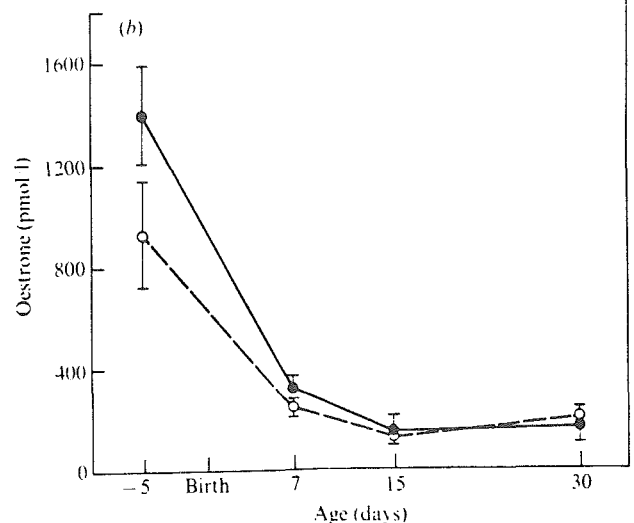


FIGURE 1. Plasma concentrations of (a) oestradiol and (b) oestrone at the perinatal ages indicated in male (●) and female (○) ferrets. Each point represents the mean of 7 to 11 determinations. Vertical lines indicate S.E.M.





### EFFECT OF TEMPERATURE ON GESTATION LENGTH IN MINK.

(Cercetari privind influenta temperaturii asupra duratei gestatiei la nurca).

M. Bura, L. Rebreanu, S. Crisan.

Data collected on 350 female mated during 1-18 marts showed that gestation length decreased from 58.39 to 46.50 days with advancing date of mating, and as av. ambient daily temperature increased from 5.36 deg. to 6.83 deg.C. The relationship between gestation length and temperature was significant.

Lucrari Stiintifice, Inst. Agron. Timisoara, Zootehnie, 18, 254-257, 1981. (Publ. 1983).

1 table, 3 references.

CAB-abstract.

In ROMN. Summary in ENGL.

### EFFECT OF LIGHT FACTORS ON GESTATION LENGTH IN MINK.

(Cercetari privind influenta factorului limina asupra duratei gestatiei la nurca).

L. Rebreanu, M. Bura, S. Crisan.

For 350 female mated during 1-18 March, gestation length decreased from 58.39 to 46.50 days as day length increased from 13.16 to 14.12 h, the relationship between gestation length and day length being highly significant.

Lucrari Stiintifice, Inst. Agron. Timisoara, Zootehnie, 18, 258-263, 1981. (Publ. 1983).

1 table, 7 references.

CAB-abstract.

In ROMN. Summary in ENGL.



## EFFECT OF NUMBER OF MATINGS AND PROLIFICACY ON GESTATION LENGTH IN MINK.

(Cercetari privind influenta numarului de monti si a prolificitatii  
asupra duratei gestatiei la nurca).

L. Rebreanu, M. Bura, St. Crisan.

For 42, 104, 172, 27 and 5 female mated 1-5 times resp. in the same breeding season, gestation length averaged 51.90, 47.77, 46.65, 43.33 and 43.20 days. Gestation length increased from 52.00 to 55.25 days as litter size increased from 1 to 8, the effect of litter size on gestation length being highly significant.

Lucrari Stiintifice, Inst. Agrn. Timisoara, Zootehnie, 18, 249-253, 1981.  
(Publ. 1983).

2 tables, 1 reference.

CAB-abstract.

In ROMN. Summary in ENGL.

## A NEW METHOD OF MATING MINK.

### Новый способ проведения гона

V.G. Bernatskii, V.V. Pomerantsev, G.A. Myasoedova, G.V. Pomerantseva,  
V.A. Kopylov, B.V. Korotkov, V.A. Khoriniov, N.A. Blokhina.

Groups of 25 pastel mink female, comprising litter mates (1 female from each litter in each of the 3 groups), were given (1) 80 IU Gravohormone (purified PMSG); (2) 10 IU HCG; (3) no treatment, as controls to the 1st group; (4) no treatment, as controls to the 2nd group. There were no differences in whelping rate between the 1st group and the 2 control groups; for the 2nd group, litter size was 1.3 kits greater than for the other groups. In a follow-up experiment, 60 female were each treated with 10 IU HCG, and 60 female were untreated. The the 2 groups resp., litter size averaged 6.25 and 5.6. For female treated on 3, 5, 7 or 9 March, litter size averaged 5.4, 5.4, 5.9 and 4.5 resp. Due to differences in mating ability of males, 90% of females treated on 3-7 March were mated, vs. 60% of females treated on 9 March. The number of kits weaned per female whelping after treatment with HCG was similar to

that for female mated several times during mating season (4.8 vs. 4.9).

Krolikovodstvo i Zverovodstvo, 1, 22, 1980.

In RUSS.

CAB-abstract.

#### A NEW METHOD OF MATING SABLES.

### Новое в технике гона соболей

Yu. M. Dokukin, A.B. Kulichkov.

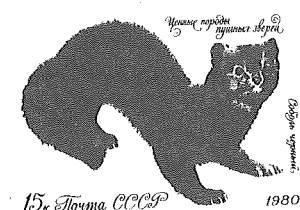
147 female sables were allowed to mate once daily and no more than twice during oestrus, 140 females were allowed to mate twice on the 1st day of oestrus and once on the 2nd day or once on the 1st day and twice on the 2nd, and 140 females were allowed to mate 4-6 times during each of 3-4 oestrous periods of the mating campaign (a traditional method). For the 3 groups resp., the percentage of females returning to service was 13.1, 10.7 and 14.0, and the number of weaned kits per female whelping averaged 2.53, 2.65 and 2.52. In the following year, for similar groups comprising 481, 472 and 466 females, the percentage returning to service was 17.5, 20.0 and 23.2 resp., and the number of weaned kits per female averaged 2.53, 2.50 and 2.36. 64 females that had regularly exhibited oestrus early in the season in previous years were not allowed to mate during their 1st oestrus, and were mated three times during the 2nd oestrus. 109 similar females were jointed with males on the appearance of 1st oestrus (controls). For the 2 groups resp., the percentage of females returning to service was 7.8 and 10.1, and the number of kits weaned per female 2.8 and 2.7, indicating the possibility of shortening the breeding season and delaying its onset.

Krolikovodstvo i Zverovodstvo, 3, 24, 1980.

2 tables.

CAB-abstract.

In RUSS.



## BREEDING RACCOON DOGS. (CONCLUSION).

## Возвращаясь

## к енотовидной собаке\*

R.L. Akkuratov, E.P. Tret'yakova, A.M. Boitsov.

In the mating period from 15 February to 20 March 70% of females mated in the first 4 weeks. For 110 females, the number not mated was 7, the number not conceiving 8, the number aborting 13, the number of liveborn pups 600, the number of stillbirths 40, the number of pups not surviving to weaning 37, and litter size 7.8. Corresponding data for 64 young females were 4, 5, 8, 370, 27, 31 and 8.4. Oestrous behaviour and mating are described, 70% of females mated once, and 15.3% thrice. Old males each mated with 6-7 females, and young males with 4-5 females. Pregnancy duration was 61 days (58-63). Birth weight of pups was 70-122 g. Growth and development of pups is described. The young born in May were weaned at 35 days of age, and growth terminated in mid-October; any further weight gains were due to fat deposition.

Krolikovodstvo i Zverovodstvo, 6, 10-11, 1980.

2 tables.

CAB-abstract.

In RUSS.

## FERTILITY OF FEMALE SABLES.

## О плодовитости самок соболей

I.G. Zenov.

Data were obtained from records for 1964-78 at one farm and 1966-76 at a 2nd farm, involving 292 and 218 females. At the 1st farm, for females born in a litter of 1, 2, 3, 4, 5 or 6 kits, the percentage of females whelping in all the first 3 breeding seasons was 16.6, 38.1, 38.8, 46.2, 42.7 and 33.3 resp., litter size averaged 2.4, 2.6, 2.8, 3.0, 3.1 and 2.3, and the number of kits weaned per litter from females aged 2-4 years 0.40, 0.99, 1.15, 1.38, 1.31 and 0.89. At the 2nd farm, for females born in a litter of 1, 2, 3, 4 or 5 kits, the percentage of females whelping in all the first 3 breeding seasons was 28.6, 39.4, 49.5,

43.5 and 49.0 resp., litter size averaged 2.3, 2.8, 2.9, 3.4 and 2.9, and the number of kits weaned per litter 0.66, 1.10, 1.41, 1.50 and 1.42. The greatest annual kit production was obtained for daughters born in litters of 5 to dams aged 4 years (1.08 kits), and the smallest (0.44 kits) for daughters born in litters of 1 to dams aged 12-14 years.

Krolikovodstvo i Zverovodstvo, 4, 15, 1980.

2 Tables.

CAB-abstract.

In RUSS.

## FROM THE OVUM TO A BLUE FOX CUB.

### 1. DEVELOPMENT OF THE FOETUS.

#### Från äggcell till blårävsvalp. I. Fosterutveckling.

Maija Valtonen, W.A. King, I. Gustavsson, Auli Mäkinen.

An illustrated account is given of implantation and foetal development in blue foxes. For pt. 2 see Finsk Pälstidskrift 18, 296-297.



Finsk Pälstidskrift, 18, 5, 253-255, 1984.

7 figs., 2 references.

CAB-abstract.

In SWED.

FROM THE OVUM TO A BLUE FOX CUB.

2. EMBRYO MORTALITY.

Från äggcell till blårävsvalp. II. Fosterdödlighet.

Maija Valtonen, W.A. King, I. Gustavsson, Auli Mäkinen.

For 7 blue fox females examined on day 3, 5, 7, 10, 12, 14 or 17 of gestation, the number of corpora lutea was 15, 16, 18, 13, 11, 16 and 18 resp., and the number of embryos 12, 14, 15, 10, 8, 15 and 14. Overall preimplantation embryo losses were 18%. For 8 females examined on day 17, 19, 21, 23, 26, 30, 30 and 48 of gestation, the number of corpora lutea was 18, 16, 19, 15, 17, 18, 24 and 14 resp., and that of fetuses 8, 11, 16, 12, 13, 16, 18 and 7. The overall preimplantation + postimplantation embryo losses were 28%.

Finsk Pälstidskrift, 18, 6, 296-297, 1984.

4 figs., 2 references.

CAB-abstract.

In SWED.

100,000 FOX CUBS WERE PRODUCED FROM INSEMINATIONS THIS YEAR.

(100.000 rävsvalpar producerade med inseminering i år)

Maija Valtonen.

Of 20,639 fox females inseminated once in 1984 in Finland, 55.6% conceived vs. 68.6% of 2776 females inseminated twice, and 79.5% of 2918 females inseminated and mated. In the 3 groups resp., 5.5, 3.1 and 1.8% of females killed their young soon after parturition; the number of cubs per inseminated female averaged 3.71, 4.81 and 6.88, and that per female whelping 6.68, 7.07 and 8.65.

Approximately 88% of inseminated females were blue fox females inseminated with silver fox semen. Data are tabulated by district.

Finsk Pälstidskrift, 18, 11, 548, 1984.

2 tables.

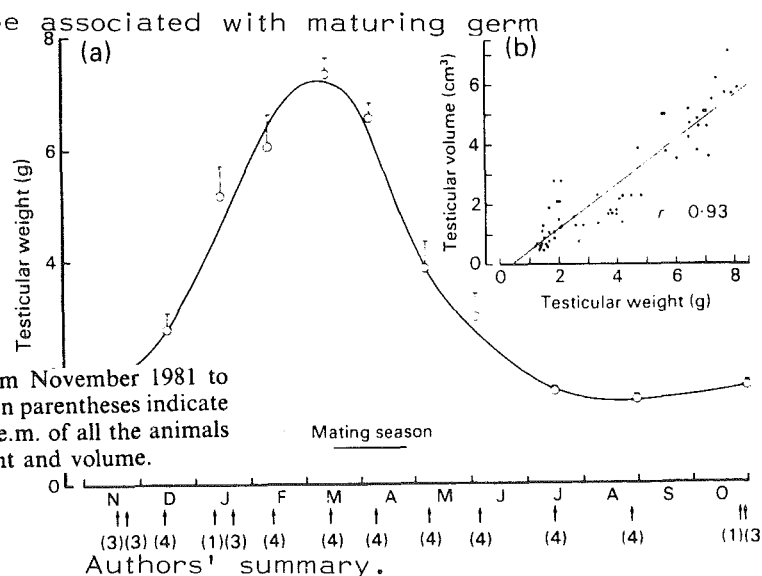
CAB-abstract.

In SWED.

SEASONAL CHANGES IN SPERMATOGENESIS IN THE BLUE FOX  
(*ALOPEX LAGOPUS*), QUANTIFIED BY DNA FLOW CYTOMETRY AND  
MEASUREMENT OF SOLUBLE  $Mn^{2+}$ -DEPENDENT ADENYLATE  
CYCLASE ACTIVITY.

A.J. Smith, O.P.F. Clausen, B. Kirkhus, T. Jahnsen, O.M. Møller,  
V. Hansson.

The testes of the blue fox (*Alopex lagopus*) showed marked seasonal variations in size. Testicular weight and volume increased rapidly during January and February to reach maximal values by the beginning of the breeding season ( $\sim$  15 March). During May and June the weights and volumes of the testes declined gradually to the quiescent state which lasted from July until October. Quantitation by DNA flow cytometry of the seasonal changes in the relative numbers of haploid (1C), diploid (2C) and tetraploid (4C) cell numbers in the testis showed that the increase in testis size from December to February was associated with a rapid expansion of the haploid cell compartment as spermatogenesis resumed. In addition, an increase in number of more mature cell types within the haploid cell population was observed over a 2-month period before the breeding season. The decline in testicular size from the middle of April until October was associated with a reduction in both the absolute and relative sizes of the haploid and tetraploid cell populations and a concomitant increase in the relative numbers of diploid cells. Measurements of the activity of the soluble  $Mn^{2+}$ -dependent adenylate cyclase revealed seasonal variations that closely paralleled those of the haploid cell population, indicating that, as in other species, the enzyme may be associated with maturing germ cells.



Text-fig. 1. (a) Testicular weights of 46 blue fox males castrated from November 1981 to October 1982. The arrows depict the dates of castration and the figures in parentheses indicate the number of animals castrated on each date. Values are means  $\pm$  s.e.m. of all the animals castrated in a given month. (b) Relationship between testicular weight and volume.

J.Reprod.Fert. 72, 453-461, 1984.

6 figs., 16 references.

SEASONAL REPRODUCTIVE ENDOCRINE PROFILES IN TWO WILD MAMMALS:  
THE RED FOX (*VULPES VULPES* L.) AND THE EUROPEAN BADGER (*MELES  
MELES* L.) CONSIDERED AS SHORT-DAY MAMMALS.

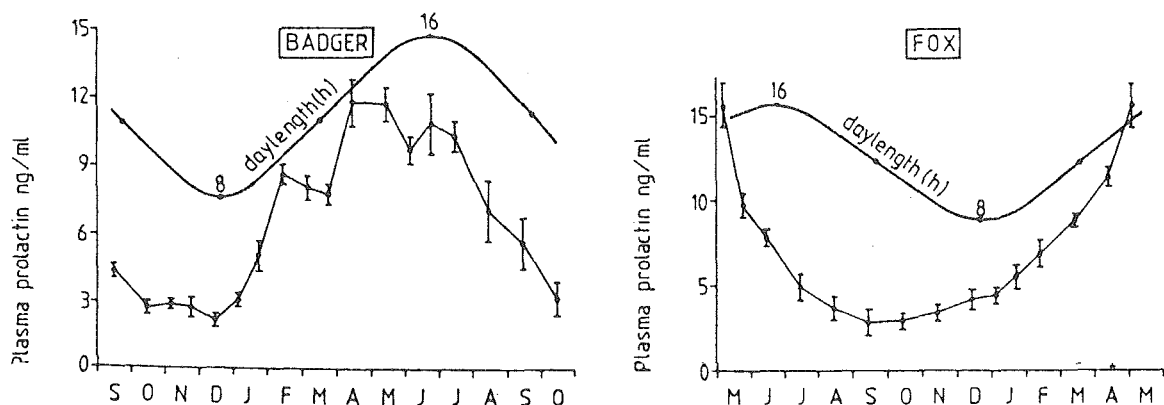
D. Maurel, A. Lacroix, J. Boissin.

The annual cycle of the testicular function (testis and epididymis weights and plasma testosterone levels) were considered in relation to seasonal variations in plasma LH and prolactin concentrations in two wild European mammals: the badger and the fox. Phase relationships were established between the annual prolactin cycles and daylight duration. The influence of castration on the seasonal variations in plasma LH levels was also studied. The resumption of activity in the testicular function occurs during autumn for both species. The reproduction period begins in winter but it is over by the beginning of spring for the fox whereas for the badger it lasts until early summer. In the same way, the annual cycle of the gonadotrophic function which, in the fox, presents only one maximum at the end of autumn, is bi-modal in the badger with one maximum in January and a second in June. On the other hand, both species have a similar annual prolactin cycle, which shows an increase from the winter solstice onwards, in synchronization with the increase in daily light duration. The highest prolactin levels are measured in spring followed by a decrease during summer. This result call into question the role played by prolactin in the regulation of testicular function in as far as the two species have an annual reproductive cycle of the "short-day" type (onset of activity occurring before the winter solstice) but show seasonal prolactin variations similar to those described for "long-day" species.

Acta Endocrinologica (Denmark), 105, 1, 130-138, 1984.

1 table, 3 figs., 28 references.

Authors' abstract.





**ROLE OF LIPOPROTEINS AND PROLACTIN IN LUTEAL FUNCTION  
IN THE FERRET.**

P.E. Mc Kibbin, K. Rajkumar, B.D. Murphy.

The study investigated luteal function *in vitro* during early pregnancy and pseudopregnancy in the ferret. Corpora lutea taken from animals on Day 13 following the ovulatory stimulus (mating or gonadotropin treatment) were dissociated with collagenase and incubated with ovine prolactin (Prl), ovine luteinizing hormone (LH), total lipoprotein fraction from canine serum, canine high-density lipoproteins (HDL), canine low-density lipoproteins (LDL) or combinations of Prl, LH, HDL and LDL. Total lipoproteins produced statistically definable increases in progesterone accumulation in incubation media at 5  $\mu$ l (approx. 50  $\mu$ g protein) through 25  $\mu$ g (250  $\mu$ g protein) of the total lipoprotein solution. LDL in doses of 1 or more  $\mu$ g protein stimulated progesterone accumulation in 2-h incubations and a similar stimulation was observed in the presence of 60 or more  $\mu$ g HDL. Prl, LH or the combination of Prl and LH had no apparent stimulatory influence on progesterone accumulation *in vitro*. Prl in combination with LDL further stimulated progesterone output by luteal cells in short-term incubation relative to LDL alone. Prl and LH together with LDL produced an increase in stimulation over LDL alone, but, for the most part, this augmentation did not exceed that recorded in the presence of the combination of Prl and LDL. No interactions between HDL and luteotropic hormones were present. The results indicate that lipoproteins increase progesterone output from ferret luteal cells, presumably by providing substrate for steroid hormone synthesis. No direct role for LH in ferret luteal function emerged from these experiments. The interaction between Prl and LDL suggests that Prl may exert its luteotropic effects in this species by increasing uptake or liberation of lipoprotein-borne cholesterol to allow it to enter hormone synthetic pathways.

Biology of Reproduction, 30, 1160-1166, 1984.

5 figs., 3 references.

Authors' abstract.

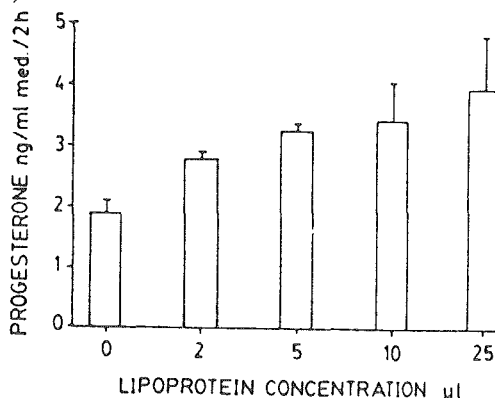


FIG. 1. Mean ( $\pm$  SEM) progesterone accumulation in media from incubation of ferret luteal cells ( $5.0 \times 10^5$ /tube) with 0 to 25  $\mu$ l total canine lipoproteins. Protein concentration of lipoprotein solution was 9.95 mg/ml. Each bar represents the mean of triplicate incubations in three separate trials.

## REPRODUCTION IN FOXES.

### I. COLLECTION OF SEMEN AND SOME OF THE PARAMETERS IN THE SEMEN: A PRELIMINARY REPORT.

(Reproduktion hos ræv. I. Sædopsamling og nogle parametre i rævesæd.  
Foreløbig meddelelse.)

Ib J. Christiansen, Tove Cleemann, Mette Schmidt.

A survey is given of the procedure of semen collection from foxes by digital manipulation, the equipment used and characteristics of the collected semen, the easiness and the duration of the procedure.

Årsberetning, KVL, Inst. for Sterilitetsforskning, Denmark, 27, 195-201, 1984.

6 tables, 1 fig., 1 reference.

Authors' summary.

In DANH. Summary: ENGL.

## REPRODUCTION IN FOXES.

### II. THE OCCURRENCE OF ABNORMAL SPERMATOZOA IN SEMEN. A PRELIMINARY REPORT.

(Reproduktion hos ræv. II. Forekomst af morfologisk forandrede spermier i rævesæd. Foreløbig meddelelse.)

Ib. J. Christiansen, Tove Cleemann, Mette Schmidt.

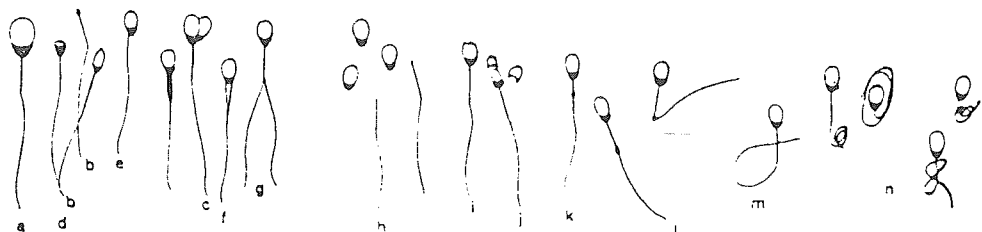
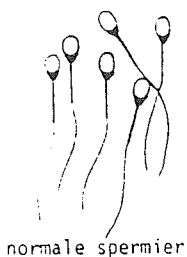
A survey is given of the occurrence of abnormal spermatozoa in ejaculates from 39 foxes. The most frequently occurring abnormalities comprised distal and proximal droplets. In average 23.3% of the spermatozoa were abnormal.

Årsberetning, KVL, Inst. for Sterilitetsforskning, Denmark. 27, 202-207, 1984.

2 tables, 2 figs., 3 references.

Authors' summary.

In DANH. Summary ENGL.



### REPRODUCTION IN FOXES.

#### III. BACTERIAL FLORA OF THE PENILE SURFACE AND IN SEMEN FROM FOXES. A PRELIMINARY REPORT.

(Reproduktion hos ræv. III. Bakterief flora på penisslimhinden og i sæd fra ræv. Foreløbig meddelelse).

Ib J. Christiansen, Jens Laurits Larsen, Tove Cleemann, Mette Schmidt.

The bacteriological investigation of semen and specimens from the penile surface of 39 foxes has shown that micrococci and streptococci were isolated in nearly all specimens and that other bacteria as well were isolated from specimens originating from only a few foxes. Due to lack of information concerning the physiological contamination, it is not possible from this investigation to draw any conclusion on the consequence for the reproductive capability or capacity. Further investigations are in progress.

Årsberetning, KVL, Inst. for Sterilitetsforskning, Denmark. 27, 208-213. 1984.

6 tables, 4 references.

Authors Summary.

In DANH. Summary ENGL.

### REPRODUCTION IN FOXES.

#### IV. EXTENDERS FOR DILUTION OF SEMEN MEANT FOR DEEP-FREEZING AND THE RESULTING MOTILITY OF THE SPERMATOZOA. A PRELIMINARY REPORT.

(Reproduktion hos ræv. IV. Fortyndingsvæsker og deres indflydelse på spermimotiliteten i forbindelse med dybfrysning af sæd. Foreløbig meddelelse).

Ib J. Christiansen, Tove Cleemann, Mette Schmidt.

Out of several extenders investigated it seems that Tris-extender with egg-yolk and glycerol results in the best survival of the spermatozoa after deep-freezing and thawing.

Årsberetning, KVL, Inst. for Sterilitetsforskning, Denmark, 27, 214-219, 1984.

1 table, 7 references.

Authors Summary.

In DANH. Summary ENGL.

# Mineral Concentrations in the Hair of Natural Dark and Pastel Mink (*Mustela vison*)<sup>1</sup>

T. C. Hornshaw, R. J. Aulerich and R. K. Ringer, Department of Animal Science and M. B. Martin, Animal Health Diagnostic Laboratory, Michigan State University, East Lansing, MI 48824-1225

## Summary

Natural dark and pastel mink were fed a basal diet, a basal diet supplemented with 200 ppm Cu or 500 ppm Zn, or a commercial pelleted diet to determine effects on the mineral content of their hair. The addition of Cu or Zn to the diet did not result in significant increases in these minerals in the hair of the mink, although added Zn did result in significant increases in the concentration of Fe and Mn in the hair. The pelleted diet differed from the basal diet only in the concentrations of Fe and Mn, and these differences were reflected in the content of Fe and Mn in the hair. The most striking results of this experiment, however, were the large differences found in the concentration of Ca, Cu, Mg, K, Na and P in the hair of the natural dark and pastel color phases of mink.

*Key words:* Mink, Hair, Minerals.

## Introduction

The quality of mink fur is of prime importance to the rancher, as fur is the product marketed. Many factors, including nutrition, have a profound effect on fur quality. Changes in hair quality and quantity may be caused by deficiencies or excess of various vitamins and minerals. Alopecia and/or achromatrichia have been reported as clinical signs associated with deficiencies of iron (1) and copper (2). Because of complicated interactions among minerals, an excess of one mineral may result in a deficiency of another mineral causing abnormalities (2). Still other fur disorders, such as fur clipping, red hip, metallic fur defect, wet belly etc., may also have nutritional implications.

In some species, including man, analysis of hair has proven useful in the assessment of nutritional status. Hair, as a biopsy material, is readily obtained and far less hazardous to the animal than using other tissues. It is also easily stored and does not deteriorate readily. In humans, it has been shown that copper (Cu) and zinc (Zn) concentrations in hair can be changed by dietary modification. Significant correlations between Cu in hair and heart, kidney and liver have been reported in

rats (3). Normal mineral concentrations for mink hair, however, are lacking and the use of hair as a diagnostic tool for mink has not been explored. This study was performed to: (1) ascertain mineral concentrations in hair of mink fed various diets, (2) correlate the hair mineral values with dietary concentrations of these minerals, (3) determine the effect of supplemental dietary Cu and Zn on the concentrations of these minerals in hair, and (4) compare the hair mineral concentrations of natural dark and pastel mink.

## Methods and materials

### *Animals and diets*

Thirty-two juvenile, male natural dark and pastel ranch mink (age approximately 10 weeks) were randomly divided into four groups, with four dark and four pastel mink in each group. The mink were placed on the following dietary treatments for 110 days beginning August 4, 1983:

- Group 1 - Basal mink diet (see Table 1). Control.
- Group 2 - Basal diet supplemented (wet basis) with 200 ppm copper<sup>2</sup>.
- Group 3 - Basal diet supplemented (wet basis), with 500 ppm zinc<sup>3</sup>.
- Group 4 - Commercial mink pellets<sup>4</sup>.

Routine commercial mink farm procedures were followed in caring for the animals. Feed and water were provided *ad libitum*. The mink were weighed at the start and termination of the study.

### *Hair sampling and analysis*

At the termination of the experiment (by which time the animals had entirely shed their summer pelage and were in full winter coat), 3-4 g of hair were cut with scissors from the mid-dorsal surface of the back of the animals for analysis of mineral content.

The hair samples were analyzed in duplicate and the diet samples were analyzed in triplicate due to the heterogeneous nature of the diets. The samples were prepared for mineral analysis as follows: 0.25 g of unwashed hair or 1.00 g of diet were ashed overnight in

Table 1. Composition and proximate analysis of basal diet

Ingredient	Percentage
Commercial mink cereal*	16.7
Whole chicken	20.0
Ocean fish scrap mix**	12.5
Beef tripe	6.7
Beef liver	3.3
Beef lungs	3.3
Beef trimmings	3.3
Cooked eggs	3.3
Added water	30.9
	100.0
<i>Proximate analysis***</i>	
Moisture	68.40
Protein	14.30
Fat	7.91
Ash	2.54
	93.15

\* XK-40, ZK Mink Foods, Inc., Thiensville, WI.

\*\* Consists of cod, haddock and flounder: National Fur Foods, New Holstein, WI.

\*\*\* analyzed by Rosner/Runyon Laboratories, Inc., Chicago, IL.

30 ml Tuf-Trainers<sup>5</sup> at 80° C with concentrated nitric acid<sup>6</sup> (4). It was felt that since mink are clean animals and were housed individually washing of hair samples prior to analyses was unnecessary as it may have lead to leaching of certain minerals (5). The ashed samples were diluted by a factor of 20, and 10 ppm of yttrium<sup>7</sup> were added as an internal standard. The samples were analyzed for Al, As, B, Ba, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, P, Pb, Sb, Se, Tl and Zn by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES)<sup>8</sup>. The operating conditions were:

Forward power = 1.1 KW

Reflected power = < 5W

Coolant flow (Ar) = 18 l/min.

Sample flow (Ar) = 0.5 l/min.

Sample flow into nebulizer = 1.0 ml/min.

The ICP-AES system was interfaced to a PDP-8A computer and the data were analyzed by a program supplied by Jarrell-Ash<sup>9</sup>.

Elements not detectable at the dilution factor of 20X were (detection limit, ppm): B (0.2), Ba (0.2), Cd (0.4), Co (2), Hg (4), Pb (2), Sb (2), Se (10) and Tl (10). The approximate limits of detection at the 20X dilution factor for the remaining elements were (ppm): Al (2.0), As (2.0), Ca (2), Cr (0.4), Cu (0.2), Fe (2), K (1000), Mg (1), Mn (0.2), Mo (0.4), Na (10), P (2) and Zn (0.2).

#### Statistical analyses

The data were analyzed by a two-factor (fur color and diet) analysis of variance, and significant differences

were tested by Dunnett's method for comparison with control of Bonferroni's method for comparison of means (6).

#### Results and discussion

There were no significant differences in body weight gains of the mink between the various groups nor were any clinical signs of Zn or Cu toxicity noted during the study.

The concentrations of the various minerals in the diets and hair of the two color varieties of mink are shown in Table 2. The concentrations in the diets are expressed on a dry weight basis, based on 68.4% water in the basal and supplemented diets and 8% water in the pellets.

Perhaps the most striking results from the study were the large differences in the Ca, Cu, Mg, K, Na and P concentration in the hair of the two color varieties of mink. While the effect of hair color on mineral concentration of hair has not been studied in great detail, other investigators have reported marked differences in the mineral concentration of hair of various colors in animals of the same species. Schroeder and Nason (7) found concentrations of 183 and 37 ppm Mg in human black and brown hair, respectively, and equal concentrations of Zn in the two hair colors. These results are in close agreement with the findings of this study. Combs *et al.* (8) summarized factors which influence the mineral concentrations of hair, and reported that Ca, Mg, K and Na appear to be most influenced by hair color, with these four minerals appearing in higher concentrations in the more pigmented hair. Since these four minerals were also all higher in concentration in the hair of the natural dark mink, it may be that these macronutrients, and also P, vary with the total amount of melanin in the hair or with the proteins associated with the melanins. It is, however, not presently understood how different pigments are expressed via the melanins (9), thus, it is difficult to say with certainty how the coloration of hair affects the concentration of macronutrients in hair.

In regard to Cu and Mn, Combs *et al.* (8) concluded that Cu concentrations in hair were not affected by color, and Cotzias *et al.* (10) and Hambidge *et al.* (11) both found strong correlations between hair color and Mn content. Hambidge *et al.* (11) reported that black hairs had twice as much Mn as white hairs from the same rabbit. These results are not in agreement with those observed for Cu and Mn in this study. It may be that, for these micronutrients, strain specific differences are more important in determining a mineral's concentration in different color hair than they are for macronutrients.

Comparisons of the mineral concentrations of the basal and pelleted diets (on a dry weight basis), revealed major differences between the two in Fe and Mn and possibly in Cu content. The higher concentrations of Fe and Mn in the pelleted diet were reflected in higher concentrations of Fe ( $P < .05$ ) and

Table 2. Concentrations of minerals found in diets and hair of natural dark and pastel mink.

Dietary group	Mink hair color	No.	Mineral concentration <sup>a,b</sup> (ppm)												
			Al	Ca	Cu	Fe	Mg	Mn	Zn	K	Na	P (total)	Mo	Cr	As
I. Basal (control)			150	19950	24	438	2290	21	69	6600	6030	14100	Tr <sup>d</sup>	1.2	ND
	Dark	4	3.2	920	8.1	57	148	0.37	278	1640	912	575	Tr	ND <sup>e</sup>	ND
	Pastel	4	4.6	240	7.9	62	42	0.40	263	1010	742	400	ND	Tr	ND
	Combined <sup>c</sup>	8	3.9	---	---	59	---	0.38	270	---	---	---	---	---	---
II. Basal + Cu			105	12900	588	363	1260	20	54	6300	5610	11400	Tr	1.5	ND
	Dark	4	6.2	912	9.1	82	147	0.59	250	1560	916	590	ND	ND	ND
	Pastel	4	4.6	254	8.1	75	44	0.46	257	1000	783	431	ND	Tr	ND
	Combined	8	5.4	---	---	79	---	0.53	254 <sup>g</sup>	---	---	---	---	---	---
III. Basal + Zn			114	23100	16	390	1440	20	1497	5850	5940	17400	Tr	1.5	ND
	Dark	4	6.0	1014	9.1	110	193	0.70	302	1900	1412	678	Tr	ND	ND
	Pastel	4	7.4	280	8.0	100	50	0.59	304	1080	807	441	ND	Tr	ND
	Combined	8	6.7	---	---	105 <sup>**</sup>	---	0.64 <sup>*</sup>	303 <sup>g</sup>	---	---	---	---	---	---
IV. Pellets			150	24780	13	685	2010	27	68	6630	7920	16520	Tr	0.9	ND
	Dark	4	5.6	1035	8.6	100	179	0.67	286	1720	814	631	Tr	ND	ND
	Pastel	4	4.4	274	7.7	88	50	0.54	283	931	483	452	ND	Tr	ND
	Combined	8	5.0	---	---	94 <sup>*</sup>	---	0.60	285	---	---	---	---	---	---
SEM <sup>f</sup>			±0.96	±69.8	±0.29	±9.7	±12.8	±0.066	±12.4	±142.1	±172.7	±32.4	---	---	---

a Analyzed by atomic emission spectroscopy. See text for limits of detection for minerals.

Minerals not detectable were B, Ba, Cd, Co, Hg, Pb, Sb, Se, and Tl.

b Dry weight basis, for diets.

c Color varieties were combined where differences were nonsignificant ( $P > 0.05$ ).

d Trace.

e Not detected.

f Standard error of the mean =  $\sqrt{msE/8}$  for minerals in which color varieties are combined and  $\sqrt{msE/4}$  for minerals in which color varieties are different.

g Means with same superscript are significantly different ( $P \leq 0.05$ ).

\* Significantly different from control ( $P \leq 0.05$ ).

\*\*Significantly different from control ( $P \leq 0.01$ ).

Mn ( $P < .10$ ) in the hair. (Fe was added as iron oxide and ferrous sulfate in the pellets used in this study).

The addition of Cu and Zn to the basal diet of mink did not result in a significant accumulation of either mineral in the hair. Similar results have been reported by Anke (12) for cows fed supplemental Cu (although the added Cu was found to increase the P concentration of the hair, a result not noted in this study). On the other hand, supplemental Zn in the diets of rats (13, 14) has been shown to result in dose-dependent increases of Zn in the hair, although the concentration was shown to be much more responsive to dietary deficiency than excess. Combs *et al.* (14) also reported linear responses for Fe, K and Mg in hair with increasing dietary concentrations of Zn. K and Mg were increased and Fe decreased with increased concentrations of Zn. Similar (but not significant at  $P < .05$ ) results were noted for K and Mg in this study, while the results for Fe were the opposite. The increased iron content of hair of mink fed the pelleted diet is probably not a consequence of the amount of Zn as in the Zn supplemented diet but rather a reflection of the amount of iron in the diet. In view of the many interactions between Cu, Fe and Zn which occur within the body (see (15) for a review of these interactions), a more precise explanation of the increase in Fe content in the hair of mink fed the Zn-supplemented diet would require further study.

Comparison of the Cu and Zn concentrations in the diets and hair of the mink points to the relationship that exists between these two minerals. While neither diet produced a significant difference from the control values in the concentration of Cu or Zn in the hair, there was a significant difference in the Zn content of the hair of the mink fed the two supplemented diets (see Table 2). The added Cu tended to decrease the concentration of Zn in the hair, while the supplemental Zn increased the Zn content of the hair. Similar results however, were not observed in the concentration of Cu in the hair of mink fed the Cu- or Zn-supplemented diets.

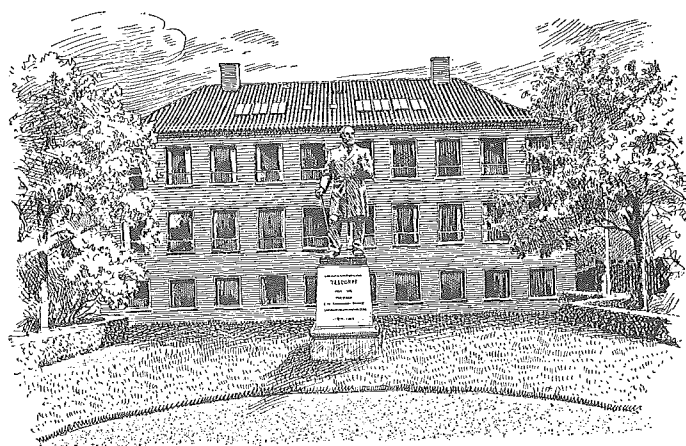
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**Footnotes**

- <sup>1</sup> This research was supported in part by the Mink Farmers Research Foundation, Thiensville, WI and by funds from the Michigan State University Agricultural Experiment Station for purchase of the Plasma Emission Spectrometer and is published with the approval of the Michigan State Agricultural Experiment Station as Journal Article No. 11364.
- <sup>2</sup> Analytical reagent  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , Mallinckrodt Chemical Co., Paris, KY.
- <sup>3</sup> Analytical reagent  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ , Mallinckrodt Chemical Co., Paris, KY.
- <sup>4</sup> XK-100, XK mink Foods, Inc., Thiensville, WI.
- <sup>5</sup> Pierce Chemical, Rockford, IL.
- <sup>6</sup> Baker Instra-Analyzed, J. T. Baker Chemical Co., Phillipsburg, NJ.
- <sup>7</sup> Aldrich Chemical Co., Milwaukee, WI.
- <sup>8</sup> ICP, Jarrell-Ash Model 955 Plasma Atomcomp; Generator, Jarrell-Ash Model 2500 R. F. Generator, Allied Chemical Corp., Waltham, MA.
- <sup>9</sup> Jarrell-Ash Software, Allied Chemical Corp., Waltham, MA.

**SCIENTIFUR, VOL. 9, No. 3, 1985.**







## NUTRITION

### CHARACTERISTIC SECRETORY RESPONSE OF THE EXOCRINE PANCREAS IN VARIOUS MAMMALIAN AND AVIAN SPECIES.

Etsumori Harada, Kyoko Nakagawa, Seiyu Kato.

1. Secretory responses induced by vagal stimulation, intravenous injection of CCK-PZ and intraduodenal infusion of synthetic trypsin inhibitor were investigated in the exocrine pancreata of pentobarbital anesthetized rats, pigs, rabbits, sheep, mink, ducks and chickens.
2. The pigs and rats secreted amylase-rich juice, which was controlled vagally or hormonally.
3. The mink and rabbits secreted protease-rich juice, which was controlled hormonally.
4. The ducks and chickens secreted amylase- and chymotrypsin-rich juice, which was controlled weakly by the vagus and hormones.

Table 2. Changes in the ratios of amylase, trypsin and chymotrypsin to protein in the pancreatic juice evoked by vagal stimulation and CCK-PZ injection

Species	Amylase protein (mU $\mu$ g)		Trypsin protein ( $\mu$ U $\mu$ g)		Chymotrypsin protein ( $\mu$ U $\mu$ g)	
	Vagus	CCK-PZ	Vagus	CCK/PZ	Vagus	CCK-PZ
Rat	666.1 $\pm$ 56.8 (5)	711.6 $\pm$ 49.6 (8)	164.2 $\pm$ 13.5 (5)	186.8 $\pm$ 15.2 (8)	—	12.8 $\pm$ 5.2 (4)
Pig	894.6 $\pm$ 134.0 (5)	736.7 $\pm$ 70.7 (5)	697.0 $\pm$ 113.6 (5)	920.1 $\pm$ 325.0 (5)	0.38 $\pm$ 0.21 (5)	0.27 $\pm$ 0.09 (5)
Rabbit	190.1 $\pm$ 34.8 (4)	241.6 $\pm$ 19.7 (5)	—	1350.0 $\pm$ 116.0 (5)	—	0.97 $\pm$ 0.05 (4)
Sheep	92.6 $\pm$ 9.7 (4)	98.0 $\pm$ 10.9 (4)	560.1 $\pm$ 35.0 (4)	545.3 $\pm$ 31.6 (4)	25.9 $\pm$ 2.7 (4)	26.8 $\pm$ 5.9 (4)
Mink	131.1 $\pm$ 11.7 (4)	169.1 $\pm$ 14.1 (5)	614.7 $\pm$ 230.0 (3)	954.8 $\pm$ 169.3 (4)	7.5 $\pm$ 0.1 (3)	22.3 $\pm$ 8.4 (4)
Duck	840.3 $\pm$ 473.0 (5)	773.9 $\pm$ 65.2 (7)	240.1 $\pm$ 19.7 (5)	280.6 $\pm$ 45.0 (7)	64.2 $\pm$ 6.2 (5)	57.9 $\pm$ 7.4 (7)
Chicken	881.0 $\pm$ 69.2 (4)	745.5 $\pm$ 211.0 (4)	74.9 $\pm$ 20.7 (4)	89.9 $\pm$ 33.2 (4)	21.4 (2)	25.6 $\pm$ 1.7 (3)

Numbers in parentheses indicate the number of animals.  
Mean  $\pm$  SE of the mean.

Comp. Biochem Physiol, Vol. 73A, 3, 447-453, 1982.

2 tables, 3 figs., 31 references.

Authors' abstract.

## AMMONIUM SULPHATE IN THE DIET FOR YOUNG MINK.

Сернокислый аммоний в рационе молодняка  
норок

B.A. Isupov.

Young mink fed on diets containing digestible protein 6.0 to 6.7, fat 3.9 to 4.6 and carbohydrate 8.0 g/100 kcal metabolizable energy (ME) and supplemented with ammonium sulphate 0.3 to 0.5 g/10 kcal ME developed satisfactorily and produced pelt of improved quality.

Krolikovodstvo i Zverovodstvo, 6, 9-10, 1983.

1 table.

CAB-abstract.

In RUSS.

## COMPOUNDING OF RATIONS OF NUTRIA.

СОСТАВЛЕНИЕ РАЦИОНОВ  
ДЛЯ НУТРИЙ

V.F. Kladovshchikov.

Tables give the nutrient requirements of nutria in relation to age and physiological state, nutrient composition of traditional feeds and feed intake of nutria. The tables are a guide to compounding of rations for nutria.

Krolikovodstvo i Zverovodstvo, 1, 27-28, 1984.

4 tables.

CAB-abstract.

In RUSS.

SUN RISE.



HOUNE PISSEK

## USE OF CHLAMYDOMONAS BIOMASS AS A BIOLOGICAL STIMULATOR OF GROWTH AND DEVELOPMENT OF ANIMALS.

О ПРИМЕНЕНИИ БИОМАССЫ ХЛАМИДОМОНАД В КАЧЕСТВЕ  
БИОСТИМУЛЯТОРА РОСТА И РАЗВИТИЯ ЖИВОТНЫХ

V.M. Sorokin.

Mink on a basal diet supplemented with chlamydomonas paste gained 18 to 23.7% more in bodyweight and had 10 to 27% greater concentration of albumin in serum than mink fed on the basal diet alone.

Uzbekskii Biologicheskii Zhurnal, 5, 69-70, 1982.

1 table. 1 reference.

CAB-abstract.

In RUSS.

## VITAMIN C FOR FUR ANIMALS.

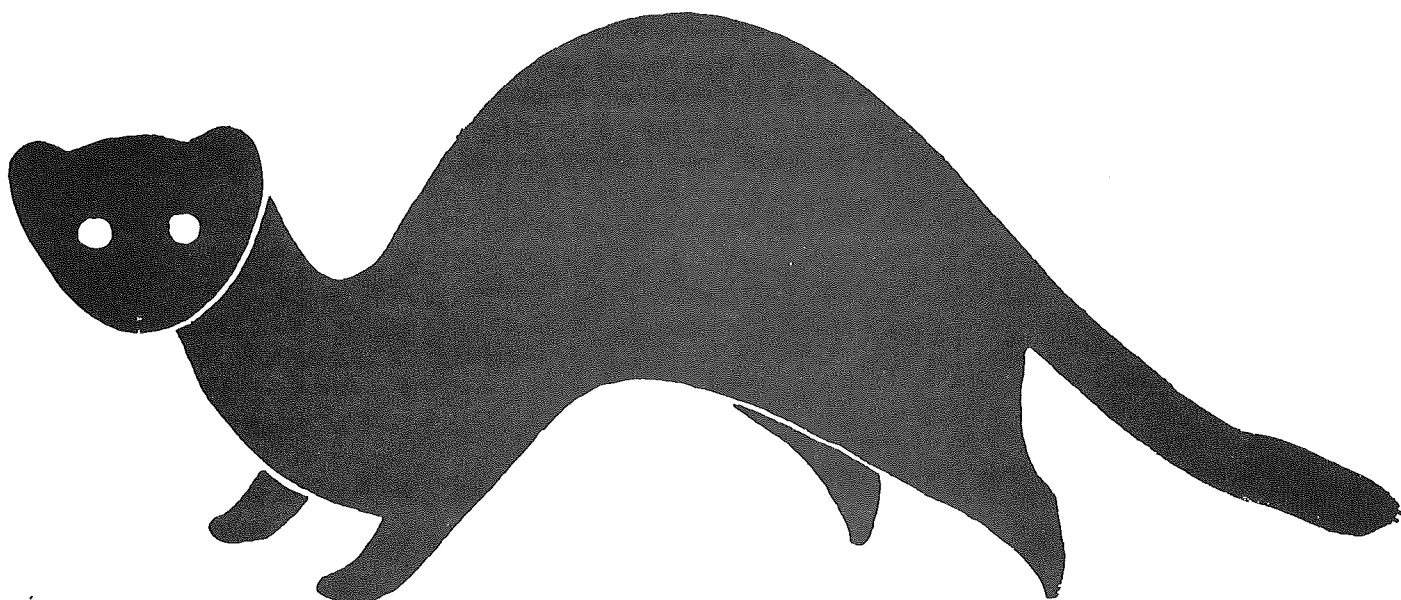
(C-vitamin til pelsdyr?)

Asbjørn Brandt.

Female mink given ascorbic acid 500 mg/Mcal feed had significantly more ascorbic acid in blood plasma and milk than mink given no added vitamin. There was no effect on blood picture in the female mink or in male offspring after weaning.

1 table, 1 reference.

CAB-abstract.



Mink fodder stabilized with an antibiotic

By

J.G. Engel &amp; Jørgen Schou

A Support in June ... A Clinical Observation.

Dansk Pelsdyr Avl No. 5, 20 May, 1984

(In DANH)

Problems of the suckling period: Diarrhoea in the nursing bitches, deaths amongst these and "greasy" puppets are well known phenomena in many minkfarms during the month of June. The sum of these difficulties is of course a depression of the production result.

J.G. Engel, Work manager, Sorø, and Jørgen Schou, veterinarian, Snertinge, describe those problems from a big Zealand minkfarm with 130.000 minks with a weak status of plasmacytosis. A spot test showed that 94% of the herd reacted positively. This herd was especially sensitive to all kinds of difficulties, and this was the background for improving the bacteriologic stability of the fodder in a period during which the bitches as well as the puppets are most vulnerable - in acknowledgement of an almost linear relation between the puppets' weight at the age of 7-8 weeks and the fur size at skinning - other things being equal.

Linco-Spectin Premix in a concentration of 1 kilo per ton fodder for the first two weeks of June and  $\frac{1}{2}$  kilo per ton fodder for the rest of the month was chosen, because a similar trial at Nordjysk Pelsdyrforsøgsfarm (experimental farm) in 1981 had proved fine results. The difference was that we medicated for only 30 days strategically chosen against 5 months on the experimental farm.

The authors emphasize that this is a clinical observation, not a controlled study. Also they are well aware that any antibiotic given in small doses and over a longer period of time carries the risk of self-created resistance problems. At the same time the authors mention that in the poultry production as well as in the pork production feed additives are widely used all through the growth period, and they go through the many theories postulated about the efficacy of the preparations used.

Comparing the production result of this year with those of the previous year it is found that the litters at birth are of equal size for the two years but death amongst the puppets at the time of weaning has fallen dramatically. Death amongst the bitches during the nursing period is reduced from 3,6% to 1,4% - a remarkable reduction. The average weight of the male puppets as per 1 September increases from 1.785 gram to 1.895 gram. and there is a remarkable increase of the fur size at the auction account.

Medicine expenses have been D.kr. 0,85 per produced fur with the dosage in question.

By evaluating the results achieved, the fur farmers' attention is drawn to the fact that the antibiotic used is not a registered feed additive but a veterinary pharmaceutical, primarily used curatively in infectious diseases. During the trial, irritations of the anus or lethal colitis have not been observed as it rarely is when using a macrolide per os in curative doses.

Summary by Bent Christensen

Translation from Dansk Veterinærtidsskrift, 1984, 67, 11 1/6.

(In DANH).

## MERCURY AND SELENIUM IN WILD MINK (*MUSTELA VISON*) FROM NORWAY.

(Kvikksølv og selen i Willmink (*Mustela vison*) fra Norge)

Gunnar Norheim, Tore Sivertsen, Einar M. Brevik, Arne Frøslie.

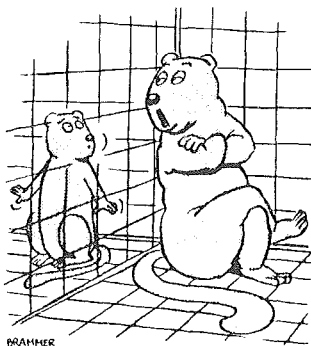
Levels of mercury, methylmercury and selenium were determined in liver samples from wild mink (*Mustela vison*) caught in the Norwegian counties of Rogaland (38 samples), Sogn and Fjordane (15 samples) and Hedmark (18 samples). The average mercury levels from these counties were 2.6, 3.1 and 2.1  $\mu\text{g Hg/g}$  wet weight, respectively. No significant differences in mercury levels were found. The methyl mercury levels (MeHg) were determined in 30 samples. A very strong positive correlation between total mercury (Hg) and methyl mercury ( $r=0.91$ ,  $P < 0.001$ ) was found. The average methyl mercury level was 35 per cent of total mercury. This indicates that wild mink has the ability to demethylate mercury. The selenium levels were determined in 35 samples. A strong positive correlation between the levels of total mercury and selenium ( $r = 0.87$ ,  $P < 0.001$ ) was found. There was no correlation between age or nutritional condition and mercury level. In the present study mink was examined to see if it could be recommended as an indicator species for monitoring the local environment for mercury contamination. No definite answer to this question could be found. The study did reveal, however, that in all the counties studied there are individuals that are considerably contaminated with mercury.

Nord. Vet.-Med. 36, 43-48, 1984.

1 table, 2 figs., 21 references.

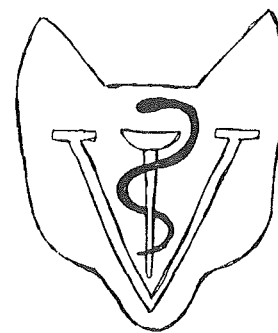
Authors' summary.

In NORG. Summary ENGL.



Don't worry, the Vet. have also mercury  
in his thermometer.





### CARCINOMA OF THE ANAL SAC GLANDS IN RANCH MINK.

W.J. Hadlow.

During a 14-year period, carcinoma of the anal sac apocrine glands was found in 52 pastel and 8 sapphire mink (*Mustela vison*) kept for studies on slow viral diseases. The pastel mink varied in ages from 72 to 135 months (mean age 108 months), the sapphire mink from 63 to 100 months (mean age 81 months). All but one pastel mink were females. The primary tumor varied in size from masses that caused bulges in the perineum to those that were found only after microscopic examination of the anal sac glands. Although the primary tumor grew mainly by expansion with little local infiltration, 41 of the 60 tumors had metastasized to the regional lymph nodes and sometimes also to more distant sites. The striking propensity of the carcinoma to metastasize while still small, even microscopic, often resulted in massive secondary growths, notably in the iliac lymph nodes. Hypercalcemia did not accompany the carcinoma. Its varied microscopic appearance included solid, glandular, squamous cell, and spindle or round cell components. Combinations of them formed mixed or complex histologic patterns, no doubt largely attributable to neoplastic proliferation of myoepithelial cells and squamous metaplasia of the apocrine gland epithelium. Although its cause remains obscure, the carcinoma appeared to arise from small foci of hyperplastic apocrine glands, sometimes in relation to both anal sacs. The tumor is a common and distinctive expression of neoplasia in older ranch mink.

Vet. Pathol. 22. 206-218, 1985.

18 figs., 49 references.

Author's abstract.

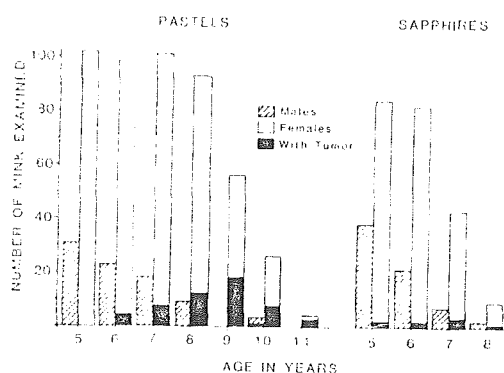


Fig. 1: Age-related prevalence of carcinoma of the anal sac apocrine glands in 870 male and female pastel and sapphire mink 5 to 11 years old.







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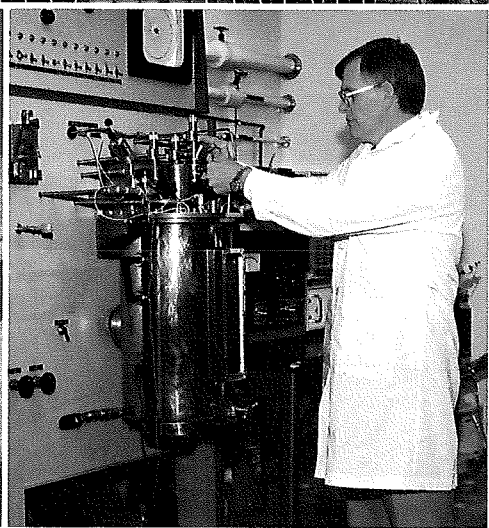
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**AN OUTBREAK OF EXCESSIVE NEONATAL MORTALITY IN FOUR  
DANISH MINK FARMS.**

**I. DESCRIPTIVE EPIDEMIOLOGICAL INVESTIGATIONS.**

Poul H. Jørgensen, Anette G. Bøtner.

An outbreak of increased mortality among mink kits in 4 Danish mink farms in 1982 is described. A comparison with data from 4 non-affected farms revealed obvious differences in neonatal mortality in the period from parturition until May 15th (early neonatal mortality) and in the period from May 15th to June 30th (late neonatal mortality) between the 2 groups of farms. The populations are described in terms of age, origin, types of mink and the extent of transfer of breeding females among the farms. Postmortal examination showed consistent pathological changes, but the etiology and pathogenesis of the diseases is uncertain until now. The increased mortality of kits, however, was accompanied by increasing numbers of Aleutian Disease (AD) positive reactors in the 4 populations.

Acta. vet. scand. 24, 488-498, 1983.

5 tables, 2 figs., 3 references.

Authors' abstract.

In ENGL. Summary in DANH.

**RINGWORM IN FARMED FOXES IN DENMARK**

**(Ringorm hos farm-ræve i Danmark).**

Per Henriksen.

In 1983 an outbreak of skin lesions seen initially on the heads of silver fox cubs on a fur farm in Jutland was diagnosed as ringworm. *Microsporum canis* was identified, thus establishing the presence of this pathogen in furbearing animals in Denmark. Spread of the disease to other litters was observed; it was thought that the prevailing wind carried spore-laden hairs from one to another. Silver foxes appeared to be more susceptible than blue foxes.

Dansk Vet.Tidskr., 67, 3, 1/2, 1984.

1 fig.

CAB-abstract.

In DANH.

## SEROLOGICAL ANALYSES OF DIFFERENT MINK ALEUTIAN DISEASE VIRUS STRAINS.

B. Aasted, B. Avery, A. Cohn.

Four different isolates of Aleutian disease virus have been compared electrophoretically and serologically. These were the DK and Utah 1 isolates, known as highly virulent strains, the Pullman isolate, known as a low virulent strain and the avirulent ADV-G isolate, which is the only strain grown in cell culture.

ADV-G was shown to migrate in agarose electrophoresis 22 per cent slower than the other strains.

Several murine monoclonal antibodies were prepared against each of the isolates. Each one reacted with all 4 of the isolates, but a few showed higher affinity for some of the isolates.

Competitive RIA analyses were also performed, and these studies indicated some serological differences between the 4 strains.

It is concluded that ADV-G polypeptides are chemically different but immunologically cross-reacting with the polypeptides present on the field ADV strains. It is suggested that the small serological differences seen between the field strains might be caused by slightly different in vivo proteolytic degradation of the viral capsid proteins and thus might not be taken as an indication of strain variation.

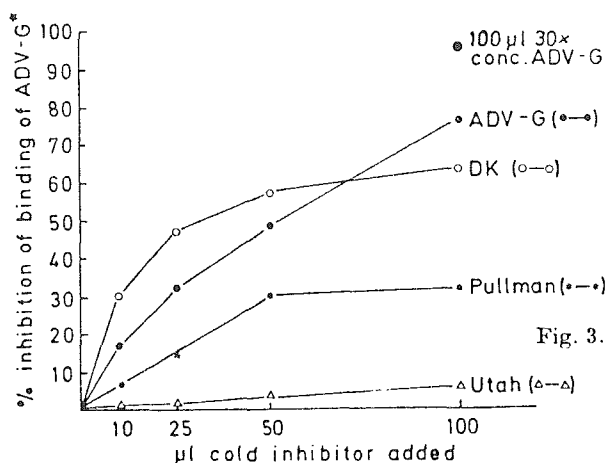


Fig. 3. Inhibition of 55 per cent binding of radiolabelled ADV-G with a mink antibody to DK virus. Inhibitors are indicated on the curve

Archives of Virology, 80, 11-22, 1984.

2 tables, 5 figs., 20 references.

Authors' summary.

**ROLE OF MATERNAL IMMUNITY IN THE PROTECTION OF NEWBORN FERRETS  
AGAINST INFECTION WITH A VIRULENT INFLUENZA VIRUS.**

R.H. Husseini, C. Sweet, H. Overton, H. Smith.

Intranasal infection of newborn ferrets with a virulent strain of influenza virus invariably resulted in their deaths following virus replication to high titre in both lung and nasal turbinates (Collie et al., 1980). However, a similar challenge of newborn ferrets born to mothers immunized by infection with virulent or attenuated viruses resulted in complete protection; no virus replicated in their lungs and little or no virus was isolated from their nasal turbinates. Protection appeared to be antibody-mediated since it was sub-type-specific and milk-derived since newborn ferrets born to non-immune mothers but fostered onto immune mothers exhibited a similar level of protection to neonates born to and suckled by immune mothers.

Immunology, 52, 3, 389-394, 1984.

2 tables, 19 references.

Authors' summary.



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## SUPPRESSION AND ENHANCEMENT OF TRANSFORMATION OF FERRET PERIPHERAL BLOOD MONONUCLEAR CELLS BY MYCOBACTERIA.

C.J. Thorns, J.A. Morris.

The effect of heat killed *Mycobacterium bovis* on the phytohaemagglutinin (PHA) response of normal peripheral blood leucocytes from ferrets was dose dependent. Concentrations of  $10^6$  organisms  $\text{ml}^{-1}$  and below enhanced the response, whereas more than  $10^6$  organisms  $\text{ml}^{-1}$  suppressed it. This suppression correlated with cytotoxicity of *M bovis* for ferret peripheral blood leucocytes. Three environmental strains, *M phlei*, *M smegmatis* and *M aurum* were not cytotoxic and did not affect the PHA response but were found to be mitogenic at high concentrations.

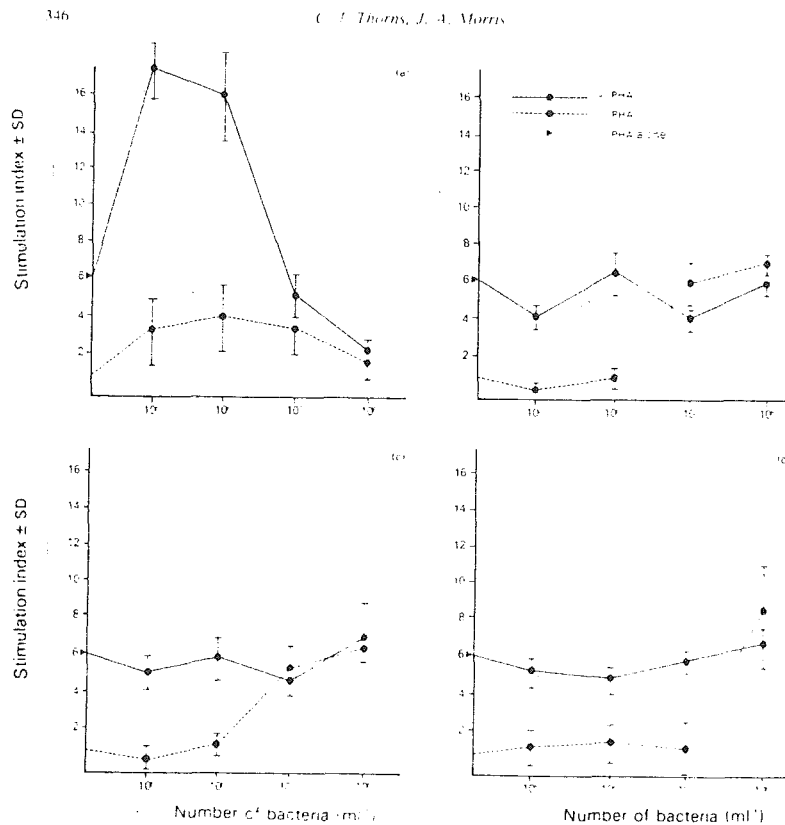


FIG 1: Effect of mycobacteria on the in vitro transformation of normal ferret leucocytes with and without PHA. (a) *M bovis*, (b) *M smegmatis*, (c) *M aurum*, (d) *M phlei*.

Res. in Vet. Sci. 36, 345-347, 1984.

1 fig., 9 references.

Authors' summary.

## NEOPLASTIC DISEASES IN THE COYPU.

(Schorzenia nowofworowe u nutrii).

Zbigniew Michalski, Witold Scheuring.

Post-slaughter examinations of 255,290 animals (*Myocastor coypus*) at a slaughter-house in the Zielone Góra region revealed neoplastic diseases in the 12 cases (0.0047%). They included benign and malign neoplasma of the kidney, liver, spleen, uterus, ovary, udder, bone, and peritoneum.

Medycyna Weterynaryjna XL, no. 11, 661-663, 1984.

1 table, 4 figs., 17 references.

Authors' summary.

In POLH. Summary in RUSS and ENGL.

## ANAEROBIC (CLOSTRIDIAL) DYSENTERY OF YOUNG COYPU.

АНАЭРОБНАЯ ДИЗЕНТЕРИЯ  
ЩЕНКОВ НУТРИИ

R.A. Kadymov, M.A. Kurbanova.

Acute dysentery in young coypu aged 5-10 days was observed mostly in the spring and autumn. *Clostridium perfringens* was present in smears and isolated from tissues of some 100 coypu which had pathological lesions of anaerobic infection, and also from samples of the environment. Alpha-toxin was identified in the intestinal contents of 36 coypu, beta-toxin in 9. Of 210 isolated 150 produced alpha, 44 beta and 26 epsilon toxin. Chlortetracycline (1 g/animal) and neomycin (500 000 IU) provided effective control of infection. Good environmental hygiene was of prophylactic value.

Veterinariya, Moscow, USSR, 5, 42-43, 1984.

In RUSS.

CAB-abstract.



**NEUROLOGICAL SYNDROME IN THE FERRET (MUSTELA PUTORIUS FURO).**

S.M. Niemi, C.E. Newcomer, J.G. Fox.

A disease of unknown aetiology affected 3 ferrets, kept in a laboratory, at 4 months of age, manifested by ulcerative rhinitis, tremor, polydipsia, hyperphagia, photophobia and posterior paresis. They recovered after a week. Antibody to distemper virus was present, but the titres showed no increase during the course of the illness. Antibodies to canine parainfluenza, feline rhinotracheitis, and bovine rhinotracheitis viruses, and to Toxoplasma were absent. Haemolytic Escherichia coli was isolated from the nose.

Veterinary Record, 114, 18, 455-456, 1984.

9 references.

CAB-abstract.

**MORPHOPATHOLOGICAL DATE IN HAEMORRHAGIC UROYSTITIS  
IN THE NUTRIA (MYOCASTOR COYPUS).**

**(Date morfologice in urocistita hemoragica la nutrie (Myocastor coypus))**

I. Macarie, Lidia Seiciu.

A frequently diagnosed disease of the male nutria, irrespective of age, is haemorrhagic urethritis.

The diagnosis is possible after post-mortem examination.

Histopathologically it was found that the haemorrhage may include all the structural layers of the urinary bladder, in diffused or localised forms. In most cases the urethral lumen revealed a fibrinous contents.

The authors could not establish the cause of the disease, but Corynebacterium beta haemolytic is a possible agent.

Lucrari Stiintifice Inst. Agron. "Nicolae Balcescu", C (Med. Vet.) 26, 47-51, 1983.

3 figs., 2 references.

Author's summary.

In ROMN. Summary in ENGL.



**EXPERIMENTAL INFECTION OF RED FOXES (*VULPES VULPES*)  
WITH *SARCOPTES SCABIEI* VAR. *VULPES*.**

Torsten Mörner, Dan Christensson.

Two of 3 red foxes became experimentally infected with *Sarcoptes scabiei* v. *vulpes* isolated from a naturally infected wild fox. The first clinical sign was seen after 10 days. After 30 days hairless patches were observed on the back of one of the foxes while general hair loss continued slowly. On the other fox the only macroscopical change was tangling of the hair. The foxes died after 67 and 94 days, respectively. Both foxes were anaemic and in very poor condition. Scratching was seen in only 1 of the foxes.

Veterinary Parasitology, 15, 159-164, 1984.

1 fig., 17 references.

Authors' abstract.

**PHYSIOLOGY AND PATHOLOGY OF FERRETS.**

**(Ein Beitrag zur Physiologie und Pathologie beim Frettchen  
(*Mustela putorius furo*)).**

H. Kraft.

Observation on physiological and pathological conditions of ferrets (*Mustela putorius furo*).

Ferrets are commonly used for rabbit hunting and presented as patients in veterinary surgeries.

Some conditions such as vulval swelling and dermatitis on the neck of females appear to be due to disease, but are physiological in origin. These conditions can be remedied by changing the system of housing. Ferrets are susceptible to parvovirus, distemper virus, canine hepatitis virus, leptospirosis, rabies and botulism and vaccination is advisable.

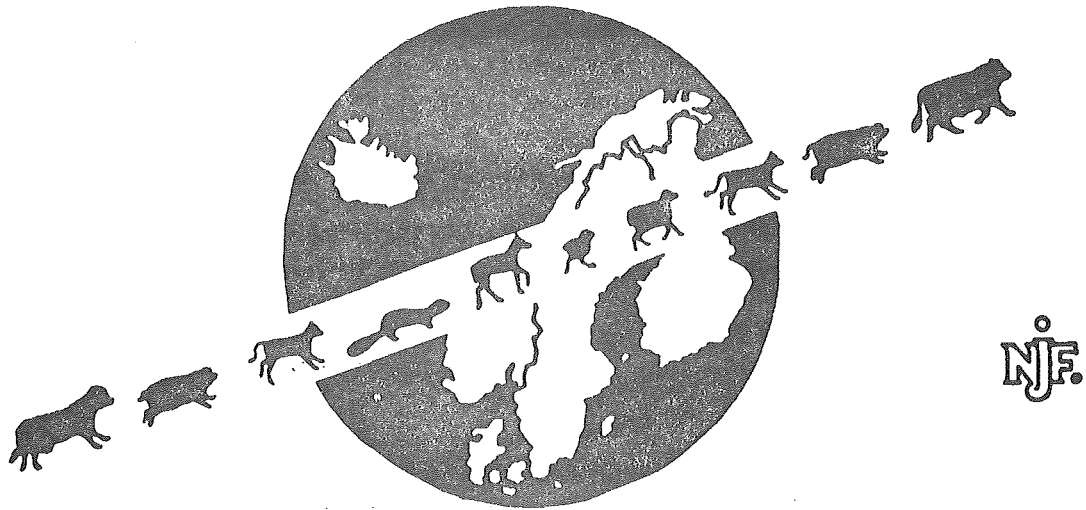
Tierärztliche Umschau, 39, 10, 776, 779-781, 1984.

7 references.

Author's summary.

In GERM. Summary ENGL.

## COMMUNICATION



## NORDISKE JORDBRUGSFORSKERES FORENING

SCANDINAVIAN ASSOCIATION OF AGRICULTURAL SCIENTISTS  
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Final program for scientific meeting about fur animal production.

NJF SEMINARIUM NO. 85, 1985.

Hotel White House, Denmark 3.-5. september 1985.

Genetics and reproduction:

Einar Einarsson, Norway: Parameters of reproduction in blue foxes.

Maija Valtonen, Finland: Diagnosis of pregnancy in foxes.

Peer Ola Hofmo, Norway, Tove Cleemann Mitchell, Denmark, and Maija Valtonen, Finland: Provisional results from freezing experiments with fox semen.

Christer Sundqvist, Finland: Examinations of the spermatogenesis in mink.

Altti Lukola, Finland: Sterility in mink males.

Ejner Børsting, Denmark: Economical weights of different skin characteristics. (Results of an Scandinavian collatorative project).

Gabrielle Lagerquist and Nils Lundeheim, Sweden: Economical weights and heritability skin characters evaluated in August, November or as skin.

Outi Lohi, Denmark: Heritability of skin characters based on the auction-grading.

Outi Lohi and Knud Christensen, Denmark: Progeny tests with mink.

Diseases.

Mikko Harri and Hannu Korhonen, Finland: The diagnostic importance of organ size in finn raccoon.

Søren Alexandersen, Denmark: Plasmacytosis-pneumonitis in mink kits.

Åse Uttendal Jensen, Denmark. Resouar hosts for plasmacytosis virus. (Experimental investigations).

Torbjørn Mejerland, Gunnar Rockborn and Tomas Svensson, Sweden: Examination of the "3-days disease" in mink.

Torbjørn Mejerland, Sweeden: Observations regarding the epizooti of "3-days disease".

Gunnar Rockborn, Sweeden: Enterovirus involved in "3-days disease" in mink.

Gudbrand Loftsgaard, Norway: The epidemiology of nosematose in mink.

Knut Nordstoga, Norway: The pathology of nosematose in mink.

Per Henriksen, Denmark: Results of examinations regarding nursing sickness in mink.

Svend Lindgren, Sweeden: Use of lactobacillus for preservation of raw material of animal origin.

Nutrition:

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Tuomo Kiiskinen, Finland: Digestibility trials with different vegetable feed stuffs.

Anders Skrede and Knud Erik Gulbrandsen, Norway: Fat sources in pelleted dry feeds for mink and blue foxes.

Maria Neil, Sweeden: The influence of some feed-factors on the water balance in mink.

Jaakko Mäkelä, Finland: Alginate as supplement in mink feed.

Niels Enggaard Hansen, Denmark: Fibrous feedstuffs in feed for fur animals.

Hans Berg, Finland: The influence of the feed's protein level or some blood parameters compared to the skin characteristics.

Anne-Helene Tauson, Sweden: The influence on reproduction, growth and pelt quality in mink of feeding management.

Physiology:

Leena Blomstedt, Finland: Hair development.

Katriina Jokivartio, Finland: The influence of melatonin treatment on growth and fur quality in mink.

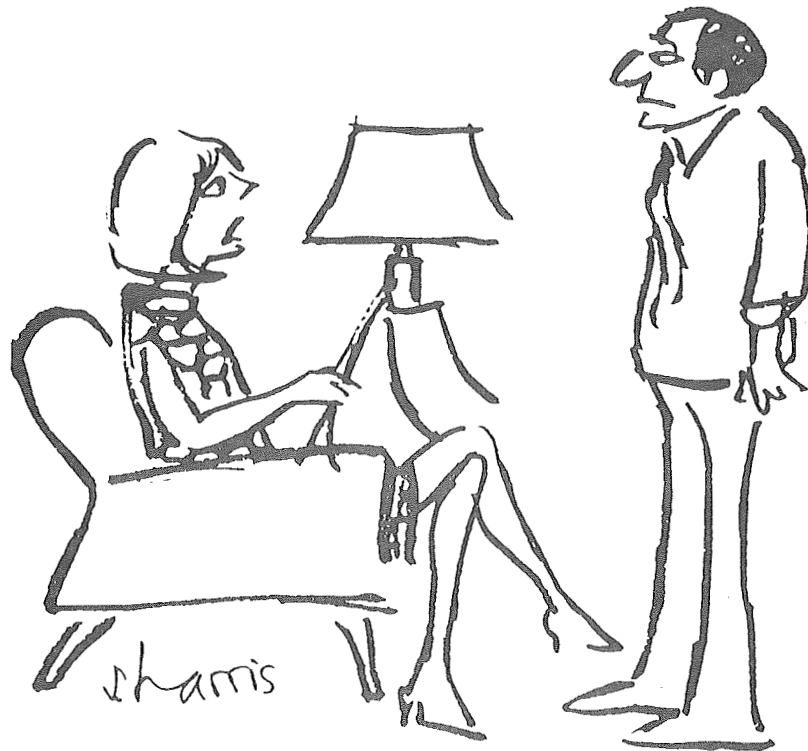
Leena Blomstedt, Finland: The influence of melatonin-treatment on fur development in mink.

Maija Valtonen, Finland: The influence of melatonin-treatment on the feed metabolism in mink.

Nelly Blumenkrantz, Denmark: Effect of melatonin implantation in mink on connective tissue macromolecules and their metabolism.

Nelly Blumenkrantz, Denmark: Status regarding biochemical studies on mink skin.

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### SECRETARY:

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NATIONAL VETERINARY INSTITUTE  
OSLO - NORWAY

ENCEPHALITOOZONOSIS  
IN THE BLUE FOX (*Alopex lagopus*)

TRANSMISSION, DIAGNOSIS AND CONTROL

BY

SVEIN FREDRIK MOHN

Oslo 1983

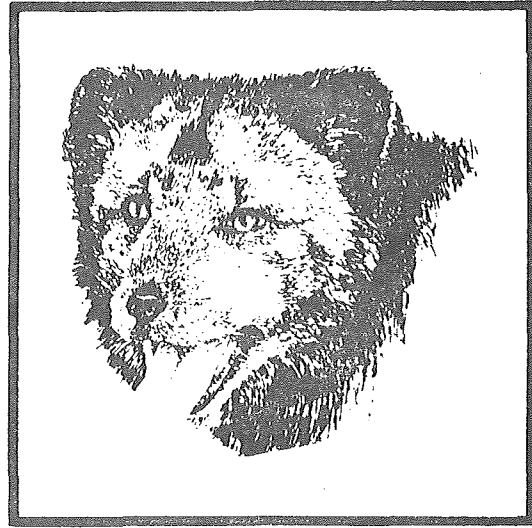
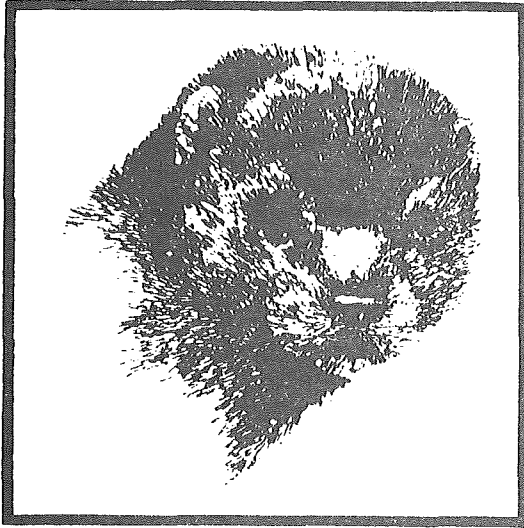
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- Paper II: The indirect fluorescent antibody test (IFAT) for the detection of *Nosema cuniculi* antibodies in the blue fox (*Alopex lagopus*). *ACTA VET. SCAND.*, 1977, 18, 290-292.
- Paper III: Encephalitozoonosis in the blue fox - Comparison between the india-ink immunoreaction and the indirect fluorescent antibody test in detecting *Encephalitozoon cuniculi* antibodies. *SCIENTIFUR*, Vol. 7, No. 2.
- Paper IV: Experimental encephalitozoonosis in the blue fox - Transplacental transmission of the parasite. *SCIENTIFUR* Vol. 7, No. 3.
- Paper V: Experimental encephalitozoonosis in the blue fox - Neonatal exposure to the parasite. *SCIENTIFUR*, Vol. 7, No. 3.
- Paper VI: Experimental encephalitozoonosis in the blue fox - Clinical, serological and pathological examinations of vixens after oral and intrauterine inoculation. *SCIENTIFUR*, Vol. 8, No. 1.
- Paper VII: Experimental encephalitozoonosis in the blue fox - Clinical and serological examinations of affected pups. *SCIENTIFUR*, Vol. 8, No. 1.

General discussion and summary



# RESEARCH REFERENCES ON MINK & FOXES

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8 pages, 107 references.

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LETTERS TO THE EDITOR.

THE 4TH INTERNATIONAL SCIENTIFIC CONGRESS ON FUR ANIMAL PRODUCTION

*Canada Mink Breeders Association*

ASSOCIATION DES ELEVEURS DE VISOONS DU CANADA

65 Skyway Avenue Suite B, Rexdale, Ontario M9W 6C7 416-675-9400



August 13, 1985

Mr. Gunnar Jorgensen  
 Scientifur  
 48 H Roskildevej  
 DK - 3400 Hilleroed  
 Denmark

Dear Mr. Jorgensen:

It is with great pleasure that we announce tentative arrangements for the 4th Scientific Congress under the joint planning of the National Board of Fur Farm Organizations and Canada Mink Breeders Association.

1988, Saturday August 20th and Sunday August 21st:

arrive Toronto, Canada, settle in Hotel, registration, sight seeing tour of Toronto for ladies and gentlemen

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4th Scientific Congress to be held in the Hudson's Bay Fur Sales Centre, Toronto

Wednesday, August 24th:

ranch tour and sight seeing trip to Niagara Falls, stopping the night at Lansing, Michigan State University

Thursday, August 25th:

en route to Mishicot, Wisconsin for U.S. resort

Friday, August 26th and Saturday 27th:

rancher seminar and visits, sight seeing and shopping

Sunday, August 28th:

to Northwood Fur Farms Inc. Cary, Illinois for visit, thence to Chicago for return flight



THE 4TH INTERNATIONAL SCIENTIFIC CONGRESS ON FUR ANIMAL PRODUCTION.

Page Two

August 13, 1985

A questionnaire will be circulated to those who attended the 3rd Scientific Congress in Versailles in 1984.

The Congress programme will be edited by:

Dr. Richard Aulerich  
Michigan State University  
responsible for editing of manuscripts  
pertaining to nutrition and toxicology

Dr. Legrande C. Ellis  
Utah State University  
responsible for editing of manuscripts  
pertaining to fur growth and reproduction

Dr. Bruce Hunter  
University of Guelph  
responsible for editing of manuscripts  
pertaining to pathology

Dr. Bruce Murphy  
University of Saskatchewan  
Editor in Chief

Manuscripts must be submitted to Canada Mink Breeders Association six months in advance of the Congress and be written in English.

All correspondence pertaining to the 4th Scientific Congress should be addressed to Canada Mink Breeders Association.

We issue a warm welcome to those who plan on attending - and look forward to a successful fur animal production seminar.

Yours sincerely,



Arlen V. Kerr (Mrs.)  
Executive Secretary, Treasurer

AVK/ef

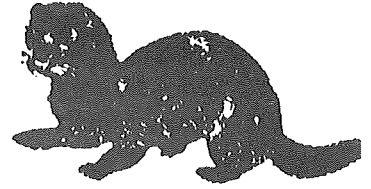


## *Fur Breeders Agricultural Cooperative*

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July 15, 1985



Gunnar Joergensen  
Scientifur  
48 H Roskildevej  
DK - 3400 Hilleroed  
Denmark

Dear Gunnar,

Please find enclosed an article published a few months ago authored by Drs. Schmitz, Gorham and myself. I thought you might be interested in it as an entry for SCIENTIFUR. This article describes a pathologic condition we saw in mink but we did not find a etiologic agent.

I would hope by having the opportunity to have it published we may receive some response from people who have seen similar syndromes.

Best Regards,

Bill Wustenberg, DVM

BW/dh  
Enclosures

Vet. Pathol. 22: 112-116 (1985)

### **Nonsuppurative Meningoencephalomyelitis of Unknown Etiology in Mink**

J. A. SCHMITZ, W. WUSTENBERG, and J. R. GORHAM

College of Veterinary Medicine, Oregon State University, Corvallis, OR; Fur Breeders Agricultural Cooperative, Midvale, UT; and Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, WA

**Abstract.** A central nervous system disease of mink occurred in three unrelated fur farms in Oregon in September, 1981. Only kits four to five months old were affected. Clinical signs consisted of posterior ataxia progressing to complete posterior paralysis with loss of motor control and sensation. Complete or partial recovery occurred in approximately 1.5 months in most mink. Microscopic lesions consisted of severe nonsuppurative meningoencephalitis and meningomyelitis with vacuolation of the white matter of the brain and spinal cord. Canine distemper virus infection and other recognized causes were ruled out on the basis of clinical signs, history, lesions, or laboratory findings. Experimental inoculations of mink with brain and spinal cord specimens from affected mink failed to reproduce the disease.

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