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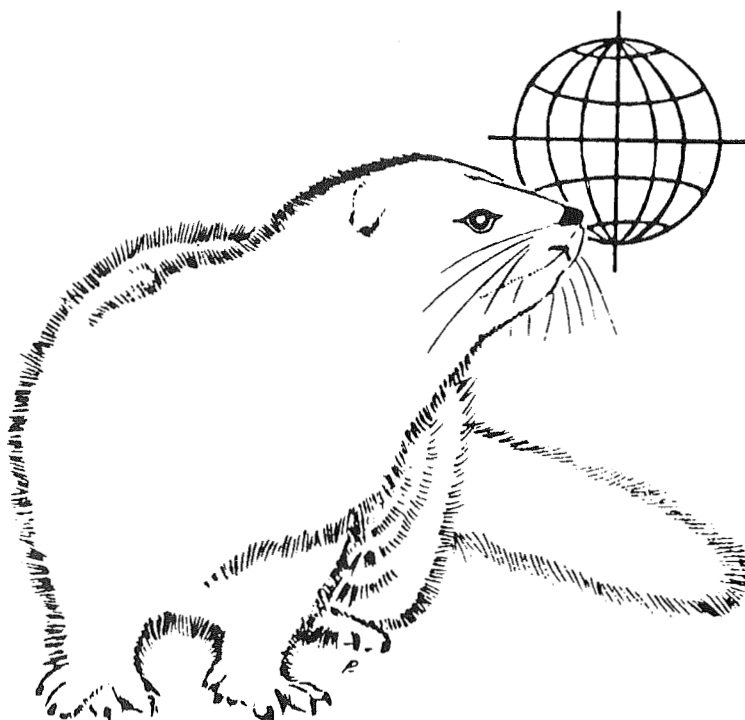
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**NORDISKE  
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**Scandinavian Association of Agricultural Scientists  
Fur Animal Division**

**40 years anniversary**

The Fur Animal Division under the Scandinavian Association of Agricultural Scientists was established in 1947 with the purpose to stimulate the cooperation between production and science regarding fur animals in the Scandinavian countries.

It is no doubt that this establishment has been one of the cornerstones in the development of the fur animal production in Scandinavia. These countries have today, as all know, a leading position in the worldwide fur animal production.

The international cooperation regarding fur animal production have also been heavily stimulated by the NJF's division of fur animals, mainly through arrangement of the first International Scientific Congresses on Fur Animal Production in Helsinki 1976 and Copenhagen 1980 and the establishment of Scientifur in 1976/77.

The event will be celebrated in connection to the advertised meeting in Tromsø, Norway 28. - 30. September this year.

The board of the Fur Animal Division has asked one of the pioneers, namely professor Per Slagsvold, Norway to write the story of the first 40 years of the Division, and we do hope that this story will be presented in Tromsø during the celebration.

SCIENTIFUR hope to be able to bring the story in English in future issues.

We are sure that everybody wishes all the best for the NJF - Fur Animal Division in the future.

The board wishes to use the jubilee as occasion for establishment of a SCIENTIFIC FUND which gives economical help to young scientists, who wants to study fur animal production elsewhere, for learning and stimulation.

If some of you - private farmers, companies or organizations wishes to stimulate the work of NJF's Division of Fur Animals through such a fund, SCIENTIFUR will gladly be of help.

**Congratulations to The Scientific Stimulator of Scandinavian and International Fur Animal Production.**

*Gunnar Jørgensen*

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## The escape distance in farm silver foxes with regard to cronism problem

T. Kaleta, A. Lewandowska, Instytut Hodowli i Technologii Produkcji Zwierzęcej, ul. Prezejazd 4. 05-840 Brwinow, Poland

### Summary

The escape distance of three silver fox - groups (males, good mothers and killing cubs females) was measured and behaviour of these animals was also observed. The males and the good mothers turned out to be better adapted to the farm conditions in comparison with the females committing infanticide. Their agonistic behaviour was more complex and the relationship between the aisles breadth and the escape distance was clearer than in bad mothers.

### Introduction

Acts of cronism (killing and often eating pups) are common in silver fox females in Polish farms. *Koscianski (1984)* showed that this disturbance of maternal behaviour caused main losses in reproduction of this species in Poland. Various theories tried to explain cronism in farm fur animals as engendered by deficiency of feed components, stress and other reasons (*Wenzel 1982*).

The escape distance is a factor of agonistic behaviour enabling its better description and assesment. Since the effect of agonistic responses on the reproductive capacity was found (*Kaleta, 1983*), the aim of this study was to ascertain whether there is a relationship between the escape distance and killing pups by the silver fox females.

### Material and Method

The investigations were carried out in the state farm Witkowizna in autumn, 1986. The

group consisted of 316 foxes: 150 males and 166 females. The preliminary investigations concerned escape distance of males which were selected at random. The group of females comprised 85 cub-killing specimens and 81 good mothers, rearing 5 or more pups (control group). The escape distance of each animal was measured only once.

The observer approached perpendicularly to the cage until the moment when the first sign of fox's reaction was perceived. Then the distance was measured between the body of the observer (at the waist level) and the wire of the cage with a measuring tape. Subsequently the behaviour of foxes was observed for 30 sec.

### Results and Discussion

There were various distances between rows of cages in the farm. the results of escape distance measurement are arranged in Tab. 1 and 2, taking into account this fact.

The relationship was ascertained between aisles' breadth and the escape distance (Tab. 3). The correlation calculated was highly significant in the case of silver fox males and significant in the female group. As concerns vixens, in the group of good mothers (control group) correlation coefficient was significant, but in the females which killed cubs this coefficient was non-significant. Hence, although normally vixens shortened escape distance with narrower space between the rows of cages, in the females committing infanticide this regularity was not clear.

Table 1. The escape distance of silver fox males

Aisle breadth, cm	170	330	380	525	550
Number of specimens	31	27	33	26	33
Escape distance (mean)	32	98	138	155	176

Table 2. The escape distance of silver fox females

Aisle breadth, cm	155	160	170	180	195	230	240	250
Number of specimens								
Total	8	11	7	22	4	14	58	42
Good mothers (control group)	8	6	7	8	3	9	21	19
Bad mothers (exp. group)	-	5	-	14	1	5	37	23
Escape distance, cm								
Mean	86	84	93	55	72	62	81	106
Good mothers	86	91	93	57	78	72	94	138
Bad mothers	-	77	-	54	66	45	74	79

Table 3. Correlation (r) and regression (b) coefficients concerning relationship between the aisle breadth and escape distance

Group	Number of animals	r	b x/y	Significance	
				r	b x/y
Males	150	0,39	0,27	highly significant	highly significant
Females					
Good mothers	81	0,22	0,40	significant	highly significant
Females					
Bad mothers	85	0,09	0,16	non-significant	non-significant

The escape distance in the control group was usually longer than in experimental group. It means that females rearing cubs well responded faster to observers' approach some forms typical for an agonistic behaviour were recorded (see Tab. 4). In cases of stress defensive posture and freezing, these displays

were frequently observed in the experimental group, while in the control group aggressive postures prevailed. The agonistic behaviour of good mothers was in general more ample than in the experimental group. It seems that these animals were able better to resolve conflict situations evoked by observer's presence.

Table 4. Some agonistic displays observed after escape distance

Display	Number		Frequency in group, %	
	Good mothers	Bad mothers	Good mothers	Bad mothers
Stress	9	16	11	19
Freezing	22	22	27	26
Aggression	8	2	10	2
Defence	11	9	13	10
Urination	27	14	33	16
Defecation	22	10	27	12
Stereotyped movements	5	-	6	-

In both groups apparent increase in the number of agonistic behaviour forms was observed when the distance between rows of cages was 230 cm or more. It particularly concerned acts of urination, defecation and facial displays. This increase was more clearly visible in the experimental group.

It is difficult to find comparable data in the recent literature. The investigations of Keeler (1975) revealed that there were particular escape distances for various red fox colour morphs. For example in the silver foxes kept without restriction the escape distance was about 180 m. The adaptive change of this distance in the case of "in-cage" keeping system was also observed in this work.

### Conclusions

1. Under the farm conditions there is a relationship between the aisles breadth and the escape distance of silver foxes.
2. The correlations calculated in male and female groups were significant or highly significant with the exception of females which killed cubs. The bad mothers seemed to have worse adaptability.
3. These females had shorter escape distance than good mothers and their agonistic behaviour was less complex.

4. With the narrower aisles (less than 230 cm) the investigated foxes revealed less agonistic forms of behaviour in disturbing situations evoked by the presence of men.

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- Koscianski J., 1984: Budowa narządu rozrodczego samicy lisów pospolitych (*Vulpes vulpes*) i polarnych (*Alopex lagopus*). Praca doktorska SGGW-AR, Warszawa.
- Wenzel U.D., 1982: Pelztiergesundheitsdienst. VEB Gustav Fischer Verlag, Jena.

Original Report

## Lipid peroxidation and protein solubility during long-term storage of dried raw mink skins

*Ilpo Jääskeläinen.* Department of physiology, University of Kuopio, Box 6. SF-70211 Kuopio, Finland

### Abstract

1. Dried raw mink skins were stored for 14 months at about +4 C (cold room), about +20 C (room temperature) and frozen at -80 C (control). Soluble collagen and protein (neutral salt and acid soluble) were measured after different storage times. Lipid peroxidation was also followed.

2. When skins were stored at -80 C no observable changes were seen in the parameters measured.

3. Neutral salt soluble protein decreased both at +4 C and at +20 C significantly during the storage.

4. There were also changes in collagen solubility: Increase of neutral salt soluble fraction at +20 C and decrease of acid soluble fraction at +4 C.

5. Significant lipid peroxidation took place both at +4 C and at +20 C.

### Introduction

Storing of skins greatly changes their properties. Storage time and conditions (temperature, humidity and air-conditioning etc.) determine the behaviour of skins during tanning and also affect the properties of finished products (*Hollstein 1981*). Drying has also profound effects on skins, especially if high temperatures are used (*Heidemann and Kröll 1982*). Great economic losses are possible.

Changes in fat are most prominent (*Hahn and Herzschuh 1971*). These changes affect the properties of other skin components. Lipid peroxidation may cause collagen breakage (*Monboisse et al. 1984*). On the other hand, lipid peroxidation products can cross-link proteins

(*Tappel 1973*) and thereby make them more insoluble.

In the present study the influence of different storing conditions (about +4 C, +20 C and -80 C) on the solubility properties (proteins and collagen) and lipid peroxidation of dried raw mink (*Mustela vison*) skins were investigated.

### Materials and Methods

#### *Minks*

Male mink skins were used. They were obtained from local farm (Juankoski) near Kuopio in December. Animals were skinned and dried at about +15 C (relative humidity about 55) for 68 hours. The skins were stored in cold room (about +4 C, relative humidity set to 55), room temperature (about +20 C) and at -80 C. The pieces of skins stored at +4 C and +20 C were parts of same skins, the specimens stored frozen were whole skins. Samples (about 2.4 cm) were taken with a cork borer from the back of the skins. After sampling the skins were shaved and cut into small pieces.

#### *Experimental Treatments*

Fat of the skins was extracted for 24 hrs at 4 C with occasional stirring by a mixture of chloroform-methanol 2:1, v/v, containing 0.05% of  $\alpha$ -tocopherol as preservative. This extract was later used for the determination of lipid peroxidation. Skins were then dried with ether and used for further extractions. Neutral salt soluble fraction was obtained by extraction with 1 M NaCl - 0.05 M Tris-HCl buffer, pH 7.4, with two 24 hr treatments at 4 C. The

samples were stirred occasionally. The extracts were then combined. Part of the extract for hydroxyproline determination was then evaporated to dryness and hydrolyzed for 3 hours at 140 C with 6 N HCl. The hydrolysate was evaporated to dryness and dissolved in acetate-citrate buffer, pH 6.0.

Acid soluble fraction was obtained by an extraction with 0.5 M acetic acid with two 24 hour treatments at 4 C. The extracts were then combined. Again, one part of the extract was evaporated to dryness, hydrolysed with 6 N HCl, and used for the determination of hydroxyproline.

#### Assays

From the acid soluble fraction protein content was measured by the method of *Lowry et al. (1951)*. From the neutral salt soluble fraction protein was measured by the *Bensadoun and Weinstein (1976)* modification of the *Lowry* procedure, because Tris interferes with the normal procedure.

Collagen was determined as hydroxyproline using the method of *Stegemann and Stadler (1967)* after hydrolysis of the sample with 6 N HCl.

Lipid peroxidation was determined by thiobarbituric acid (TBA) reaction according to *Ohkawa et al. (1979)*.

#### Statistics

The results are expressed for 6 samples as the mean  $\pm$  SD. For clarity, SD for the control skins (-80 C) not shown in figures. The data were treated statistically using the Student's method of correlation analysis.

#### Results and Discussion

Fig. 1. shows the fall in the level of neutral salt soluble protein in mink skins during a 14-month storage. the decrease appears to proceed linearly ( $r = -0.95$  for storage at +4 C and  $r = -0.85$  for storage at +20 C). The amount of soluble protein decreased almost 50% in 14 months both at +4 C and at +20 C. This is probably due to cross-linking of proteins by aldehydic products of lipid peroxidation (*Chio and Tappel 1969*).

The amount of neutral salt soluble collagen after different storage times is shown in Fig.2. A significant increase took place in the skins stored at +20 C after about 3 months of storage, but after that the level stayed at about the same for the rest of the storage. No changes were seen in skins stored at +4 C. The collagen in neutral salt soluble fraction is

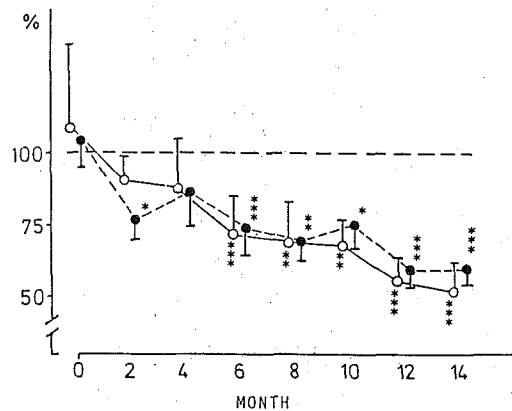


Fig. 1. Loss of neutral salt soluble protein of raw dried mink skins during a 14-month storage at +4°C (0—0) and at +20°C (0---0), expressed as percentage of levels in control skins (100%) stored at -80°C. Actual values, expressed as  $\mu\text{g}/\text{mg}$  skin, were  $20.4 \pm 4.0$ ,  $19.6 \pm 2.0$  (+20°C) and  $18.7 \pm 4.0$  (control) before storage (0 months). Correlation between storage time and neutral salt soluble protein was  $r = -0.95$  (+4°C) and  $r = -0.87$  (+20°C),  $p < 0.001$  (Pearson product moment correlation). Risk level in figure, compared with control skins, are \*  $P < 0.05$ , \*\*  $P < 0.01$  and \*\*\*  $P < 0.001$  (Student's *t*-test).

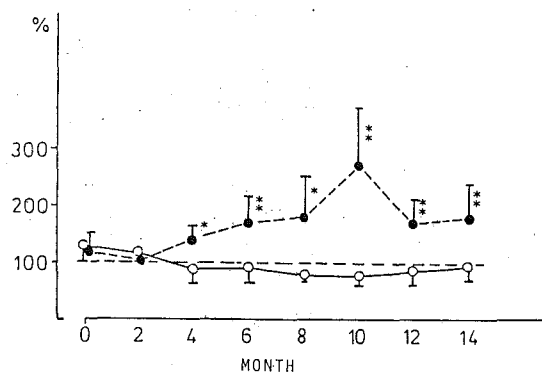


Fig. 2. Neutral salt soluble collagen of raw dried mink skins during a 14-month storage at +4°C (0-----0) and at +20°C (0---0), expressed as percentage of levels in control skins (100%) stored at -80°C. Actual values, expressed as  $\text{ng}$  hydroxyproline/ $\text{mg}$  skin, were  $71 \pm 15$  (+4°C),  $69 \pm 15$  (+20°C) and  $56 \pm 6$  (control) before storage (0 months). Risk levels: \*  $P < 0.05$ , \*\*  $P < 0.01$  (Student's *t*-test).

considered to represent either newly synthesized collagen or degradation products (Oxlund 1983).

The amount of acid soluble collagen showed only slight differences (Fig. 3). At +20 C there was a small decrease. The acid soluble fraction represents the collagen that is rendered soluble after cleavage of acid labile cross-links (Oxlund 1983).

In this study the amount of lipid peroxidation (expressed as nmoles of malonaldehyde formed) showed a sharp rise after about 1 month of storage at +20 C (Fig. 4.). The rise is followed by a drastic fall. Still the amount of lipid peroxides is significantly higher throughout the 14 month storage. The fall in malonaldehyde level is probably due to reaction of aldehydic products with skin proteins (Chio and Tappel 1969). At +4 C (RH 55) the rise in malonaldehyde level appeared about two months later. It is remarkable that in these conditions no fall in the level was seen in contrast to the room temperature. It should be mentioned, that malonaldehyde is not the sole product of lipid peroxidation reacting with TBA (Sevanian and Hochstein 1985).

If the neutral salt soluble and acid soluble fractions are combined together there

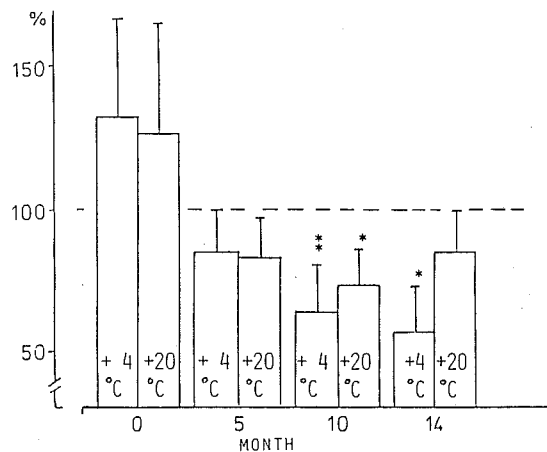


Fig. 3. Acid soluble collagen of raw dried mink skins during a 14-month storage at +4°C and at +20°C, expressed as percentage of levels in control skins stored at -80°C. Actual values, expressed as ng hydroxyproline/mg skin were 410 ± 110 (+4°C), 390 ± 120 (+20°C) and 310 ± 15 (control) before storage (0 months). Risk levels: \* P < 0.05, \*\* P < 0.01 (Student's t-test).

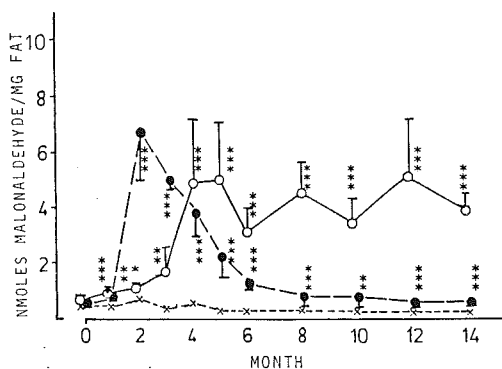


Fig. 4. Lipid peroxidation, expressed as nmoles malonaldehyde/mg fat in raw dried mink skins during a 14-months storage at +4°C (0-----0), at +20°C (0---0) and at -80°C (x---x). Risk levels compared with control skins, are \* P < 0.05, \*\* P < 0.01, \*\*\* P < 0.001 (Student's t-test).

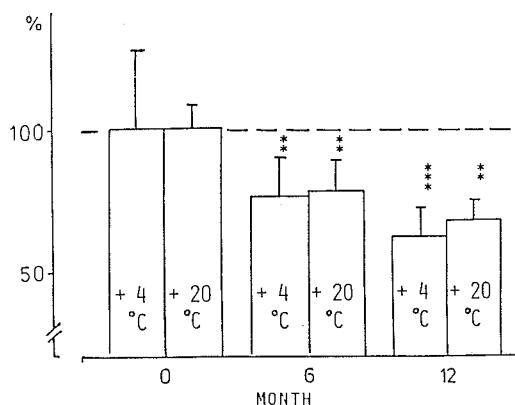


Fig. 5. Total soluble protein (neutral salt soluble + acid soluble) of raw dried mink skins during a 14-months storage at +4°C and at +20°C, expressed as percentage of levels in control skins (100%) stored at -80 C. Actual values, expressed as ug/mg skin, were 26.0 ± 7.0 (+4°), 26.0 ± 2.0 (+20°C) and 26.0 ± 5.0 (control) before storage (0 months). Risk levels: \*\* P < 0.01, \*\*\* P < 0.001 (Student's t-test).



was a marked lowering in total protein solubility during 14 month storage both at +4 C and at +20 C (Fig. 5.). The changes in the amounts of soluble collagen were less striking, but at least at +4 C the amount of soluble collagen seems to decrease somewhat during the storage (Fig. 6.).

No significant changes in the mink skins stored frozen at -80 C were seen in any of the parametres determined.

#### Acknowledgements

The author likes to thank *The North Savo Cultural Foudation* and *Olvi Foundation* for financial support and *Mrs. Eeva-Liisa Palkispää* for skillfull laboratory work.

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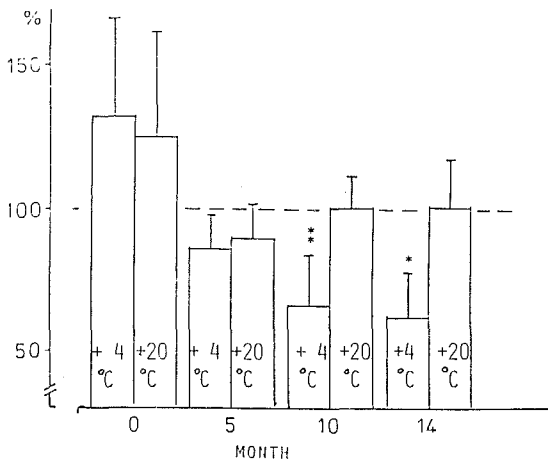


Fig. 6. Total soluble collagen (neutral salt soluble + acid soluble) of raw dried mink skins during a 14-month storage at +4°C and at +20°C, expressed as percentage of levels in control skins (100%) stored at -80°C. Actual values, expressed as ng hydroxyproline/mg skin were  $485 \pm 125$  (+4°C),  $460 \pm 132$  (+20°C) and  $366 \pm 15$  (control) before storage (0 months). Risk levels: \*  $P < 0.05$ , \*\*  $P < 0.01$  (Student's t-test).

### Skin Surface Lipids of the Mink

Sabin W. Colton 6th, Jane S. Lindholm, William Abraham and Donald T. Downing

1. Skin surface lipids from mink (*Mustela vison*) were collected in acetone and analyzed by thin-layer chromatography and gas chromatography.

2. The principal components were wax monoesters (92%), cholesteryl esters (5%), free fatty acids (1%), fatty alcohols (1%) and cholesterol (1%).

3. The fatty acids and alcohols contained in these lipids were composed principally of homologous series of straight chained 7-unsaturated structures (C<sub>27</sub>-C<sub>31</sub>), accompanied by lesser proportions of homologous series of saturated (C<sub>27</sub>-C<sub>31</sub>) and 9-unsaturated (C<sub>27</sub>-C<sub>31</sub>) structures.

*Comp. Biochem. Physiol. Vol. 84B, No. 3, pp. 369-371, 1986.*

1 table, 9 references.

Authors abstract

### The Pine Marten as a Farm Animal

(Marden som farmdjur)

K. Pessa



Mårdkull i famnen på farmskötare Sulo Karjalainen.

Pine martens have been bred in captivity in Finland for 5 years. Details are given of housing, feeding and management. Mating occurs in July, but the fertilized ova are not implanted until February, and birth take place between 29. March and 23. May, with the majority of births occurring at the end of April and the beginning of May. Litter size ranges from 2 to 6 young.

*Finsk Pälstidskrift: 20(12): 652-655, 1986  
7 fig.  
In SWED.*

CAB - abstract

### The Effect of Colony Size on Fetal Resorption and Secondary Sex Ratio in Domestic Chinchilla

Laniger

Anne Dorita

Male-biased at-birth sex ratios have been previously reported for colonies of domestic *Chinchilla langier*. It was hypothesized that skewed offspring sex ratios were not universal trends but were characteristic of small colonies of fewer than twenty animals. Larger colonies were predicted to produce an nearly equal proportion of male and female young. This hypothesis was tested by statistically analyzing complete ranch records and by breeding chinchillas under controlled laboratory conditions in colonies of two sizes. Histological assays were also performed to determine at which point in the reproductive cycle the sex ratio bias occurred. Ranch records and laboratory data both supported the hypothesis, demonstrating a high proportion of males born in small colonies and a nearly equal ratio of males:females born in large colonies. Analysis of litter size distribution revealed that small colonies produced a higher proportion of small litters than did large colonies. Histological studies demonstrated that conceptus loss was higher in small colonies than in large colonies. It was thus proposed that male-biased at-birth sex ratios observed in small colonies were the result of differential loss of female conceptuses.

*Dissertation Abstracts International, B: 46(8)  
2523, 1986.*

Only abstract recieved

**Behavioural Experiments with Cage-Sizes for Mink**

(Adfærdsforsøg med burstørrelser til mink)

*Birthe Jonassen*

In autumn 1986 two behavioural-experiments with cages in different sizes for mink were undertaken.

The purpose was to record any differences in the behaviour of minks in the three different cages.

The animals used in the first experiment were adult male minks. In the second minkpups of both sexes were used.

Six cages of each of the following types were used:

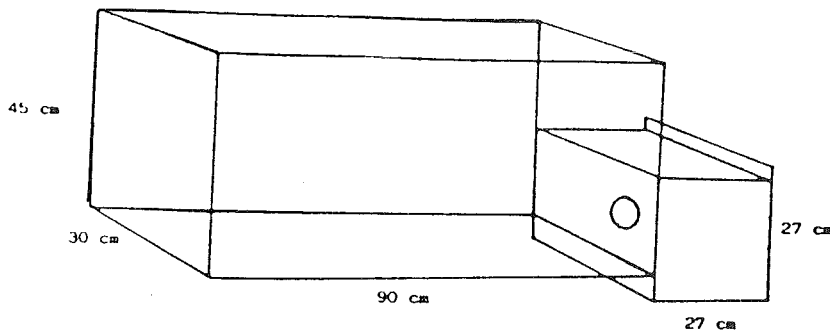
A. Standard 6, B. Standard 8, C. Topcylinder.

The behaviour was registered in three periods of five days with 10 observations on each animal in both experiments.

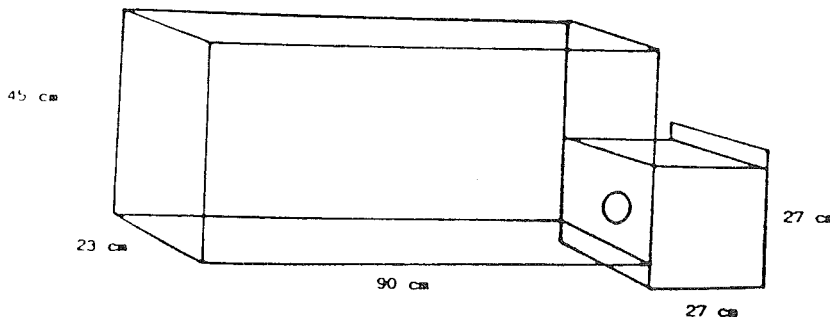
No behavioural differences were found in the three cages.

Large sexual-differences were found. The female-pups were more sensitive to their envi-

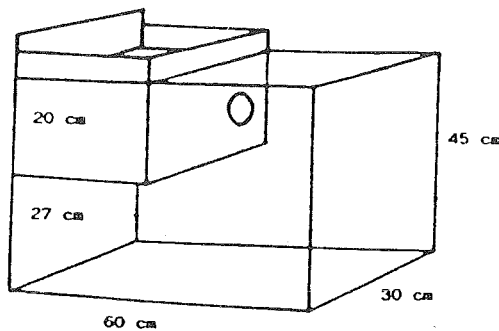
*Fig. 1. Standard-6 buret*



*Fig. 2. Standard-8 buret*



*Fig. 3. Topcylinderburet*



ronment than the males.

Because of very large individual differences, some animals contributed very little, or not at all to the final result, whereas other animals contributed a lot.

*Statens Husdyrbrugsforsøg Meddelelse Nr. 652, 27. marts 1987.*

*4 tabels, 3 fig.*

*In DANH. Su. DANH*

*Authors abstract*

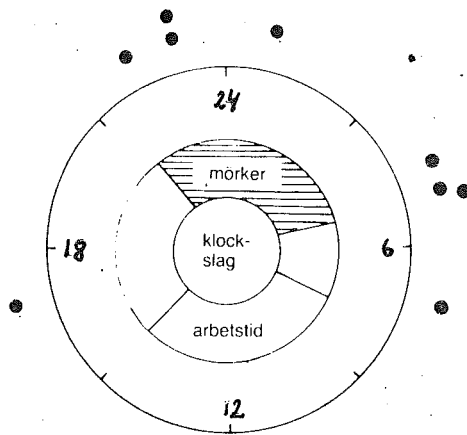
**Studies on the Behaviour of Foxes in Relation to Reproductive Performance**

(Studier av rävens beteende i relation till reproduktion)

*Bjarne O. Braastad*

By means of a video camera, the behaviour from 2 days before to 5 days after parturition was

compared in 19 normal silver fox females and 18 females which had savaged their cubs the previous year. For normal and aggressive females, litter size at birth averaged 4,7 and 4,6 resp., litter at weaning 4.0 and 0.72, the number of tailless cubs at weaning 0 and 0.61, and the number of unharmed cubs at weaning as a percentage of the number born 84 and 2.4%. Of the cubs killed, 80% died between 22.00 and 07.00 h. Females with tailless cubs at weaning



Figur 1. Tidpunkt under dygnet då valparna bits ihjäl. Varje punkt anger den tid då en valp dödades. Det skuggade området anger den mörka tiden av dygnet, medan ett annat område visar den tid då skötare rörde sig på farmen.

were more likely to have killed some cubs than those with no tailless cubs. Possibilities of preventing attacks on cubs by means of housing are discussed. It was concluded that all aggressive females should be culled.

*Finsk Pälstidskrift: 20(12): 657-660, 1986  
1 tabel, 3 fig.  
In SWED.*

*CAB abstract*

**Housing Experiments with Blue Foxes in 1985 and 1986**

(Lyförsök med Blåräv 1985 och 1986)

*Kjell Nydahl & Fjalar Fors*

For 120 blue fox and 80 silver x blue fox females housed in wooden cages with an entrance tunnel, the number of cubs born per mated female averaged 5.9 and 4.5 resp. vs. 6.5 and 5.5 for females in standard cages without a tunnel. Of 39 blue fox females housed in a small wooden cage (measuring 53 x 33 x 31 cm), 84.6% whelped, and the number of cubs weaned per mated female averaged 6.38 vs. 77.3% and 5.25 for 39 females housed in a standard cage (measuring 70 x 45 x 42 cm). In a further experiment, females (24-28 per group) were hou-

sed in (1) a high wooden cage measuring 43 x 43 x 66 cm, (2) a round wooden cage, with a diameter of 43 cm, and 37 cm high, (3) a small wooden cage measuring 33 x 33 x 31 cm, or (4) a standard cage measuring 54 x 40 x 37. In the four groups resp., the percentage of females whelping was 60, 62,5, 79,2 and 62,5, the number of cubs surviving to 7 days of age per mated female averaged 6.44, 5.67, 4.56 and 4.12, and the number weaned 5.8, 5.42, 4.15 and 3.71. There was a predominance of young females in all groups except group 2.

*Finsk Pälstidskrift: 20(9): 476-479, 1986  
4 tables 6 fig.  
In SWED.*

*CAB abstract*

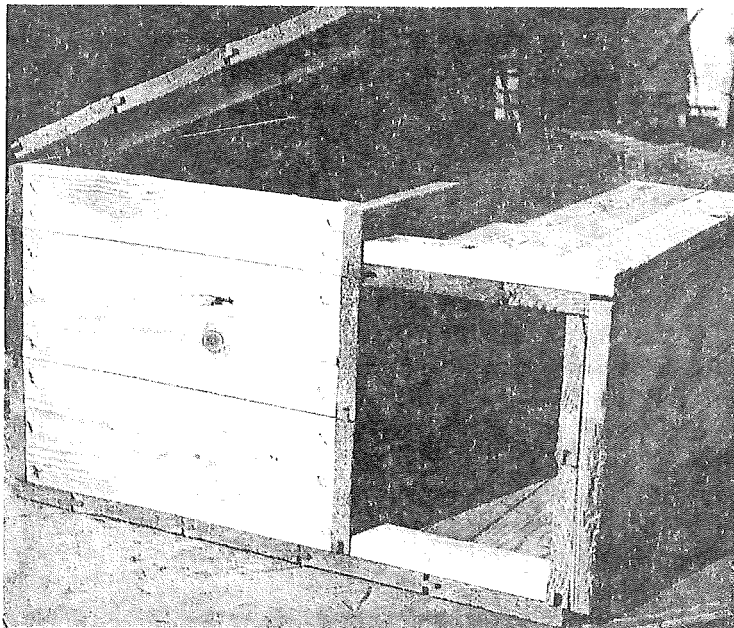


Bild 1. Liten lya (mikrolya 53×33×31) med icke löstagbar ingångstunnel.

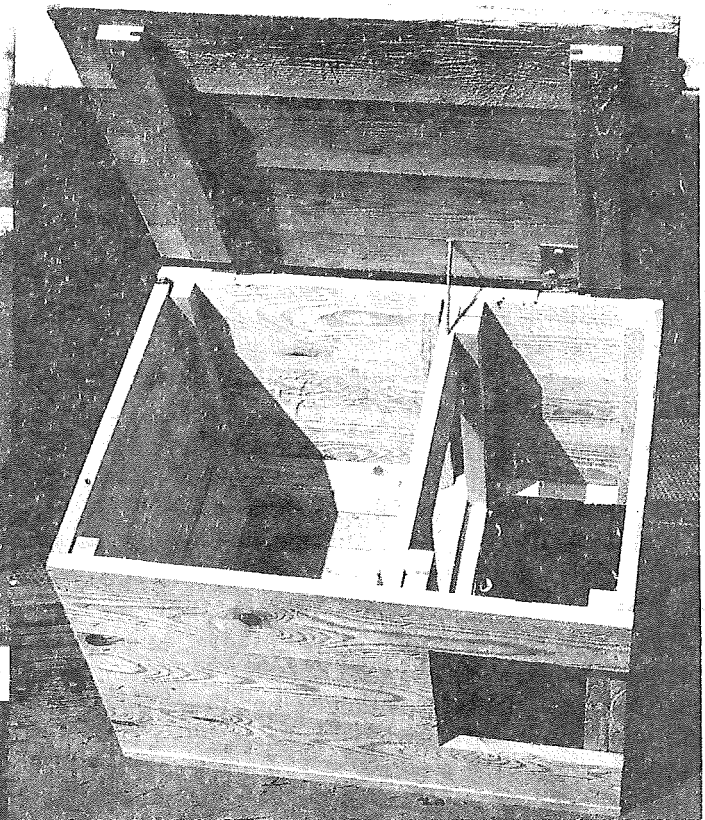


Bild 4. Standardlya av trä (54×40×37) med krympta mått.

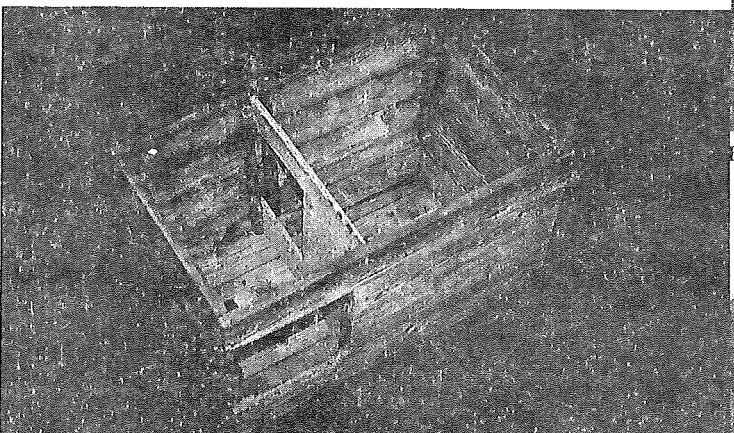


Bild 2. Standardlya av trä (1×b×h (cm) = 70×45×42) som användes i jämförelsegrupperna 1985.

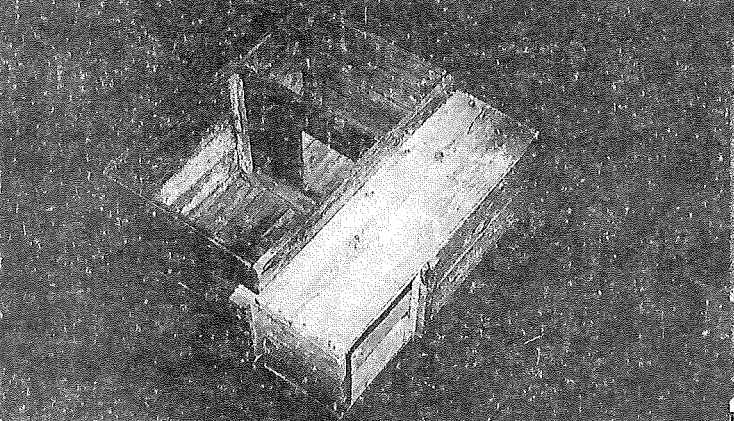


Bild 3. Standardlya av trä (70×45×42) med ingångstunnel.

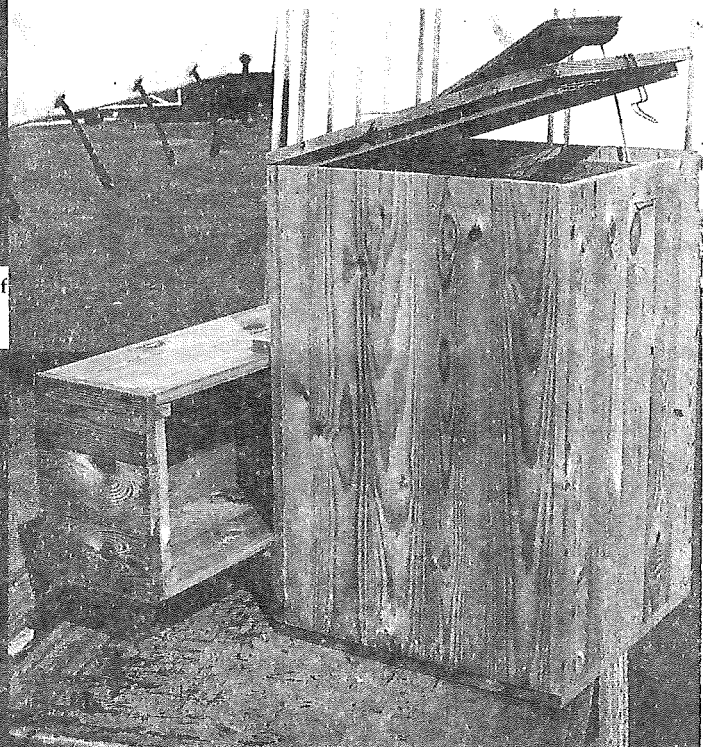


Bild 5. Hög lya (43×43×66) med kontrollfönster och ingångstunnel.

### It Pays to Provide Shelter for Silver Foxes

(Ge Silverräven lä - det lönar sig)

*Michael Sönderup*

Silver fox females (48-50 per group) were housed in (1) standard pens (controls), (2) pens with extra insulation (from Dec.), or (3) pens with sheltered shelves (from Dec. to mating in spring). In the 3 groups resp., the percentage of infertile females averaged 11.1, 7.1 and 4.3, the percentage of still-born cubs 20.7, 15.7 and 12.3, the number of liveborn cubs per mated female 3.33, 3.35 and 3.89, and the number of cubs weaned 2.84, 3.62 and 3.02. The av. dates of mating in the 3 groups were 14. March, 12. March and 8. March resp., with two thirds of females mating from 1. to 28. March, from 25. February to 27. March, and from 23. February to 21. March. Females in group 3 showed the strongest signs of oestrus, followed by those in groups 2 and 1. Of young females, 23% lost their cubs prior to weaning vs. 14% of older females, and the number of liveborn and weaned cubs averaged 3.24 and 2.47 resp. vs. 3.89 and 3.38.

*Våra Pälsdjur: 57(11): 368-369, 1986*

*4 tables.*

*In SWED.*

*CAB - abstract*



*Vinterlyan ger räven bra lä.*

### Good Shelter Improves the Reproductive Performance of Blue Foxes

(Goda läförhållanden förbättrar blårävens valpresultat)

*Michael Sönderup*

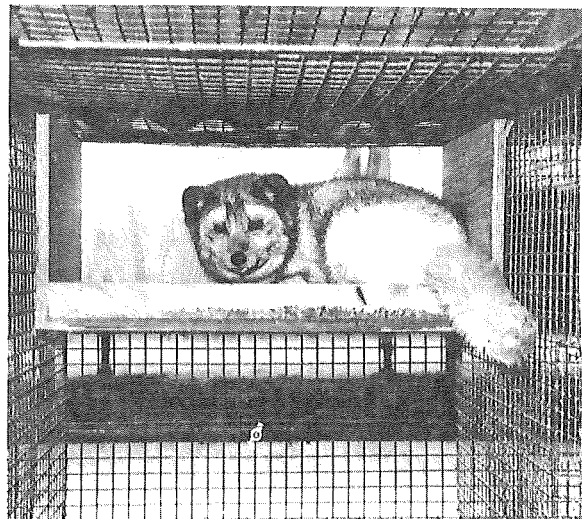
From 5. January to 15. March, blue fox females (78-79 per group) were housed in cages (1) without shelter (controls), (2) provided with a shelf with solid back and sides, or (3) provided with a winter lining. In the 3 groups resp., 17.39, 9.72 and 6.94% of females were infertile; litter size at birth averaged 7.88, 8.99 and 9.15 resp. (8.91, 9.86 and 9.92 per mated female), and litter size at weaning averaged 6.15, 7.09 and 7.04 (6.96, 7.78 and 7.63 per mated female).

*Våra Pälsdjur: 57(12): 406-408, 1986*

*3 tables, 2 fig.*

*In SWED.*

*CAB - abstract*



*Blåräven trivs med denna billiga och enkla lä-anordning.*



### Endocrinology of Fur Growth and Reproduction in Mink

Rose, William Jackson, Ph.D.

Experiments were conducted to determine: (1) the effects of exogenous melatonin and reduced photoperiod on molting and growth of the winter pelage (fur) and (2) whether changes in serum prolactin levels of treated and control mink during this same period were correlated with growth of winter fur. Adult and kit female and male mink were utilized and treatments were initiated in late June. Regardless of sex or age, mink treated with 10 mg melatonin or a 6 hour light: 18 hour dark photoperiod molted the summer pelage and attained prime winter pelage 6 weeks earlier than controls ( $P < .001$ ). Both reduced photoperiod and exogenous melatonin caused serum prolactin concentrations to decline from a mean high of 5.9 ng/ml in mid-July to basal levels of less than 1.5 ng/ml by late July-early August, 6 to 8 weeks earlier than controls. These findings indicate that the photoperiodic effects on growth of the winter pelage of mink may be mediated through the pineal gland and its secretion of melatonin. These data also suggest that part of the mechanism of action of melatonin may be through the regulation of prolactin synthesis and secretion.

Experiments were also designed to determine: (1) if prolactin receptors were present in the ovaries and uterus of the mink and (2) the relationship of changes in serum prolactin concentrations to levels of ovarian prolactin receptors during embryonic diapause. Concentrations of uterine and ovarian prolactin receptors of mink were quantified during (1) anestrus (uterus only), (2) when blastocysts were entering a state of diapause, and (3) during the period of blastocyst reactivation, just prior to implantation. Mink were also bled at periodic intervals during gestation and the serum levels of prolactin determined by use of radiimmunoassay. Scatchard analysis revealed a single class of binding sites for prolactin with  $K$  values of  $8.25 \times 10^{-7} \pm .68$  M (uterus) and of  $6.14 \times 10^{-7} \pm .93$  M (ovaries). The total concentration of uterine prolactin receptors during anestrus was 28 fmol/mg protein. The total concentration of ovarian receptors during anestrus was 90 fmol/mg protein, which increased significantly during embryonic diapause to 484 fmol/mg protein, and then declined to 16 fmol/mg protein during blastocyst reactivation. Serum prolactin

concentrations began to increase soon after the vernal equinox (March 21) and were significantly elevated by March 27. The results of these studies clearly established that the ovaries and possibly the uterus of the mink are target organs for prolactin.

*Dissertation Abstracts International, B: 47(1): 96-B, 1986*

Only abstract received



### Contents of Sodium, Potassium, Calcium, Phosphorus and Iron in the Skeletal Musculature of Nutrias

(Obsah sodíka, Draslíka, Vápníka, Fosforu a Zeleza v kostrovom svalstve Nutrií)

Olga Palanská, Milan Bárta, Viliam Nosál

The content of mineral substances - sodium, potassium, calcium, phosphorus, and iron - was examined in 20 head of standard nutrias of male and female sex (10 males and 10 females) at the age of 8 months and three years by random selection. Significantly higher contents of phosphorus, sodium, potassium, calcium, and iron were recorded in the musculature of males at the age of 3 years in contrast to females at the age of 8 months. The musculature of females at the age of 3 years showed a significantly higher percentage of phosphorus, sodium and potassium in comparison with females at the age of 8 months. Intersexual differences were recorded in females at the age of 8 months in a lower iron content and in a lower phosphorus content. A higher percentage of potassium and a lower percentage of calcium were found in the musculature of beef cattle.

*Polnohospodarstvo (Czechoslovakia). (February 1986). V. 32(2) p. 162-167.*

2 tables, 5 references.

In CZECH Su. ENGL., RUSS., CEZC.

Authors summary

**Parting in Silver Foxes**

(Bena hos Silverräv)

*Ulla Joutsenlahti*

Recent sharp increases in the population of silver foxes in Finland have led to an increased incidence of pelts with a parting along the back. The defect, which is due to a recessive gene, also occurs in silver x blue fox and silver x red fox hybrids. When 20% of pelts are affected, the defect can be brought under control in 2-3 generations by means of culling affected cubs and their parents.

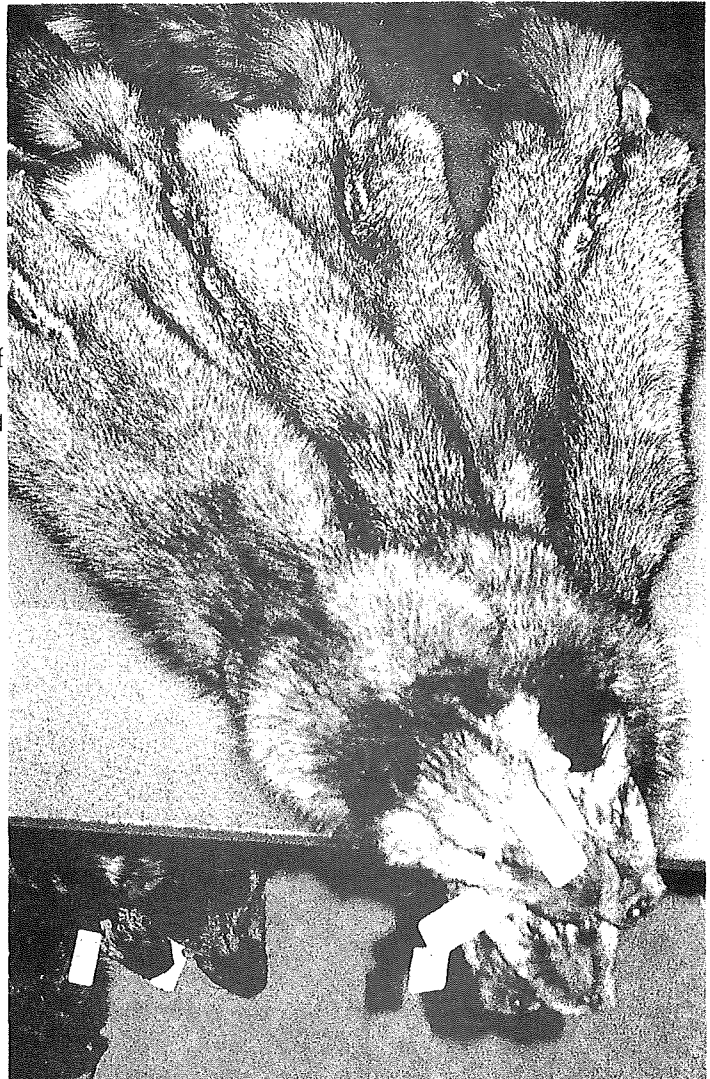


Bild 1. Skinn med bena.

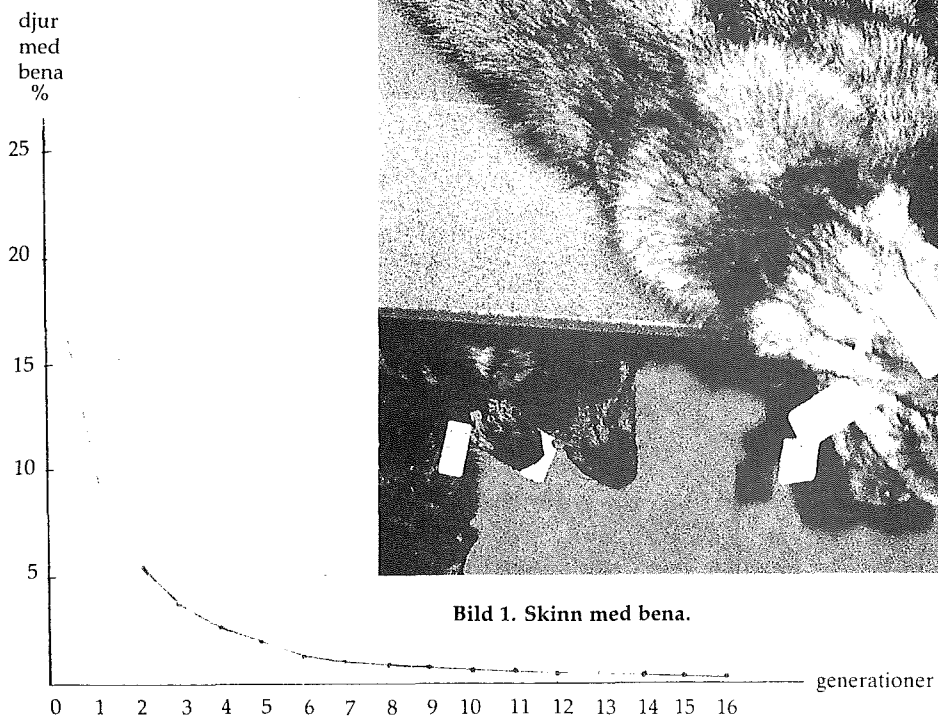


Bild 2. Andelen skinn med bena minskar då djur med detta fel systematiskt gallras bort.

*Finsk Pälstidskrift: 20(12): 630-631, 1986.  
2 fig.  
In SWED.*

*CAB - abstract*

**Anatomical Organization of the Visual System of the Mink, *Mustela vison***

*Susan K. McConnell and Simon LeVay*

The organization of the retinogenicuicortical visual system of the mink was studied by anterograde and retrograde tracer techniques, by physiological mapping, and by direct recordings from axonal terminals after injection of kainic acid.

In the lateral geniculate nucleus, retinogeniculate afferents are segregated according to eye of origin between the two principal layers, A and A1. Within each of these layers there is a further parcellation according to functional type: on-center afferents terminate in the anterior leaflets of A and A1, and off-center afferents in the posterior leaflets. This separation is preserved in area 17: geniculocortical afferents terminate in ocular dominance patches in layer IV, and these patches



coexist with an alternating, partially overlapping set of patches for on-center and off-center inputs that we have demonstrated previously (McConnell and LeVay: *Proc. Natl. Acad. Sci. USA* 81: 1590-1593, '84.) In both the lateral geniculate nucleus and in area 17, the contralateral eye predominates to a much greater extent than in the cat.

Visual cortical areas corresponding to the cat's areas 17, 18, and 19 can be identified in the mink, but they are shifted posterolaterally in the hemisphere, and they show less emphasis on the representation of central retina. Mapping studies also revealed the existence of a fourth visual area in the splenial sulcus (area SV) adjacent to the representation of the far periphery in area 17. This area differs from the corresponding region in the cat in that it receives direct projections from the lateral geniculate nucleus and from areas 17 and 18.

The lateral geniculate nucleus projects to each of the four cortical areas that were mapped. The bulk of the projection to area 17 is derived from the principal layers, A and A1, while most cells projecting to areas 18 and SV are found in the C-layer complex. The recurrent projection from area 17 to the lateral geniculate nucleus arises from pyramidal neurons in layer VI, and terminates through all layers of the lateral geniculate nucleus, but most densely in the interlaminar zones. Areas 18 and SV project predominantly to the C layers.

Areas 17, 18, and SV are reciprocally connected with the claustrum and the LP-pulvinar complex, and project to the superior colliculus. All four visual cortical arise from both the supragranular and infragranular layers.

*The Journal of Comparative Neurology*  
250:109-132 (1986).

1 table, 20 fig., 55 references.

*Authors abstract*

#### Comparative Studies on the Plate of Farmed Mink and Polecats with Particular References to the Pattern of Palatine Ridges

(Vergleichende Untersuchungen an Gaumen von Farmnerzen und Farmiltissen unter besonderer Berücksichtigung der Gaumenleistenmuster)

Claudia Niehoegen

The palatine ridges of 138 minks (*Mustela vison* f. dom.) and 69 farm polecats (*Mustela putorius*) were examined. Investigations were based on photographs of the fixed skulls showing the hard palate on a 1:5 scale.

This paper includes descriptions and univariate evaluations of these data. Subsequent allometric calculations enable the exclusion of body weight influence on the ridge area parameters. Size and length of the ridge area as well as the total length of ridges were set in relation to the weight of the eviscerated carcass without fur.

Ridge patterns in both species differ distinctly. Minks and polecats both bear specific features within the limits of typical genus configurations.

Apically the palatine ridges cover the hard gum in its entire width. Median interruptions in the pharyngeal region result in bilateral symmetry in *M. vison*. Its ridges lie in 7 or 8 rows, females having less than males.

The typical pattern of *M. putorius* consists of a varying number of ridge fragments in the pharyngeal section. They lie unarranged and cannot be classified in rows.

In relation to the molar tooth  $M^1$  the ridge area of polecats extends further towards the pharynx than that of minks.

Differences between the two species exist for all relations for which allometric calculations were carried out. While the straight lines describing minks and polecats have the same allometric exponents, their positions differ. Thus the relation of total ridge lengths, as well as of size and length of the ridge area to the body weight are the same for both *Mustela* species.

But with corresponding weight palatine ridges of minks are 22.1% shorter. Their ridge area is 15.5% smaller and 1.6% shorter than that of polecats.

Sex differences in the absolute data base on the males higher body weight alone.

Investigations into differences between mink mutations did not lead to evaluable results about intraspecific variability.

In the following heredity of ridge features is discussed. The influence of domestication and nutrition on the configuration is considered.

*Inaugural-Dissertation, Tierärztliche Hochschule, Hannover: 90pp., 1985.*

11 tables, 15 fig., 61 references.

In GERM. Su ENGL.

*Authors summary*

**The main Arteries of Aortic Arch and the way of their Branching in Nutria Myocaster Coypus (Molina, 1782)**

(Głównie tetnice luku aorty i sposób odejścia ich galezi u nutrii Myocaster coypus (Molina 1782)

*Violetta Knasiecka*

The way of branching the main aortic arch and their branches were studied on 35 preparations (17 females and 18 males) of nutria standard variety. The results indicated that in 77.1% the aortic arch ramifies into 2 branches, i.e. the brachiocephalic trunk and the left subclavian artery. The brachiocephalic trunk gives rise to the left and right common carotid arteries and continues as the right subclavian artery. In 22.9% it was found that three branches originated in the aortic arch, i.e. the brachiocephalic trunk gave rise to the right common carotid artery and continued as the right subclavian artery. The branches of the subclavian arteries were: the costocervical trunk, the dorsal scapular artery, the internal thoracic artery, the vertebral artery and the superficial cervical artery. The branches showed variability in the sequence and the way of branching, separating independently or jointly into two or three arteries respectively. The greatest variability in the way of branching from subclavian arteries was demonstrated by the dorsal scapular artery, whereas the least variable in the branching mode was the internal thoracic artery.

*Roczniki Akademii Rolniczej w Poznaniu, Zootechnika (Poland). (1984). (no. 148/31) p. 81-95.*

*7 table, 1 fig., 22 references.  
In POLH. Su. ENGL., RUSS.*

*Authors summary*

**Electrocardiographic Evaluation of the Healthy Raccoon (Procyon Lotor)**

*Robert L. Hamlin, DVM, PhD; J. Hren, BSc; P.V. Sparrow* (Pälsdjursuppfödningen i Danmark)

Leads I, aV, V, and V ECG were obtained from 12 healthy raccoons anesthetized with xylazine and ketamine. Intervals and amplitudes of component deflections were remarkable uniform among the individuals. Vector orientation of ORC mimicked that for the dog; but the relatively low voltages to QRS mimicked those of cats. The QT interval varied inversal with heart rate, whereas the PQ interval varied directly with body weight. Relationship between heart rate and body weight was not significant ( $P > 0.05$ ).

*Am J Vet Res., Vol 47, No. 4, April 1986.  
1 table, 4 fig., 15 references.*

*Authors summary*

**Contribution to the Study on Mortality of Blue Fox Whelps**

(Smierternosc szczeniat lisow polarnych)

*Irena Narucka, Adam Malecki*

During 5-year investigations in a farm of blue fox the authors observed that in the breeding stock 32 percent of females did not bear whelps and 11 percent lost their offspring after whelping. The losses of whelps from birth to weaning in the age of 7 weeks constituted 12% of all born whelps in the season. Basing on the investigation carried out it was not possible to form a reliable opinion on the causes of death in individual cases.

*Roczniki Akademii Rolniczej w Poznaniu, Zootechnika (Poland). (1984). (no. 148/31) p. 125-129.*

*2 tables, 3 references.*

*In POLH. Su. ENGL., RUSS.*

*Authors summary*

**Breeding of Fur Bearers in Denmark in 1985-86.**

*Anonymous*

In 1985-86, in Denmark, there were 2 143 213 mink breeding females representing an increase of 15.4% over the previous year. Of the females 43% were Scan Black, 21.1% Pastel, 8.4% Pearl and 20.5% wild type vs. 40, 23.9, 9.6 and 19.2% resp. in 1984-85. The av. number of breeding females per farm was 505. Litter size per mated female averaged 4.69, and the percentage of infertile females 10.9. The number of fox breeding females increased by 19% to 56 262, and 68% of the increase was due to increased number of blue and silver fox females. Litter size per mated female averaged 5.30 for

blue fox and 3.07 for silver fox females. There were 6500 chinchilla breeding females at 240 farms, 212 farms with polecats and 56 farms breeding raccoon dogs. Details are given of feeding, health and AI of foxes (almost 30% were inseminated vs. 11% the previous year). Economic aspects are considered.

*Våra Pälsdjur: 57(12): 412-418, 1986.*

*In SWED.*

*CAB - abstract*

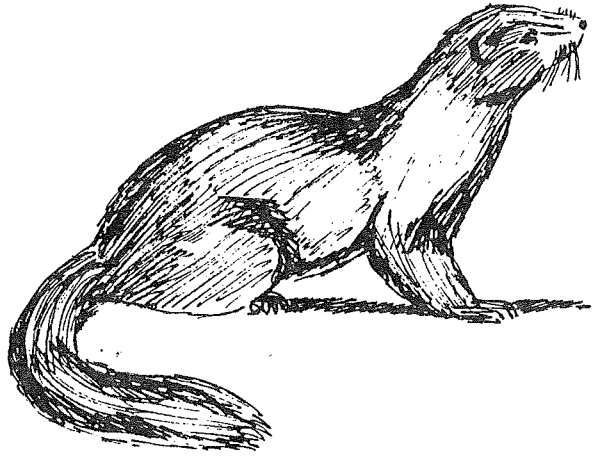
# Beauties and Hur Amma

- and their colour genetics

AVAILABLE FROM NOVEMBER 1987 .

By Norodd Nes, Einar J. Einarsson and Outi Lohi  
with contribution from S. Jarosz and R. Scheelje

Published by SCIENTIFUR



**Immunogenetics of Immunoglobulins in American Mink**

**V. Instability of Expression and the Problem of Genetic Control of C gamma -Allotypes**

*Baranov O.K., Volkova O.Yu., Metchetina L.V., Taranin A.V., Fomicheva I.I.*

The results of the study on expression of immunoglobulin C gamma -allotypes (H2, H3 and H4) of mink blood serum are given. Significant enhancement of quantitative expression, and even the appearance of an allotype anew, were shown with the aid of double immunodiffusion to take place at high frequency upon intensive hyperimmunization with different antigens in adult mink. Three main facts which supplement the above mentioned results were established with the help of highly sensitive enzyme-linked immune assay adapted to H4 testing:

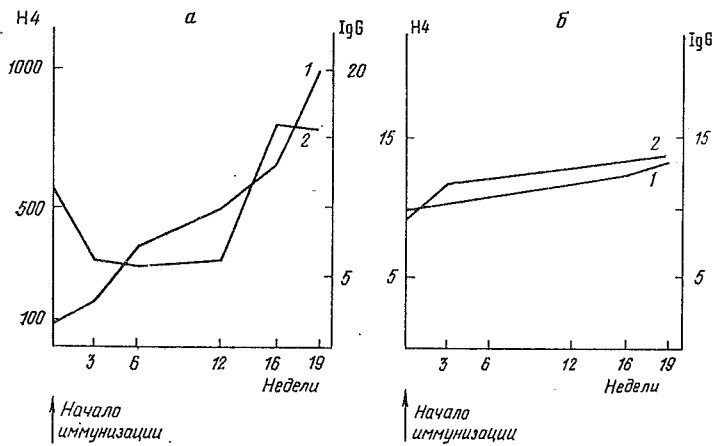


Рис. 2

Рис. 2. Изменение концентрации аллотипа H4 (мкг/мл) и общего Ig G (мг/мл) в процессе гипериммунизации норки: а - норка № 1053, б - интактная норка контроля № 1063. 1 - концентрация H4, 2 - концентрация Ig G

Рис. 3. Часть родословной норки, в сыворотках крови которых аллотип H4 тестировали методом двойной иммунодиффузии (ДИД) и иммуноферментным анализом (ИФА). Обозначения: 1 - норки с нормальной, регистрируемой ДИД, концентрацией H4 в сыворотке крови; 2 - норки с минорной концентрацией H4 (H4 регистрируется в ИФА, но не регистрируется в ДИД); 3 - норки, отрицательные по H4 и в ДИД, и в ИФА

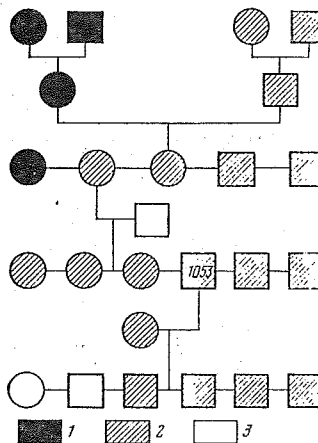


Рис. 3



1. Many H4-negative mink sera (as shown by double immunodiffusion) contain this allotype in minor concentration (10 to 200 g/ml) which is typical for the latent type of allotype expression.

2. The H4-allotype which turned out to be determined by double immunodiffusion in some mink during hyperimmunization, i.e. reached the normal serum concentration of 1-10 mg/ml, was shown to have been present in minor concentration prior to immunization.

3. The latent (minor) type of expression is shown to be inherited.

Unprecedentedly high frequency of expression of latency and instability is likely to be the main reason for deviations from mink C<sub>gamma</sub>-allotypes Mendelian pattern and difficulties of establishing the genetic relations among them.

3 tables, 4 fig., 41 references.  
In RUSS, Su. ENGL.

*Authors summary*

### Mottled Mink - a new Mutation?

(Spräcklig Mink - ny Mutation, eller...?)

*Lars Elofsson*

An illustrated description is given of a black male mink whose winter coat turned mottled, with black, grey and white underfur and white guard hairs with black tips. It is not yet known whether the coat colour changes are due to deficient melanin production or genetic factors, but test matings are planned to investigate the latter.

*Vära Pälsdjur: 58(1): 18, 1987*  
1 fig.  
In SWED.

CAB - abstract

### Attempt in Determining Heritability of the Diameters of Hair and Medulla in Blue Fox

(Proba okreslenia odziedziczalnosci cech grubosci i rdzenistosci owlosienia lisa polarnego)

*Ryszard Cholewa, Jerzy Gedymin*

As the quality of coat depends on the morphological traits of the hair, the authors attempted to find whether the diameters of medulla and hair in blue fox could be used as indices in selection. It is possible if these traits are inherited and heritable.

The investigated material included 263 pairs: dam and daughter, originating from 2 farms situated near Poznan. The authors measured the hair samples taken on the back of the animals in winter when the coat was in full maturity. The  $h^2$  in the tested population ranged from 0.37 to 0.72. This finding may indicate that these traits are heritable, thus they can be useful in evaluating animals for selection.

*Roczniki Akademii Rolniczej w Poznaniu, Zootechnika (Poland). (1984). (no. 148/31) p. 13-16.*

1 table, 3 references.

In POLH. Su. ENGL, RUSS.

*Authors summary*

### Genetic Problems in mink Culture

*LeGrande C. Ellis and L.C. Pace*

While the mutant color phases of mink arose from genetic mutations, dark mink were developed by intensive inbreeding for short, uniform, darkly pigmented guard hairs with a sheen and dark underfur. The genes for a number of pelt priming defects and infertility are known to reside on a specific chromosome in man and animals in close association with the histocompatibility, HLA, growth, reproduction, and production gene complexes. Some important genetically inherited problems in mink are: primary and secondary male infertility, autoimmune orchitis, cytotoxic destruction of

the testes and epididymides both spontaneously and melatonin induced, genetic infertility, cryptorchidism, neonatal kit loss, watery kits, nursing sickness, male and female non-reproductive seasonal losses of mature mink, singe and cotton fur syndrome in nursing kits. The above disease were discussed as they rela-

te to similar states in other farm animals and man.

*Utah Science* 47 (3): 86-93, 1987.  
1 table, 4 fig., 12 references.

*Authors summary*

### Current Insights on Selected Fur Characteristics of Standard Mink

(Aktuelle Erkenntnisse zu ausgewählten Felleigenschaften beim Standardmink)

Jörg Schumacher, Ulf D. Wenzel

The present study compiles contributions of international authors and results of our own research.

It is significant that the parameters of fur structure and fur colour are considered under more differentiated aspects in the Scandinavian countries. In addition to degree of brightness, *Reiten (1977)* distinguishes leather thickness, hair length, fur density, tension, hair quality and general fur quality. Estimated heritability is indicated separately according to the component of variance from females and males. This opens the possibility that the heritability component calculated for the mother may be bigger, since possible dominance, epistasis and maternal performance may be involved.

In our own investigations, heritability of fur structure and fur colour were calculated with the help of estimate rates of the components of variance  $\sigma$  and  $\sigma^2$  as half-sibling analysis with the help of the equation

$$h^2 = \frac{4\hat{\sigma}^2 a^2}{\hat{\sigma}^2}$$

If  $h$  values were not too small and random sample amounts were larger, it was possible to calculate confidence limits as approximations with the following equation:

$$h^2 = u \left(1 - \frac{\lambda}{2}\right) s_h^2 ; \quad h^2 = u \left(1 + \frac{\lambda}{2}\right) S_h^2$$

(according to *Rasch et al. 1978*).

These calculations were applied with 245 half-sibling groups of a standard line and 196 half-sibling groups of jet line.

Table 1. Estimate rates of  $h^2$  for fur structure on November 1:

sex	genotype	half sibling groups	fur structure		KI for $h^2$ if = 5%
			$h^2$	$sh^2$	
♂	standard	215	0.855	0.017	(0.822;0.888)
	jet	83	0.765	0.021	(0.724;0.806)
♀	standard	30	0.534	0.038	(0.460;0.608)
	jet	113	0.667	0.047	(0.575;0.759)

The high estimate rates indicated point out that it may be possible in future to improve the quality of the furs produced by selective breeding. It is obvious that the jet line as well as the standard line exhibits a high degree of hereditary disposition. It must be emp-

hasized that in both lines presumably the males offer more favourable hereditary features than the females.

When assessing fur colour, it is frequent international practice to provide one common quality mark for both straight hair and under-

fur colour. The calculated  $h$  values of *Johansson* (1964), *Udris* (1968), *Sandh* (1975) and *Olausson* (1976) vary between 0.20 and 0.50. The results of *Reiten* (1977) are in the range between 0.40 and 0.50. Accordingly, the degree of brightness does not seem to be particularly

influenced by maternal effects, since the estimate rates of both components of variance are on the same level. Our own results prove relatively high hereditary disposition of fur colour (table 2) and largely confirm the findings of *Reiten* (1977).

Table 2.  $h^2$  Estimate rates of fur colour on November 1:

sex	genotype	half sibling groups	fur colour		KI for $h^2$ if = 5%
			$h^2$	$sh^2$	
♂	standard	215	0.625	0.017	(0.592;0.658)
	jet	83	0.675	0.020	(0.636;0.714)
♀	standard	30	0.473	0.028	(0.418;0.528)
	jet	113	0.735	0.018	(0.670;0.770)

Only the estimate rates of heritability of standard females, amounting to  $h = 0.473$ , deviate somewhat from the level of the other estimate rates (0.625 - 0.735). One reason for this could be the small random sample amount of  $n = 30$  half-sibling groups. The high estimate rate indicated should point out future opportunities of selective improvement of the

mink fur produced with regard to fur structure and fur colour.

*Brühl, No 3, 86, pp. 11-13.*  
*tables, 12 references.*  
*In GERM Su. GERM*

*Authors summary*

### Considerations on Selective Breeding of Standard Mink with Regard to Improving Fur Quality

(Betrachtungen zur zielgerichteten Verpaarung von Standardnerzen hinsichtlich der Verbesserung der Fellqualität)

*Jörg Schumacher, Ulf D. Wenzel*

National and international references indicate that "fur quality" is a significant criterion for achieving high fur prices. The quality criteria of fur colour (colour of underfur, colour of straight hair) and fur structure (density of straight hair, quality of straight hair, nap) are closely interrelated.

The present study tests the results of selective mating with regard to fur quality of high and very high quality animals concerning colour and structure. 1477 minks of three test generations were tested. Either fur quality component was tested with a scaling system comprising 5 marks. The tables presented show colour and structure development of paternal and maternal performance and the average performance characteristics of their offspring. In both classification procedures of parental performance the maximum index of 10 (5 points for colour and 5 points for structure) is found most frequently with an index of father of 10 and of mother of 5-10, namely at a level of 30.7 percent, and with an index of mother of 10 and a father of 5-10, namely at a level of 24.1 percent.

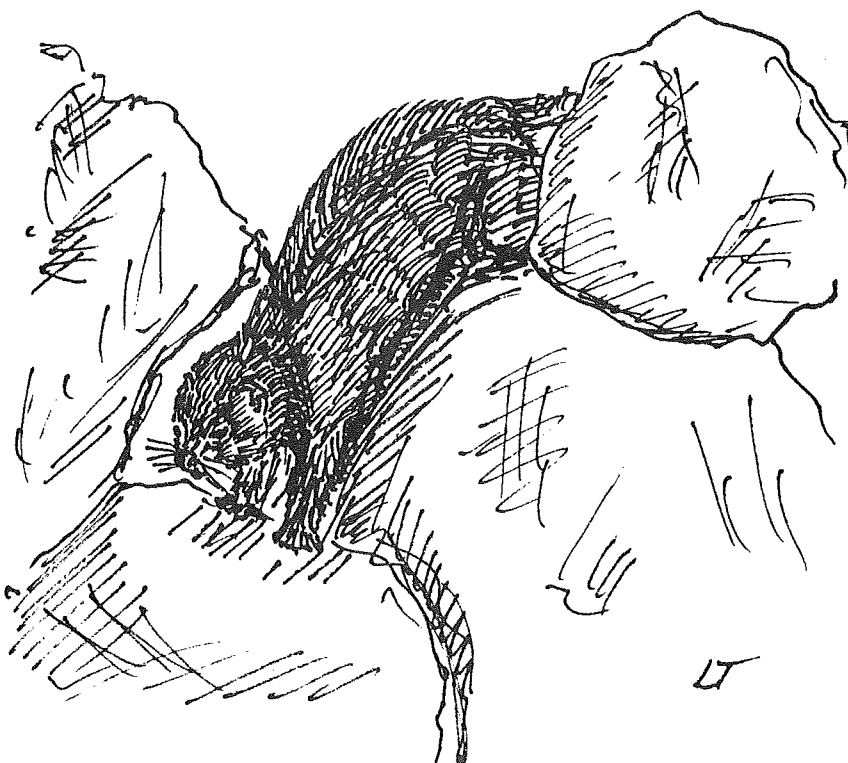
*Table: Parental performance characteristics and splitting up of the performance of their offspring with regard to fur colour and fur structure with the help of indices*

Parental performance			Index of offspring performance (%)					
Father	mother	n	10	9	8	7	6	5
10	5 - 10	88	30.7	18.2	21.6	19.3	5.7	4.5
9	5 - 10	245	16.3	22.0	25.7	25.7	8.2	2.1
8	5 - 10	359	11.1	12.8	23.8	30.2	18.2	3.9
7	5 - 10	398	9.3	13.8	21.1	33.2	18.1	4.5
6	5 - 10	342	5.5	7.3	24.6	32.8	21.9	7.9
5	5 - 10	16	0	6.3	6.3	25.0	43.7	18.7
Mother	Father							
10	5 - 10	112	24.1	21.4	21.4	22.3	8.0	2.8
9	5 - 10	177	18.6	19.2	22.6	25.4	11.3	2.9
8	5 - 10	344	11.3	18.3	23.8	30.2	11.1	5.3
7	5 - 10	391	8.7	10.8	24.8	32.2	19.6	8.9
6	5 - 10	351	6.8	8.6	21.4	33.6	22.5	7.1
5	5 - 10	73	6.8	6.9	23.3	26.0	30.1	6.9

As shown in the comparison of parental performance with the average performance of the offspring concerning the features of fur colour and fur structure (table), decreasing quality marks of parents on November 1 will decrease offspring performance in the following year. From this arises the conclusion for future breeding practice to mate males and females with the highest marks.

*Brühl 6, 1986. 36-37  
5 tables, 3 references.  
In GERM.*

*Authors summary*





## Aspiration biopsy of the testis - a useful tool in mink

C. Sundqvist, M. Parvinen and A. Lukola. Department of Biology, Åbo Akademi, Porthansgaten 3B, SF-20500 Turku, Finland, Institute of Biomedicine, Department of Anatomy, University of Turku, SF-20520 Turku, Finland, and Department of Biochemistry and pharmacy, Åbo Akademi, SF-20500 Turku, Finland

### Summary

Infertile mink males frequently occur. They should be eliminated as early as possible. The aspiration biopsy of mink testes seems to be the most valuable method at present in assessing fertility. Specimen collection, staining and analysis are easy to do in a normal farm situation.

### Introduction

The surgical biopsy of testes has traditionally been the most accurate method for assessing male infertility (Charny, 1940). However, more recent studies indicate that a versatile thin needle aspiration biopsy technique for cytological examination of the testes is in agreement with the histological findings in evaluation of spermatogenic failure (Persson *et al.* 1971, Nseyo *et al.* 1984). Because infertile males frequently occur (Tung *et al.* 1984), it seemed reasonable to study mink using the fine needle aspiration biopsy of the testes. As a male mink usually fertilizes 4 - 8 females, one case of infertility raises several unfertilized or barren females. Furthermore, it is more convenient to screen the male infertility in order to increase the litter size. From the economic point of view it is important that the infertile males are eliminated as early as possible.

### Materials and Methods

Altogether, more than 1,000 male minks from a

conventional farm in SW Finland have been studied during 1984 - 1986. Their ages varied from 1 to 3 years, the majority being one year old. The open-sided sheds providing natural climatic and light conditions contained individually caged minks with most common color varieties. All animals studied were treated in the same way as the other animals on the farm.

Aspiration biopsies of the testes were taken in January and February, i.e. 1 - 2 months before the mating season. The testes of conscious minks were palpated and punctured by a 19 or 20 gauge needle connected to a 20 ml syringe. A gentle aspiration was produced as the tip of the needle passed the testicular tissue. Care was taken to avoid injury to the cauda epididymidis. In most cases, the biopsy was taken from one testis only. If differences in testicular size were found, the larger one was studied.

The sampling produced no harmful effects on libido, appetite or general behaviour. The samples were either immediately squashed and studied in live condition by phase-contrast microscope or they were smeared onto microscope slides, air-dried and analyzed after staining with a May-Grunwald-Giemsa solution. Some samples were stored inside the needle for 15 days at 0°C and later stained with May-Grunwald-Giemsa. Each view was scored on a scale from 1 to 10 using a slightly modified Johnsen's (1970) score count method (Table 1).

Table 1. The testicular aspiration biopsy samples were scored according to a scale from 1 to 10. Samples were spread onto microscope slides and stained with a May-Grunwald-Giemsa solution. More than 40 randomly selected views (400  $\mu$ m) were scored using  $\times$  400 magnification.

Scores	Cells characterized	Number of cells per view
1.	Sertoli cells only	5 - 30
2.	Spermatogonia only	2 - 30
3.	No further than Primary spermatocytes	< 10
4.	No further than primary spermatocytes	10 - 30
5.	No further than round spermatids	< 10
6.	No further than round spermatids	10 - 40
7.	No further than round spermatids	> 40
8.	Maturation phase spermatids	< 20
9.	Maturation phase spermatids	20 - 50
10.	Maturation phase spermatids	> 50

In cytological analyses, the main emphasis was focussed on the presence of haploid germ cells and particularly on those with condensing chromatin. Biopsy scores were compared with reproductive capacity, testicular development and with conventional histology. Statistical tests were performed with IBM-PC and Lotus 1-2-3 (Sundqvist & Enkvist, 1987).

### Results

When the relative distribution of the spermatogenic cells in the testis smears was scored, clear differences could be seen between minks with clinically abnormal (small and soft) testes and normal ones: The former group ( $n = 18$ ) showed a mean biopsy score count of  $5.33 \pm 2.88$  compared to  $9.40 \pm 0.58$  ( $n = 138$ ) in controls. There was tendency ( $r = 0.46$ ,  $n = 200$  and  $p < 0.05$ , single classification random ANOVA) for high scoring males to return better breeding results. Males with score counts less than 7 were considered as infertile. Additio-

nal samples ( $n = 870$ ) confirmed that those cases where spermatogenesis one month before the mating season had not progressed beyond the pachytene stage were infertile. Samples stored inside the needle could not be used for accurate diagnosis.

### Discussion

In accordance with preliminary investigations (Sundqvist et al., 1986) we could confirm in this study that testicular aspiration biopsy allows infertile mink males to be detected 1 - 2 months before the breeding season. In those cases where spermatogenesis had not progressed beyond the pachytene stage, infertility was established without doubt. An arrest at certain levels of spermatogenesis was in one study directly reflected in specific biopsy score count values (Johnson, 1970). Furthermore it has been observed that testicular biopsy is a worthwhile technique for establishing accurate diagnostic criteria in cases of canine infertility (Larsen, 1977). This speaks in favor for testicular biopsy also in mink.

The seminiferous tubules in mink are relatively fragile, and in some cases also intact seminiferous tubules could be obtained using low aspiration forces. The extremely dark mink has been shown to produce antisperm antibodies (Tung et al., 1984) and increased testicular levels of the blood-testis barrier altering substance, histamine (Nemetallah et al., 1985). There might be a risk of such reactions in other mink color varieties, too, but it has been shown histologically that autoimmune reactions had not time to develop in mink during the two months after sample collection (Sundqvist et al., 1986). The future investigations should focus on the possibility of autoimmune reactions in biopsied mink males bred through several seasons. There has been reports on testis injuries after surgical biopsy in monkeys (Plöen & Läckgren, 1984) and bulls (Gassner & Hill, 1955). In contrast with observations of no deleterious effects in rams, boars or stallions (MacDonald, 1970; Galina, 1971). In a recent work, Pelletier (1986) claims that in mink, functional blood-testis barrier is present only during part of the active period of spermatogenesis. This could be the anatomical basis for frequent occurrence of testicular autoimmune disease in this species. This correlation is even more striking if the annual disappearance of blood-testis barrier is unique to the mink.

The information gained from analyzing testis specimens collected by the aspiration

technique is valuable for practical purpose in screening for mink male infertility. Because specimen collection, staining, and analysis are easy to do, this technique is very suitable for assaying mink infertility in a normal farm situation.

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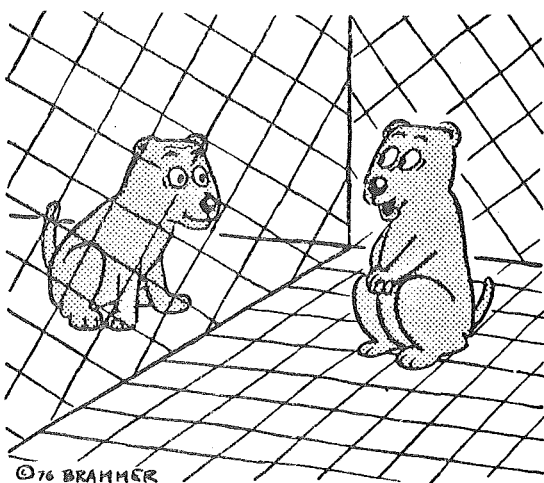
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*Sundqvist C., Lukola A. & Parvinen M. (1986):* Testicular aspiration biopsy in evaluation of mink (*Mustela vison*). *J. Reprod. Fertil.* 77:531-535

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SCIENTIFUR, VOL. 11, NO. 3, 1987



- *Aspiration Biopsy sounds much worse than it is.*
- *And immediately after you know how far you can do what you wish.*

## Male infertility in mink breeding

*Christer Sundqvist*

A high incidence of male infertility greatly impairs the economy of mink production. Infertile males should therefore be eliminated from breeding. This study constitutes a critical evaluation of two "old" methods, 1) testicular palpation, 2) the sperm test, as well as two "new" methods, 3) testosterone test, and 4) aspiration biopsy of the testis.

Aspiration biopsy of the mink testis seems to be the most valuable test method. It gives the investigator a good opportunity to observe defects in spermatogenesis with great accuracy. Although infertile males can be detected by testicular palpation, the method is largely restricted to the recognition of two major testicular disturbances, namely hypoplasia and cryptorchidism. A combination of palpation, and testis biopsy is suggested as a more reliable indicator of fertility. The sperm test offers a powerful tool in breeding mink. Males producing semen of unsatisfactory quality are effectively eliminated. The sperm test was useful in testing the effect of the anti-estrogen, clomiphene citrate, on male reproductive performance. The test method must, however, be performed during the busy weeks in March, when minks are mated. Serum testosterone was estimated by two methods, RIA and TR-FIA. The latter method had several advantages, the possibility of measuring a large number of samples within a short period of time, being worthy to mention here. The serum testosterone test gives conflicting results and must await further study before its real value can be assessed. Although there exists a correlation between serum testosterone in early February and sperm quality in March, it seems as if only males with delayed puberty or greatly disturbed testicular development can be detected by this test. In order to test the effect of long-distance transportation on male mink reproductive capacity, serum testosterone measurements were highly valuable.

*Thesis/Academie Dissertation. Dept. of Biology, Åbo Akademi, Finland. (ISBN 951-649-337-8). 67 pp, 2280 references. In ENGL.*

*This thesis is based mainly on the following articles:*

- Christer Sundqvist & Margaretha Gustafsson (1983): "Sperm test - a useful tool in breeding work of mink". Journal of the Scientific Agricultural Society of Finland. 55:119-131. (Vol. 8, No. 4, 1984)\**
- Christer Sundqvist, Altti Lukola & Maija Valtonen (1984): "Relationship between serum testosterone concentrations and fertility in male mink (*Mustela vison*)". Journal of reproduction and fertility 70:409-412 (Vol. 8, No. 4, 1984).*
- Christer Sundqvist, Jorma Toppari, Martti Parvinen, Rune Fagerström & Altti Lukola (1986): "Elimination of infertile male mink from breeding using sperm test, testicular palpation, testosterone test and fine-needle aspiration biopsy of the testis". Animal Reproduction Science 11:295-305 (Vol. 11, No. 3, 1987).*
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- Christer Sundqvist (1985): "Morphometric studies on mink testicular tissue". Theriogenology 24:713-723 (Vol. 10, No. 4, 1986).*
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- Altti Lukola & Christer Sundqvist (1986): "Improved sperm counts in mink males (*Mustela vison*) treated with clomiphene citrate". Journal of Endocrinological Investigation 9:243-244 (Vol. 11, no. 3, 1987).*

(\*) Vol. and Issue of SCIENTIFUR in which the actual report have been abstracted.

**Elimination of Infertile Male Mink from Breeding using Sperm Test, Testicular Palpation, Testosterone Test and Fine-Needle Aspiration Biopsy of the Testis**

*C. Sundqvist, J. Toppari, M. Parvinen, R. Fagersrömand A. Lukola*

Male mink have been screened for infertility using various techniques in order to find effective means of elimination of infertile individuals from breeding. The microscopical evaluation of sperm quality resulted in detection of 5.1-20.9% of infertile males (n = 395). As a consequence the mean annual number of kits per female (litter-size) significantly increased ( $P < 0.05$ ), compared to non-analysed population. With testicular palpation (n = 271), males with hypoplastic (1.9%) and cryptorchid (6.4%) testes could be eliminated from breeding. The selection based on serum testosterone measurement before the breeding season

led to a significant increase in the litter-size ( $P < 0.05$ ) in one test group as compared with 3 previous years. A poor correlation was found in another test group (n = 20) between serum testosterone concentration and sperm quality. Fine needle aspiration biopsy of the testis was used for the first time for fertility assessment with encouraging results. It is concluded that for practical purposes testicular palpation, microscopical evaluation of sperm quality and the fine-needle aspiration biopsy are most suitable in assessing male mink reproductive capacity. The significance of the serum testosterone assay remains to be evaluated further.

*Animal Reproduction Science, 11 (1986) 295-305  
3 tables, 2 fig., 33 references*

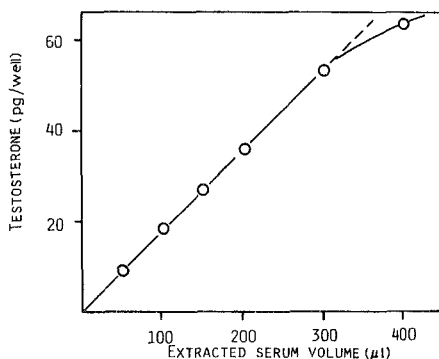
*Authors abstract*

**Comparison Between Radioimmunoassay and a New Time-Resolved Fluoroimmunoassay: Determination of Total Serum Testosterone in Male Mink (*Mustela vison*)**

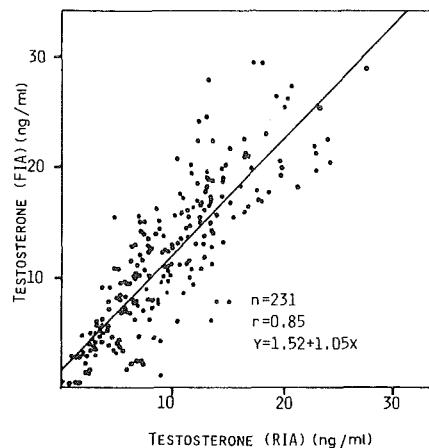
*E. Bertoft, O. Mäentausta, C. Sundqvist and A. Lukola.*

A comparison of a solid-phase immunoassay using time-resolved fluorescence (TR-FIA) and a conventional radioimmunoassay (RIA) was performed

for the determination of total serum testosterone in peripheral blood samples obtained from 231 mink males (*Mustela vison*). The correlation between the values obtained with the two methods was good ( $r = 0.85$ ;  $y = 1.52 + 1.05x$ ). The values obtained with FIA ( $11.67 \pm 5.39$  ng/ml). Standards prepared from female mink serum behaved similarly to the bovine serum standards used in the commercial kits. The data obtained show that FIA is a reproducible method and provides a useful tool



**Fig. 2. Relation between the measured testosterone content and extracted mink serum volume in TR-FIA.**



**Fig. 3. Correlation between the TR-FIA of testosterone and a commercial RIA.**

for measurement of a large number of samples within a short period of time.

*Animal Reproduction Science*, 12 (1987) 291-295  
3 fig., 8 references.

*Authors abstract*

### Improved sperm counts in mink males (*Mustela vison*) treated with clomiphene citrate

A. Lukola and C. Sundqvist

A group of 12 sterile, azoospermic mink males were treated with clomiphene citrate (10 mg/kg/day) for 10 days during the mating season; 50% of the males showed improved sperm counts already after 2 days of treatment and the maximum effect was seen 4-6 days after the start of the treatment. The other half of the group did not respond to the treatment and their sperm counts remained near zero during the whole experiment.

A. Lukola and C. Sundqvist

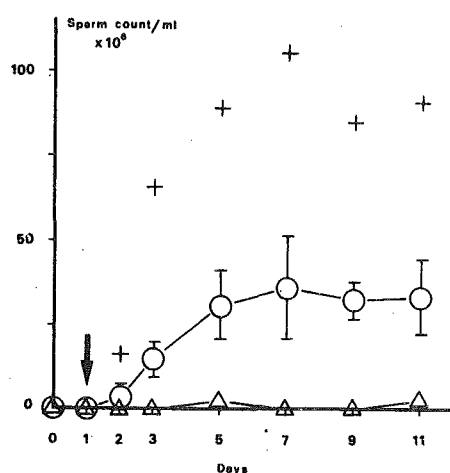


Fig. 1.- Sperm counts (mean  $\pm$  SE) of clomiphene citrate treated (○) and untreated (Δ) mink males. (+) upper range. ( $p < 0.05$  at day 5;  $\chi^2$  evaluation).

*J. Endocrinol. Invest.* 9:243, 1986.  
1 fig., 8 references.

*Authors abstract*

### Ablation of the Blood-Testis Barrier in Rats and Guinea Pigs by 48/80, a Histamine Releaser, and Cadmium Chloride

B.R. Nemetallah and L.C. Ellis

When adult male guinea pigs were injected unilaterally intratesticularly with compound 48/80 (1 mg in 0.05 ml saline), their testicular peritubular capillaries were engorged with blood, intratubular edema was present on the ipsilateral side, and the blood-testicular (BT) barrier (measured by the entrance of acriflavin into the seminiferous tubule) was ablated. The contralateral testis, when injected with saline, showed no pathological changes nor a breakdown of the BT barrier. Subcutaneous injection of guinea pigs with cadmium chloride resulted in a more intense intratubular fluorescence than was observed for 48/80-treated animals. The H and H receptor blockers (diphenhydramine and cimetidine, respectively) reduced the intensity of capillary engorgement and edema. Intraperitoneal injections of 48/80 (0.5 mg) was lethal to rats, and both diphenhydramine and cimetidine induced survival even with as much as 1 mg of 48/80. Intratubular fluorescence was less severe than that observed for similarly treated guinea pigs or from cadmium chloride-treated rat testes. Neither treatment (48/80 or cadmium chloride) altered the blood-epididymal barrier of either guinea pigs or rats. Species differences were observed in the lethal effects of exogenously administered histamine.

*Archives of Andrology* 15:41-48 (1985).  
2 tables, 2 fig., 36 references.

*Authors abstract*

### Morphology of the female genital organs of coypu

(Contribuții privind morfologia organelor genitale femele la nutrie (*Myocaster coypu*)).

V. Cotofan, C. Cotea, Valentina Hritcu

Studies made on female genital organs have revealed some characteristics: small ovaries partially covered by a large ovarian bursa with a cordonal structure and polyovocytic follicles; uterus of duplex type; two cervical

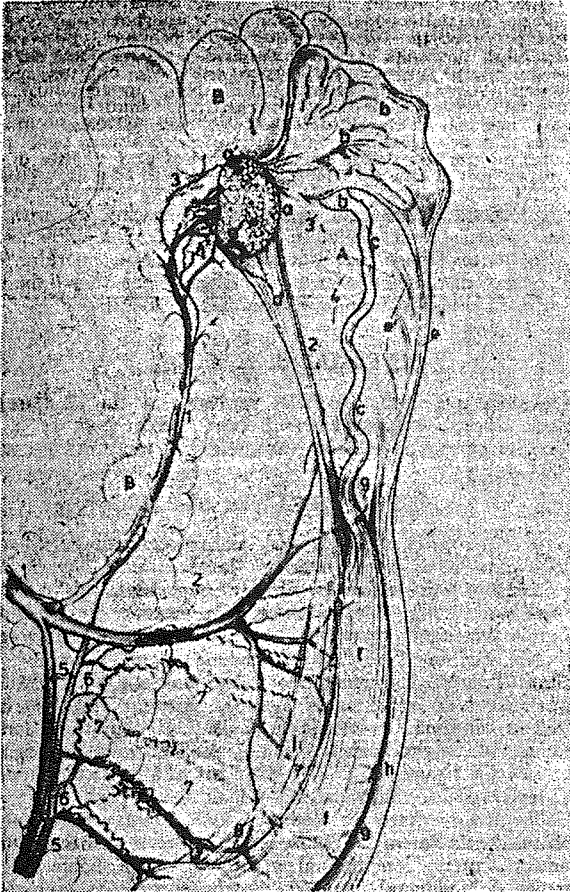


Fig. 1. Ovarul și bursa ovariană la nutrie: A — bursa ovariană; B — panicul adipos mezo-ovarian; a — ovarul; a' — corp galben de gestație; a'' — corp alb; b — pavilionul trompei; b' — orificiul abdominal al oviductului; c — oviduct; d — ligament utero-ovarian; e — ligament tubo-uterin; f — uter; h — ligament uterin longitudinal ventral; i — ligament uterin longitudinal dorsal; 1 — a. și v. ovariană; 1' — rr. ovariene; 2 — a. tubară caudală; 3 — a. tubară cranială; 4 — rr. tubare; 5 — a. uterină; 6 — rr. uterine scurte; 7 — rr. uterine lungi; 8 — arcada venoasă dorsală; 9 — arcada venoasă ventrală.

channels with separated openings into hemispheric-aplatished portion of the vaginal segment of the uterus; a very developed cytogenic chorion with numerous glands in endometrium; a long vagina with strong musculature in the caudal part and with an outside transversal aperture; a small spur that separated vulva by anus; urethra, on the dorsal part of the clitoris, with an own orifice; clitoridien glandus covered with prepuce. Subanal gland of sebaceous of contributes to the lubricance of the perineum and vagina during the copulation.

Lucrari Stiintifice Institutul Agronomic "Ion Ionescu de la Brad", Iasi, Zootechnie-Medicina Veterinara: 27/28: 51-55, 1984.

6. fig., 3 references.

In ROMN, Su. ENGL.

Authors summary

### Administration of Medroxyprogesterone Acetate in an Effort to Advance the Implantation in the Mink

(Forsøg på fremkaldelse af implantation hos mink ved behandling med medroxyprogesteronacetat)

Ib J. Christiansen

At varying distances from the last mating in mink mated once or twice, 2.5 mg medroxyprogesteroneacetate (Perlutex LEO) was administered intramuscularly. This treatment did not influence the pregnancy rate or the duration of pregnancy. Without significance ( $P < 0.1$ ) the number of cubs was greater in mink treated between the 9th and the 14th day after the last mating compared to mink in the control group, whereas the number of cubs was significantly less ( $P < 0.05$ ) in mink treated between day 5 and day 8 after the last mating compared to control mink.

Årsberetning, Institut for Sterilitetsforskning, Kongelige Veterinær- og Landbohøjskole: 28:55-60, 1985.

2 tables, 11 references.

In DANH, Su. ENGL.

### Authors summary

### Collection, Evaluation and conservation of semen of Silver Fox (*Vulpes vulpes* L.) and an attempt to test males as sperm donors

Pobieranie, ocena i przechowywanie nasienia lisow srebrzystych (*Vulpes vulpes* L.) oraz ocenę samców jako dawców nasienia)

Marian Brzozowski

Experiments were conducted on 26 ten-month-old males of silver fox. Electroejaculation as a method of semen collection was effective with 25 animals. The males were stimulated for 9-13 minutes with current of 50 Hz, voltage 1.5-3.0 V and intensity 5-15 mA.

With 105 stimulations 55 good-quality ejaculates were obtained. They were generally of whitish colour, watery consistency, medium intensive smell, pH - 6.2. The average volume of ejaculate was 1.3-1.9 ml, spermatazoa density - 100 000/mm. No morphological abnormalities were found in 94.2% of spermatazoa.

The experiments showed that 3-4-day intervals between the collections had a beneficial effect on the quality of ejaculate.

Yolk-lactose and yolk-citrate extenders used to conserve the sperm proved to be suitable and equivalent.

The evaluation of silver fox males as sperm donors, useful in determining their breeding value, may be done basing on the results of 3-4 test collections of semen.

*Roczniki Naukowe Zootechniki (Poland). Polish journal of Animal Science and Technology. (1984). v. 11(2) p. 31-39.*

*1 table, 15 references.*

*In POLH, Su. ENGL, GERM, RUSS.*

*Authors summary*

**Determining Pregnancy in Chinchillas**

*Thistle down*

Pregnancy diagnosis from body weight (an initial loss, followed by an increase), visual inspection, and palpation of the abdomen is described. Detection of a vaginal plug is indicative of mating; 85% of mated females conceive. 60 days after detection of a plug, teat enlargement starts in pregnant females. At 30 days after conception, foetal kits are palpated at palpation.

*Orejuda Chinchilla: 3(2):23, 26-27, 1986*

*CAB - abstract*

**Bone Marrow Depression Associated with Prolonged Estrus in the European Polecat or Fitch Ferret**

*Deborah Anne Martin*

Prolonged estrus is common in ferrets and is associated with a high incidence of fatal bone marrow depression characterized by nonresponsive anemia, thrombocytopenia, and granulocytopenia. Veterinary technicians who are aware of the dangers of prolonged estrus in ferrets can bring animals with clinical signs to the attention of the veterinarian for appropriate diagnosis and management.

*Veterinary Technician: 7(7): 323-327, 1986. 1 table, 3 fig., 9 references.*

*Authors summary*



Figure 1—A typical fitch ferret. (From Ryland LM, Bernard SL, Gorham JR: A clinical guide to the pet ferret. *Compend Contin Educ Pract Vet* 5(1):26, 1983. Reprinted with permission.)

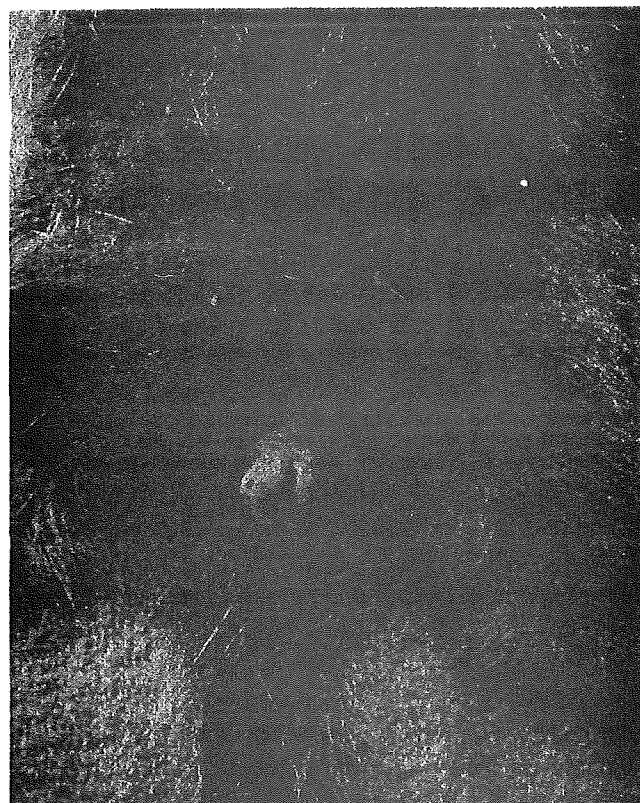


Figure 2—A swollen vulva is indicative of estrus in the female ferret. Alopecia of the ventral abdomen and tail is evident. (From Ryland LM, Bernard SL, Gorham JR: A clinical guide to the pet ferret. *Compend Contin Educ Pract Vet* 5(1):26, 1983. Reprinted with permission.)



*Seasonal changes in testicular structure and function in the Blue Fox (Alopex Lagopus), as quantified by morphometric analysis and measurement of Adenylate Cyclase Activity*

Adrian Smith, Hans Petter Bugge, Kjell Andersen Berg, Ordin Møller and Vidar Hansson

The volume of the blue fox testis showed

5-fold changes during the year, associated with considerable changes in cellular composition. The seminiferous epithelium was maximally regressed in August, when 94% of tubules contained only spermatogonia. By late October, approximately 6 months before mating season, 40% tubules contained primary spermatocytes. From the middle of January until the end of April all tubules contained spermatids or more

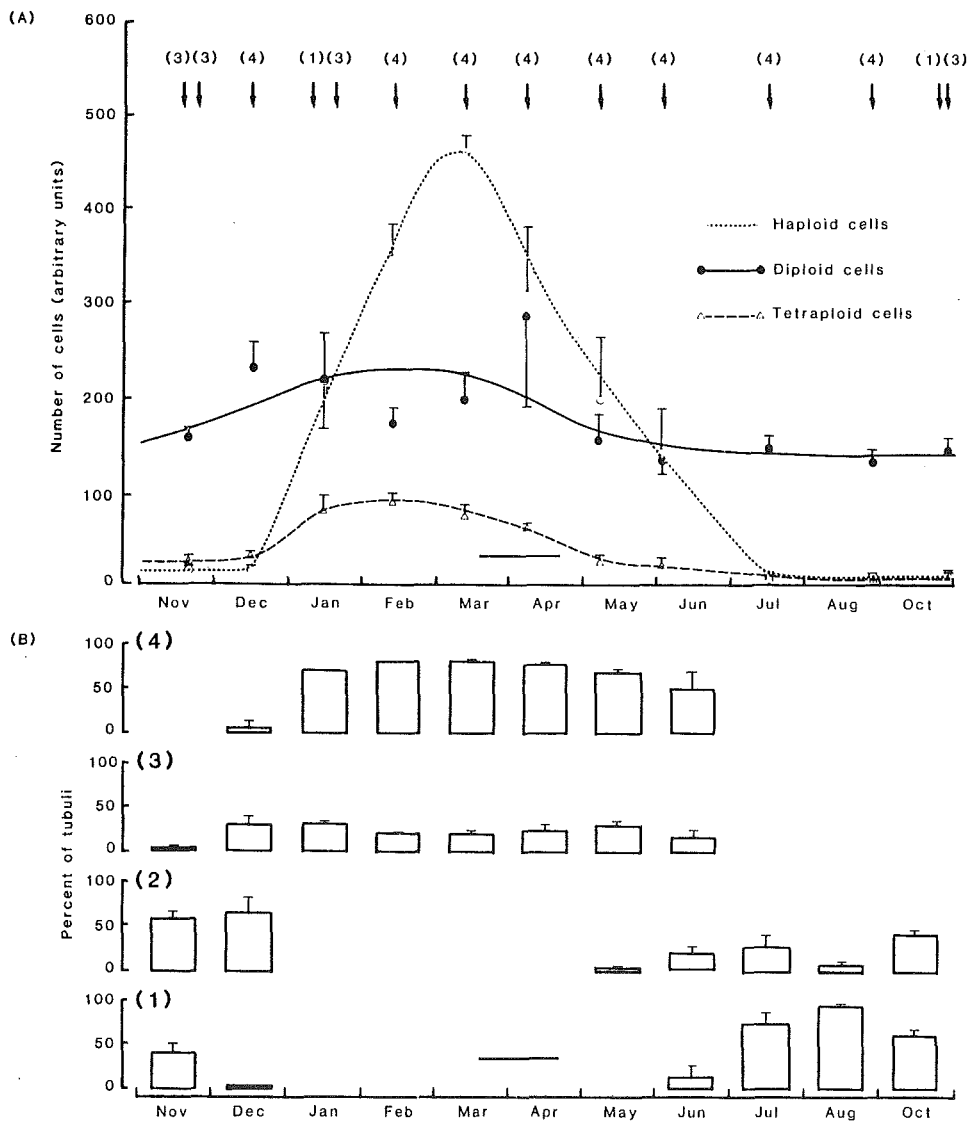


Fig. 2.

a) Seasonal variations in the testicular content of haploid, diploid and tetraploid cells, as quantified by DNA flow cytometry. The data are taken from Smith et al. (1984b) and are arbitrary values obtained by measuring the mean relative numbers of cells in each population and then multiplying them by mean testicular weight. b) Seasonal changes in the relative numbers of 4 tubular categories in the blue fox testis. Category 1: Spermatogonia only; Category 2: Spermatogonia and primary spermatocytes; Category 3: Spermatogonia, spermatocytes and round spermatids; Category 4: Spermatogonia, spermatocytes and elongated spermatids, with or without round spermatids. The arrows depict the dates of castration and the figures in parentheses indicate the number of animals castrated on each date. The horizontal bars represent the mating season, which was defined as the period between the dates of the first and last matings on the farm. Values are means + SEM for all of the animals castrated in a given month.

advanced haploid cells. Tubular diameter increased by 73% during testicular re-development, and epithelial height increased 3-fold. Regression to the basal state occurred during May to July. The volume densities of the seminiferous epithelium and of interstitial tissue remained approximately constant throughout the year. Soluble Mn<sup>2+</sup>-dependent adenylate cyclase activity showed seasonal variations that paralleled those of the haploid germ cell population and testicular volume, whereas somatic cell adenylate activity was relatively constant.

*International Journal of Andrology* 9 (1986) 53-66.  
5 fig., 23 references.

*Authors summary*

#### **Early Weaning of Arctic Foxes and its Consequences for Reproduction at Maturity**

(Casny odstav Mlad'at polarnich lisek (pescu) a jeho dusledky na reprodukci v dospelosti).

*L. Bartos*

Data for 1979-81 were obtained at 8 farms with 473 males and 1337 females in 1979, 632 males and 1725 females in 1981. The number of young was 11442, 9274 and 10962 in the 3 yr, the percentage of females whelping 77.0, 76.1 and 77.8, the percentage of infertile females 13.8, 13.5 and 12.2, the percentage of females with silent oestrus 9.5, 10.6 and 9.7, the percentage of males unwilling to mate 14.3, 12.5 and 12.5, and mortality of cubs 20.3, 18.7 and 26.9%. The cubs were weaned at 36 or 45 days of age. Age at weaning was significantly correlated with the percentage of progeny exhibiting silent oestrus in the following breeding season (-0.84), the incidence of male progeny unwilling to mate in the following breeding season (-0.83), and mortality of cubs in the following season.

*Veterinarstvi*: 36(1): 25-28, 1986.  
5 tables.

*CAB - abstract*

#### **Control of Oestrus in Blue Foxes by Means of Additional Light**

(Brunstreglering hos blåräv med hjälp av extra ljus)

*Maija Valtonen & Kjell Nydahl*

Of 74 young and 52 adult blue fox females which received 4 h extra light per day from 1 February to 15 March, 90.9 and 100% resp. mated vs. 88.7 and 100% of 72 and 53 young and adult females subjected to natural daylight (controls). In the group receiving extra light, 16 and 63% of young and adult females resp. had mated by 31 March vs. 10 and 42% of control females, and the number of cubs born per mated female averaged 7.25 and 9.93 vs. 6.73 and 8.74. Of 26 young and 48 adult females which received 6 h extra light per day from 1 February to 15 April, 100 and 100% resp. mated, and 39 and 96% had mated by 31 March vs. 91.6 and 100% and 4 and 32% for 48 young and 37 adult controls. The number of cubs born per mated female averaged 6.54 and 9.46 for young and adult females resp. in the group given extra light vs. 8.18 and 9.70 for controls. It was concluded that adult females would benefit from extra light during 1 February-15 March, and young females from extra light during 15 February-15 April.

*Finsk Pälstidskrift*: 20(12): 647-649, 1986.  
3 tables, 1 fig.  
*In SWED su. SWED.*

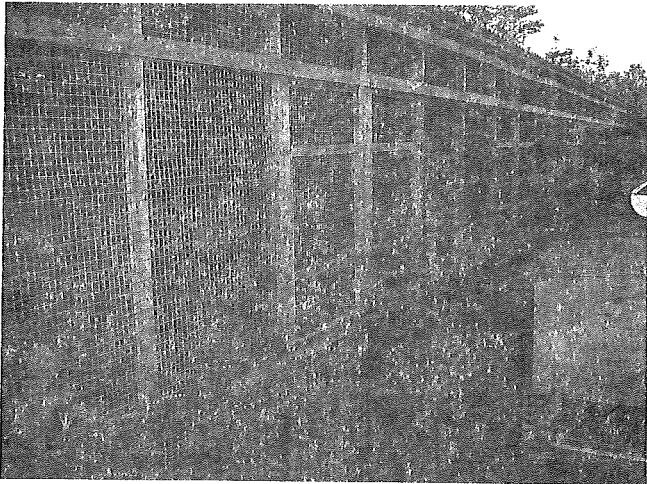
*CAB - abstract*

#### **Housing in Groups Affects the Development of Oestrus in Foxes**

(Ræve i flok påvirker brunstudviklingen)

*Michael Sønderup*

Young mink females at 2 farms in Denmark were housed in groups of 7-8 females plus 1 male or in traditional cages. Females housed in groups exhibited oestrus and mated an average of 12 days earlier than those in individual cages, but there were no conclusive effects of type



Hos Evald Jensen går tæverne 7-8 sammen i udebure langs hegnet

of cage on the intensity of oestrus.

*Dansk Pelsdyravl*: 49(12): 867, 1986.  
1 table, 2 fig.  
In DANH.

CAB abstract

**Sable Productivity Related to Term of Coupling, Sex Recurrence Type and Pregnancy Duration**

*M.D. Gel'bert*

On the base of three-years investigation it is shown that influence of coupling term, sex recurrence type and pregnancy duration to productivity changes during concrete year and is characteristic for this year only. So to increase the effectiveness of sable reproduction it is necessary to apply different techniques

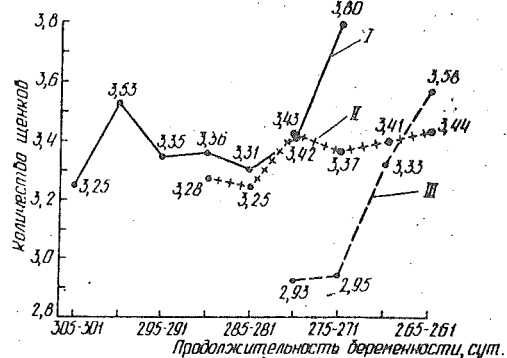


Рис. 2. Плодовитость соболей в зависимости от продолжительности беременности (в среднем за 3 года): I — одноцикловые самки (период покрытия 26 июня — 5 июля), II — двухцикловые (период покрытия 6—15 июля), III — трехцикловые (период покрытия 16—20 июля).

**Effect of Ultraviolet Radiation on the Reproductive Function of Minks and Arctic Foxes**

*G.I. Blokhin, A.A. Nikishov, F.Z. Santurian*

Automation of UV irradiation of polar foxes and minks under conditions of fur animal breeding state farm (with the lamps DRVED-220-160) contributed to earlier and more intensive heat, higher prolificacy of females, and as a result, the output of offspring per main female. The number of refused young of irradiated minks has decreased considerably.

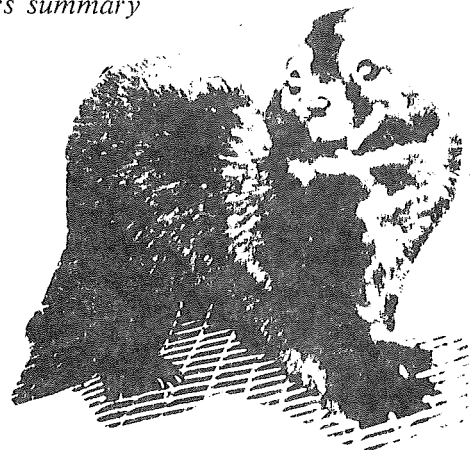
*Izvestiia - Timiriazevskoi sel'skokhoziaistvennoi akademii. Moskva "Kolos" Mar/Apr 1986 (2): p. 162-165.*  
2 tables, 7 references.  
In RUSS Su. ENGL.

Authors summary

for rising the coupling efficiency but not fecundity.

*Sel'skokhoziaistvennaya Biologiya: (No. 3): 89-93, 1986.*  
4 tables, 2 fig., 21 references.  
In RUSS Su. ENGL.

Authors summary



**Reproduction in the Stone Marten (*Martes Foina*) in Denmark**

*A.B. Madsen and A.M. Rasmussen*

Reproduction was studied in 88 male and 89 female Stone Martens (*Martes Foina*) caught in Denmark during the years 1981-83. A combination of age criteria was used to separate juvenile animals from adults. Reproduction is seen from the beginning of the second year of life and afterwards only once a year. Mating occurs between July and mid August, and after a prolonged period of delayed implantation with free blastocysts, implantation takes place from the end of January through February. Normally the females give birth to three cubs between March and April. This is followed by a period of lactation, which may continue until July. The reproductive cycle is compared with that of stone Martens in other parts of Europe.

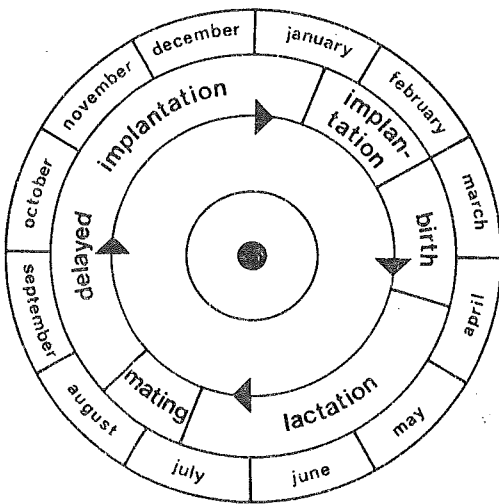


Fig. 4. The reproductive cycle of the Danish Stone Marten.

*Natura Jutlandica, Vol. 21. NO. 9 pp. 145-148. 4 fig., 17 references.*

*Authors abstract*

**The Oppdal Trials**

(Oppdal - Forsøkene)

*Jan A. Fougner*

For 10 silver foxe females in Norway which were inseminated after being transported, the number of liveborn cubs per inseminated female averaged 3.4 vs. 4.5 for 10 non-transported females inseminated with the same semen. In a 2nd experiment, 325 blue fox females, chosen at random, were inseminated once with silver fox semen containing (1) 100 x 10<sup>6</sup>, (2) 60 x 10<sup>6</sup>, (3) 40 x 10<sup>6</sup>, or (4) 20 x 10<sup>6</sup> spermatozoa, or (5) were inseminated once, 1-2 days after oestrus, with 20 x 10<sup>6</sup> silver fox spermatozoa, or (6) were inseminated twice with 20 x 10<sup>6</sup> silver fox spermatozoa. In the 6 groups resp., 85.7, 81.1, 85.2, 74.6, 88.6 and 83.3% of females conceived, litter size at birth averaged 8.18, 8.33, 8.13, 7.78, 8.63 and 8.89, and the number of 3-wk-old cubs per inseminated female 4.61, 4.53, 4.50, 3.45, 4.80 and 5.69.

*Norsk Pelsdyrblad: 61(1): 33-35, 1987.*

*2 tables.*

*In Norg.*

*CAB - abstract*

**Insemination of Foxes in 1986**

(Ræveinseminering 1986)

*Jesper Clausen, Ib Christiansen*

In 1986, in Denmark, 8906 blue fox and 4299 silver fox females were inseminated, representing 25.7 and 19.9% resp. of the total number of breeding females, compared with a total of 7907 inseminations in 1985, representing 16.7% of breeding females. Data are tabulated by district. For blue fox females inseminated with blue fox or silver fox semen and for silver fox females inseminated with silver fox semen, the CR was 74.4, 68.0 and 68.1% resp., litter size per inseminated female averaged 6.5, 5.4 and 3.0, and that per pregnant female 8.8, 8.0 and 4.4. For blue fox females inseminated once, twice or 3 times with blue fox semen, the CR was per inseminated female averaged 6.0, 6.7 and 6.4 vs. 64.2, 69.8 and 70.8% and 5.1, 5.5 and 5.7 for blue fox females inseminated once, twice or 3 times with silver fox semen and 56.2, 71.6 and 75.6% and 2.4, 3.1 and 3.3 for silver fox females inseminated with silver fox semen.

*Dansk Pelsdyravl: 49(12): 855-857, 1986.*  
5 tables, 1 fig.  
In DANH.

CAB - abstract

### Results of Inseminations in 1986 According to Colour Type

(Resultat av insemineringarna 1986 enligt färgtyp)

*Maija Valtonen, Ulla Joutsenlahti, Tore Weijola*

In 1986, in Finland, 39289 blue fox females were inseminated with silver fox semen, 1802 blue fox females with blue fox semen, 5370 silver fox females with silver fox semen, and 176 silver fox females with blue fox semen. In the 4 groups resp., CR was 74.18, 71.08, 64.13 and 51.13%, the number of cubs born per inseminated female averaged 5.04, 5.48, 2.57 and 2.17, and the number of cubs born per litter 6.79, 7.71, 4.02 and 4.24. Data are tabulated by district.

*Finsk Pälstidskrift: 21(1): 28-29, 1987.*  
5 tables  
In SWED.

CAB - abstract

### Insemination Results in 1986

(Insemineringsresultat 1986)

*Maija Valtonen, Tore Weijola*

In Finland, in 1986, approx. 100000 fox females were inseminated, of which 14% were silver foxes and the remainder bluefoxes. The CR was 73 and 63.5% for blue and silver fox females resp.; overall, litter size at birth averaged 4.6 cubs per inseminated female. Data are tabulated by district.

*Finsk Pälstidskrift: 20(11): 607, 1986.*  
1 table.  
In SWED.

CAB - abstract

### Whelping Results at the Experimental Farms in 1986

(Valpresultatet på försöksfarmerna 1986)

*Jaakko Mäkelä & Fjalar Fors*

In 1986, at the Kyrkslätt and Maxmo experimental farms in Finland, the percentage of infertile females was 23.1 and 15.5 resp. for mink, 16.7 and 35.8 for blue foxes, and 23.4 and 9.6 for polecats, with the number of liveborn young per mated female averaging 3.8 and 4.1 for mink, 7.5 and 5.1 for blue foxes, 6.2 and 7.8 for polecats. At Kyrkslätt, the percentage of infertile raccoon dogs was 47.3, and the number of young born per mated female averaged 3.2. The poor reproductive performance of raccoon dogs was attributed to the presence of many white animals.

*Finsk Pälstidskrift: 20(9): 442, 1986.*  
1 table.  
In SWED.

CAB - abstract

### Whelping Results in 1986

(Valpresultat 1986)

*K. Lindh*

For 969768 mink, 425705 blue fox, 117 517 silver fox, 27029 polecat and 16 188 raccoon dog females mated 2040, 4059, 2927, 396 and 509 farms resp. in Finland in 1986, the percentage of infertile females was 23.05, 26.88, 31.99, 14.56 and 31.76 resp.; the number of young born per mated female averaged 3.75, 5.99, 2.97, 5.95 and 4.85 vs. 4.05, 6.35, 3.01, 6.15 and 4.57 in 1985. Data are tabulated by colour type.

*Finsk Pälstidskrift: 20(9): 440-442, 1986.*  
3 tables.  
In SWED.

CAB abstract

**Fox AI Stations in 1986 - Inspections and Surveillance.**

(Rävsemineringsstationer 1986 - inspektion och övervakning)

*Liisa Jalkanen & Harri Käyhkö*

In 1986, in Finland, there were 94 fox AI stations vs. 47 in 1985. There were 138 AI technicians in 1986, who carried out an average of 280 inseminations. Details are given of insemination techniques.

*Finsk Pälstidskrift: 20(11): 608-610, 1986.  
3 tables, 1 fig.  
In SWED.*

*CAB - abstract*

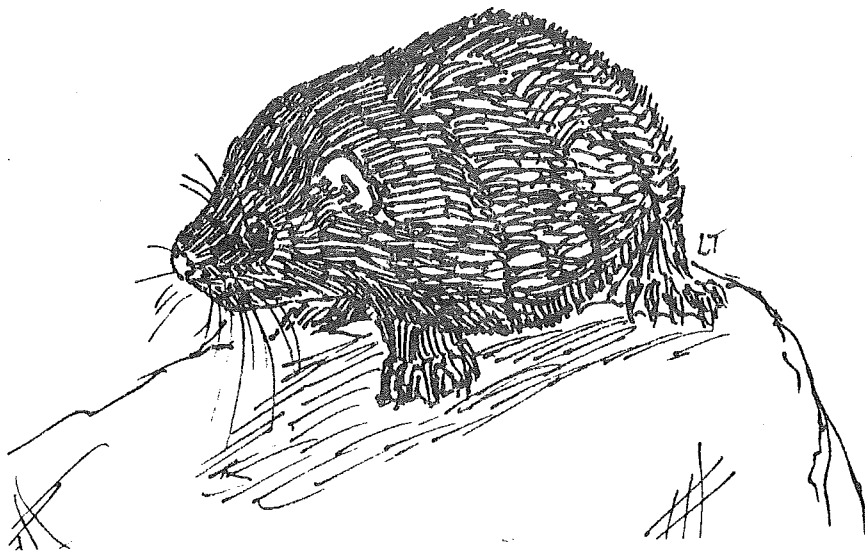
**Seasonal changes in testicular structure and function in the Blue Fox (*Alopex Lagopus*), as quantified by morphometric analysis and measurement of Adenylate Cyclase Activity**

*Adrian Smith, Hans Petter Bugge, Kjell Andersen Berg, Ordin Møller and Vidar Hansson*

The volume of the blue fox testis showed 5-fold changes during the year, associated with considerable changes in cellular composition. The seminiferous epithelium was maximally regressed in August, when 94% of tubules contained only spermatogonia. By late October, approximately 6 months before mating season, 40% tubules contained primary spermatocytes. From the middle of January until the end of April all tubules contained spermatids or more advanced haploid cells. Tubular diameter increased by 73% during testicular re-development, and epithelial height increased 3-fold. Regression to the basal state occurred during May to July. The volume densities of the seminiferous epithelium and of interstitial tissue remained approximately constant throughout the year. Soluble  $Mn^{2+}$ -dependent adenylate cyclase activity showed seasonal variations that paralleled those of the haploid germ cell population and testicular volume, whereas somatic cell adenylate activity was relatively constant.

*International Journal of Andrology 9 (1986)  
53-66.  
5 fig., 23 refernces.*

*Authors summary*



Original Report



## A study on feeding silage to nutria I. Nutria growth and feed utilization

Stanislaw Niedzwiadek, Jacek Kowalski, Grazyna Palimaka-Rapacz. Institute of Zootechnics, Dep. of Fur Animal Breeding 32-083 Balice near Kraków, Poland

### Summary

It can be confirmed that it is not only possible but also advantageous to introduce silage into nutria feeding. The nutria in a relatively short period of time became accustomed to silage and ate it willingly. The utilization of nutrients of these rations was good. Growth and weight gains were normal and gave finishing body weights. The use of silage in feed rations significantly lowered the consumption of mixed concentrates during the period from weaning to 8 months of age.

Thus the introduction of silage from green plants or steamed potatoes in nutria feeding allows for a very sensible management of that feed which is available to nutria breeders. Also it saved more than 3 kg grain feed for one female and approximately 2,5 kg for one male from weaning to slaughter.

The feeding of nutria in Poland is primarily based on farm produced feed, namely grains, roots and green feed. Some attempts have been made to feed nutria granulated complete feed. In Poland research on nutria nutrition has dealt primarily with the possibilities of utilizing waste products from the agricultural feed industry. To date, no research in Poland has dealt with the use of silage in nutria feeding. In literature from abroad there is only general information about the possibility of feeding nutria silage.

### Materials and methods

The experiment was carried out on the nutria

farm of the Zator Zootechnical Experimental Station. The experimental material consisted of 256 young Greenland nutria. The nutria were reared in cages without bathing facilities. There were 8 animals of the same sex in each cage. During the experiment the nutria were fed during the fall and winter. Farm and grown feeds, together with silage from various plants, were fed. All the animals were divided according to sex. The following feeding plans were used:

- group I - rations with grass silage
- group II - rations with maize and beet leaf silage
- group III - rations with steamed potato silage
- group IV - (control) rations with farm feeds without silage.

The ration consisted of: Mixed concentrates (barley, oats, wheat, corn), feed yeast, MM mixture, Premix F, silage, and in the control group, root vegetables (beets, carrots, fresh steamed potatoes).

In the experimental groups the amount of silage in the rations changed. At the beginning it was 30g and during the last months 180g. The animals of these groups were also fed increased doses of MM mixture and Premix F (3,5 - 9).

Observations were made from 35 days of age (weaning) to 8 months of age. The following items were observed and recorded:

- weight of each individual at weaning
- weight of individual animals every two months
- willingness of feed consumption (palatability)

- feed consumption (weight of unconsumed feed)
- deaths

During the middle of the rearing period i. e. at 4,5 months of age, digestibility was analyzed on 16 nutria (4 from each group) using the balance method.

### Results

Chemical analysis of the silages showed that levels of crude protein were similar and ranged from 2,06 to 2,32% (tab.1). Differences between silages were found for crude fat and fiber. Silage from grass as well as from corn and beet leaves contained a decidedly higher percentage of these items (0,83 - 0,90%, 4,80

Table 1. Quality and nutritive value of silages

Silages	Content of crude components					pH	Score	Descriptive evaluation
	Dry matter	Protein	Ether extract	Fibre	Nitrogen free extract			
Grass	17,30	2,13	0,83	4,80	11,03	4,1	12	good
Maize+beet leaf	21,30	2,32	0,90	5,10	10,03	4,2	13	good
Potatoes	20,86	2,06	0,07	0,76	17,58	4,3	14	very good

- 5,10%, respectively), than silage from steamed potatoes (0,07 and 0,76%). All three silages had similar pH values (4,1 - 4,3). Silage quality, expressed in points, varied somewhat. Grass silage and corn and beef leaf silage had 12 and 13 points, respectively, and were evaluated as good. However, steamed potato silage had 14 points and was very good.

Protein values were on a similar level and ranged from 16,1 in group I to 16,6% in group III. There was 2,7 - 2,9% fat and 12,3 to 12,8% fiber.

Observations on palatability of rations with silage showed that the nutria became accustomed to eating silage relatively quickly. During the first three days the animals ate more, and after a week of receiving silage the nutria ate the silage willingly.

Mean body weights at the beginning of the experiments were similar for all groups. Males weighed from 642 to 665 g (tab. 2) and females from 621 to 642 g. At two months of age the mean body weight of males was on a similar level and was 1190 g in groups I and IV and 1201 g in group II. Mean body weights of females ranged from 1140 g in group I to 1152 g in group II. At 6 months males had mean body weights from 3780 in group I to 3800 g in

group III. Females weighed from 3340 to 3362 g. At the end of the experiment (8 months of age) the mean body weights of all groups were similar and ranged from 4620 g in group I to 4780 g in group III. Females weighed from 4230 to 4370 g.

Nutria growth in the experimental groups was normal as is indicated by body weight gains at various ages (tab. 3). From 35 to 60 days it was relatively small and was from 536 to 548 g in males and from 509 to 519 g in females. Faster growth rates occurred at 61 to 180 days and was slower from days 181 to 240. For the entire rearing period body weight gains in males in groups fed rations with silage ranged from 3978 g in group I to 4122 g in group II. Body weight gains of control males were 4079 g. Body weight gains for females, aged 35 to 240 days, ranged from 3609 g in group I to 3735 g in group III, while in the control group, 3889 g.

Control males, during the period from weaning to 8 months of age, consumed 25,2 kg concentrates, 14,8 kg root vegetables and 12,4 kg steamed potatoes (tab. 4). Females during this same period consumed 23,8; 14,8 and 12,4 kg, respectively. The use of concentrates in groups fed silage was less and ranged from



Table 2. Body weight of nutrias (g).

Group	Sex	A G E (month)											
		At weaning		2		4		6		7		8	
		x	v	x	v	x	v	x	v	x	v	x	v
I	Male	642	17,3	1190	16,8	2270	14,2	3780	9,8	4410	9,3	4620	8,3
	Female	621	15,8	1140	17,2	2130	13,7	3340	10,1	3970	9,8	4230	9,2
	mal.+ fem.	630	16,6	1168	17,1	2205	14,1	3562	10,1	4192	9,6	4428	9,1
II	Male	665	16,1	1201	18,1	2320	15,1	3790	11,3	470	10,1	4710	9,7
	Female	642	15,4	1152	16,2	2190	14,2	3352	10,8	3950	9,7	4310	8,8
	mal.+ fem.	654	15,9	1178	17,8	2258	14,8	3575	11,0	4212	9,8	4508	9,2
III	Male	658	17,2	1194	17,1	2340	12,3	3800	10,7	4495	8,5	4780	10,1
	Female	637	18,3	1143	16,3	2200	13,1	3362	9,8	3998	9,1	4370	7,3
	mal.+ fem.	648	18,1	1169	16,9	2268	12,8	3585	10,2	4248	8,8	4578	9,2
IV	Male	651	18,1	1190	16,2	2310	13,2	3790	11,1	4480	9,6	4730	8,3
	Female	641	17,6	1150	18,3	2195	12,8	3345	10,2	3985	9,6	4350	10,1
	mal.+ fem.	648	18,0	1168	17,6	2255	13,1	3570	10,9	4235	9,2	4538	9,1

Table 3. Body weight gains at various ages

Group	Sex	Periods (days)				
		35-60	61-120	121-180	181-240	35-240
I	Male	548	1080	1510	840	3978
	Female	519	990	1210	890	3609
	mal.+ fem.	538	1037	1377	866	3798
II	Male	536	1119	1470	920	4045
	Female	510	1038	1162	938	3668
	mal.+ fem.	524	1080	1317	933	3854
III	Male	536	1146	1460	980	4122
	Female	506	1057	1162	1008	3733
	mal.+ fem.	521	1099	1317	993	3930
IV	Male	539	1120	1480	940	4079
	Female	509	1045	1150	1005	3889
	mal.+ fem.	520	1087	1315	968	3890

21,9 to 22,1 kg. The difference between the consumption of mixed concentrates in males in comparison to the control groups was 3,1 to 3,3 kg, which was statistically significant.

The consumption of concentrates by females fed rations with silage was less than in the control group and ranged 21,1 to 21,4 kg. The difference in relation to the control group

Table 4. Feed intake (kg) from weaning to age 8 months

Group	Sex	Concentrates	Roos	Steamed potatoes	Silage		
					Grass	Maize+beet leaf	Potatoes
I	Male	22,0 <sup>a</sup>	-	-	24,9	-	-
	Female	21,3 <sup>d</sup>	-	-	24,1	-	-
	mal.+ fem.	21,7	-	-	24,6	-	-
II	Male	21,9 <sup>b</sup>	-	-	-	25,3	-
	Female	21,1 <sup>e</sup>	-	-	-	24,7	-
	mal.+ fem.	21,6	-	-	-	25,1	-
III	Male	22,1 <sup>c</sup>	-	-	-	-	24,8
	Female	21,4 <sup>f</sup>	-	-	-	-	24,2
	mal.+ fem.	21,8	-	-	-	-	24,6
IV	Male	25,2 <sup>abc</sup>	14,8	12,4	-	-	-
	Female	23,8 <sup>def</sup>	13,9	12,1	-	-	-
	mal.+ fem.	24,1	14,6	12,3	-	-	-

Means followed by the same letters are significantly different ( $P < 0,05$ )

was 2,4 to 2,7 kg which was statistically significant. The consumption of silage by males and females in the various groups was similar and was, during the rearing period, in group I from 24,1 to 24,9 kg, in group II, 24,7 to 25,3 kg. The consumption of silage made from steamed potatoes ranged from 24,2 kg in females to 24,8 kg in males.

Digestibility coefficients for basic nutrients were similar for all experimental groups. Dry matter utilization was from 81,2% in group I to 82,1% in group III. Protein utilization ranged from 76,0 to 76,7%. Fiber digestibility varied from 50,4 in the control group to 51,2% in group III. Fat utilization was from 67,2 to 68,6%.

### Discussion

In this experiment silage made from grass, as well as maize and beet leaves was considered. It is the opinion of the authors that the above mentioned plants or components are easily available for a definite majority of nutria breeders. The abundance of this type of feed during the late summer and fall is not always taken of maximal advantage in feeding nutria. Silage not only enriches nutrition but also can be stored and used during the most diffi-

cult period, namely winter. The introduction of steamed potato silage was due to the fact that potatoes are one of the basic winter feeds. The making of silage prevented storage losses. The quality and nutritional value of the silage fed to the nutria was good and was similar to the data presented by *Korman and Osikowski (1979)*.

The basic nutritional value of the rations fed to the nutria confirmed to the figures given for this species by *Aleksandrova et al. (1980)*, *Kladovcikov (1982)* and *Olsson (1982)*.

The body weight at weaning at 35 days of age was similar to the weights given by *Niedzwiedek (1983)* for this variety. The weight of nutria when weaned at 35 days of age was difficult to compare with other authors due to different weaning ages. Body weight at 4 months of age as well as body weight increases are very rapid at this age. It thus seems that during this period particular attention should be paid to nutrition.

Body weights at 8 months were high and comparable to those of *Efremov et al. (1982)*, *Niedzwiedek (1983)*, *Pecenin (1980)* and *Samkov (1978)*. Then mean body weight of females at 8 months of age was approximately 400 g less than that of males and compared to the data of the above mentioned authors. The body weights of both sexes at 8 months of age indicated

that the introduction of silage did not cause a slower growth rate. Their body weights were on the level of the control group. Nutria, fed rations with silage, grew appropriately and had a fast growth rate. No deaths occurred during the rearing from weaning to 8 months. The introduction of silage significantly lowered the consumption of grain feeds which are in shortage, while at the same time it maintained a fast growth rate and high finishing body weights. No significant differences were noted between the various silages. Silage lowered the consumption of mixed grains in males by 3,1 - 3,3 kg, and in females by 2,4 - 2,7 kg.

The digestibility coefficient of basic nutrients in rations with silage showed that they were utilized by the nutria. The protein digestibility coefficient was on the level as that given by *Gacek (1976)* and *Olsson (1982)*. *Kladovscikov (1982)* gives a 3% higher protein digestibility coefficient. The digestibility coefficients of remaining nutrients were similar to those given by the above mentioned authors.

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Original Report

## A study on feeding silage to nutria. II. Fur value

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Nutria fur, besides being a basic raw product for Poland's furrier industry, is also exported to Western Europe. Polish Nutria fur is highly valued abroad due to its good quality coefficients. As is well-known, nutria fur quality depends on several factors. In addition to the genetic make-up, the environment, including nutrition, has much influence on the quality of nutria fur produced. A study carried out in the Institute of Zootechnics on feeding nutria silage made it necessary to determine the fur value and hair covering obtained with this method of feeding.

### Materials and Methods

The study included 120 Greenland nutria furs. These furs came from animals reared on the *Zator Zootechnical Experimental Station of the Institute of Zootechnics*. The nutria were reared in cages without bathing facilities. There were 4 experimental groups with 30 furs in each group (there was an even division of sex in each group). The groups were divided according to the feeding regime (See part I).

The following physical characteristics of the fur and hair covering were recorded:

1. The weight of rough skins and tanned fur,
2. the surface area of rough skins and tanned furs,
3. the weight of 1 dm<sup>2</sup> of fur,
4. the compactness of hair (SGM),
5. thickness of down and cover hairs,
6. length of down and cover hairs,
7. hair covering density,
8. the percentage of down and cover hairs in fur.

Examination of hair covering (points 4-8) was done on 7 topographical areas of the fur (Ill. 1) as described by *Kaszowski and Kawinska (1980)*.

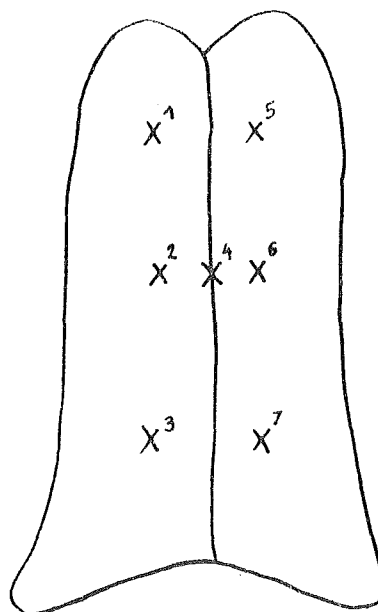


Fig. 1 Sampling areas: 1, 2, 3 - ventral part. 4 - lateral part. 5, 6, 7 - dorsal part.

The skin were tanned in the Krakow Tanners according to obligatory methods of the fur industry. A committee of experts organoleptically evaluated the skins both at the rough stage and after tanning. Appropriate quality grades were then determined.

**Results**

The results of measurements on rough skins are given separately according to sex since there were statistically significant differences between fur weights in groups II and III (Tab. 1).

The weight of male skins in all groups was similar and ranged from 183,2 g to 192,3 g. The weight of female skins was lower than that for males and ranged from 161,1 g to 173,2 g. The skin surface area for both sexes and all groups was similar and ranged from 15,7 to 16,3 dm. The weight of 1 dm of skin, heavier for males from all groups, was from 10,2 to 11,9 g.

Surface variability of skin for the groups was similar ( $v = 9,7 - 11,3\%$ ). A somewhat greater variability was found for skin weight ( $v = 9,8 - 12,8\%$ ).

These same parameters measured on tanned skins had smaller values. Fur surface area was from 14,4 to 15,4 dm. There were slight differences between sexes and between groups that were not statistically significant (Tab. 2). Skin weight was also lower in value, from 143,2 to 168,3 g, and the weight of 1 dm from 9,5 to 11,0 g.

Differences between sexes within groups were noted for cover hairs but were not statistically significant. Thus further results are

Table 1. Parameters of rough nutrias skins

Group	Sex	Area(dm <sup>2</sup> )		Weight (g)		Weight of 1 dm <sup>2</sup> (g)	
		x	v	x	v	x	v
I	Male	15,8	9,8	187,6	11,2	11,9	10,9
	Female	15,7	9,9	173,2	10,7	11,1	9,9
	Male	15,9	10,2	183,7 <sup>a</sup>	12,8	11,6 <sup>c</sup>	11,8
II	Female	15,8	9,7	161,1 <sup>a</sup>	12,7	10,2 <sup>c</sup>	13,1
	Male	16,3	11,3	192,3 <sup>b</sup>	9,8	11,8 <sup>d</sup>	10,2
III	Female	16,0	10,8	163,2 <sup>b</sup>	12,3	10,2 <sup>d</sup>	11,8
	Male	16,2	10,2	183,2	11,6	11,4	11,3
IV	Female	16,1	9,7	171,3	12,8	10,6	11,8

Means followed by same letters are significantly different P < 0.05

Table 2. Parameters of dressed nutrias skins

Group	Sex	Area (dm <sup>2</sup> )		Weight (g)		Weight of 1 dm <sup>2</sup> (g)	
		x	v	x	v	x	v
I	Male	14,6	9,2	162,3	11,3	11,0	10,3
	Female	14,4	9,7	158,2	10,9	10,7	10,1
II	Male	14,9	9,8	161,4	11,4	10,8	10,8
	Female	14,7	10,1	152,7	12,1	10,3	12,3
III	Male	15,4	10,7	168,3 <sup>a</sup>	10,2	11,0 <sup>b</sup>	10,1
	Female	15,1	9,9	143,2 <sup>a</sup>	11,7	9,5 <sup>b</sup>	11,2
IV	Male	15,1	9,7	164,5	11,1	10,9	11,3
	Female	15,0	9,5	157,2	11,7	10,5	11,5

Means followed by same letters are significantly different P < 0,05

given for both sexes together. Compactness of hair in individual topographical areas of the furs were on the same level for given groups (Tab. 3). High hair compactness was noted for samples 2,3 and 4. The mean hair compactness was from 5,00 to 5,08 mm. The furs of all groups had a SGM on the same level 34,51 - 34,81 mm.

The thickness of down hair was similar for the groups and individual samples (Tab. 4). In the ventral part (samples 1,2,3) it was from 10,0 to 10,9 microns. Along the lateral and dorsal (samples 4,5,6,7) it was higher 10,9 to 12,6 microns. The mean down hair thickness was on a similar level for the examined groups and ranged from 11,0 to 11,3 microns.

Table 3. Compactness of hair in topographical areas of skin (mm)

Group	Samples							Σ SGM		Average of 7 samples	
	1	2	3	4	5	6	7	x	v	x	v
I	4,32	5,52	5,23	5,42	4,48	4,92	4,31	34,71	11,2	5,08	10,9
II	4,41	5,31	5,28	5,39	4,81	4,87	4,30	34,51	12,3	5,00	11,8
III	4,52	5,41	5,31	5,41	4,87	4,90	4,34	34,81	11,8	5,01	12,1
IV	4,47	5,37	5,28	5,37	4,83	4,91	4,32	34,62	12,1	5,01	12,4

Table 4. Thickness of hairs (microns)

Group	Samples														Average from 7 samples		
	1		2		3		4		5		6		7		down	cover	
	x	v	x	v	x	v	x	v	x	v	x	v	x	v			x
I	x	10,1	88,2	10,4	90,2	10,8	89,1	11,2	98,3	11,4	101,3	11,8	112,3	12,1	109,3	11,3	98,8
	v	12,1	22,7	9,6	21,3	12,3	23,3	11,3	24,3	10,7	21,7	9,8	23,2	10,3	24,8	11,8	24,7
II	x	10,2	87,5	10,3	91,3	10,4	88,3	10,9	99,2	11,2	100,2	11,9	111,7	12,3	108,7	11,0	98,3
	v	11,7	21,3	10,1	19,8	14,2	24,7	12,8	25,7	8,8	24,3	11,2	25,3	12,8	25,7	12,3	25,1
III	x	10,2	89,2	10,4	92,2	10,9	89,3	11,2	99,8	11,7	102,8	12,0	112,8	12,5	110,1	11,3	99,6
	v	13,2	23,7	11,2	22,3	10,8	28,3	13,1	24,8	10,3	23,7	10,3	24,7	13,2	26,8	12,7	25,8
IV	x	10,2	89,1	10,6	91,8	10,7	88,9	11,3	98,7	11,6	101,7	11,8	110,3	12,6	109,3	11,3	98,6
	v	12,7	24,3	10,7	20,7	12,7	25,4	14,2	25,3	11,2	23,2	12,7	25,8	11,7	25,9	12,9	25,7

The thickness of cover hairs was also on a similar level in the experimental groups. Cover hairs in the ventral area were thinner than along the lateral and dorsal. The mean thickness of cover hairs for the groups was 98,6 to 99,6 microns.

The length of down hair in the respective samples for individual groups was similar. As

in the case of thickness there were differences between topographical areas. The length of down hair in the ventral area was longer. 11,9 to 16,1 mm (Tab. 5). A similar relationship between topographical area and length occurred for cover hairs. The mean length of down hair for the groups was 12,3 - 13,2 mm, and for cover hairs 35,2 - 35,7 mm.

Table 5. Length of hairs (mm)

Group	Samples														Average from 7 samples		
	1		2		3		4		5		6		7		down	cover	
	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover			
I	x	11,2	27,1	11,3	29,8	10,7	27,8	12,3	33,1	13,4	37,4	15,6	40,1	14,9	49,7	12,8	35,2
	v	9,3	10,1	8,8	10,7	10,3	12,4	11,3	13,1	10,7	12,8	11,3	13,2	10,2	12,8	11,4	13,2
II	x	11,4	26,8	11,8	29,7	11,2	28,1	12,4	34,2	13,8	36,8	16,1	41,2	15,1	50,1	13,2	35,4
	v	8,8	11,3	9,1	12,3	11,2	11,7	10,7	12,8	11,4	13,2	10,2	12,9	11,3	13,3	10,9	12,9
III	x	11,3	27,3	11,7	30,1	11,0	28,7	11,9	34,1	14,0	37,5	15,9	42,1	15,2	49,2	13,1	35,6
	v	10,1	11,4	9,7	11,4	9,8	12,1	9,8	13,8	12,1	11,3	9,8	13,1	10,3	12,7	12,1	12,7
IV	x	11,2	27,4	11,5	30,2	11,1	29,1	12,2	33,8	13,9	37,4	16,0	41,8	16,0	49,8	13,2	35,7
	v	9,8	10,9	8,9	11,8	10,3	12,3	10,7	12,7	11,9	12,9	12,3	13,3	10,7	11,9	11,8	12,8

Table 6. Hair density of nutria for 1 cm<sup>2</sup> of skin

Group	Samples														Average from 7 samples		
	1		2		3		4		5		6		7		down	cover	
	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover			
I	x	19238	87	18126	85	15683	92	11281	101	9981	109	8850	118	7250	109	12781	101
	v	18,3	24,3	17,8	22,8	19,3	24,8	19,1	27,8	21,3	27,8	19,7	28,1	21,3	27,4	19,8	25,8
II	x	18926	92	18007	87	15921	95	11781	98	10010	106	9120	121	7680	111	13060	100
	v	21,2	23,1	16,7	23,7	18,7	26,7	20,8	29,1	22,4	28,1	18,6	27,6	19,6	28,3	18,7	26,1
III	x	19167	88	18261	81	15247	89	11438	103	10121	111	9010	119	7850	107	13010	99
	v	17,6	22,6	15,4	21,4	20,1	27,1	21,3	24,3	20,7	26,7	20,3	29,8	18,7	25,3	19,6	25,7
IV	x	19082	91	18110	88	15487	92	11683	102	9980	107	8970	123	7985	112	12975	102
	v	16,8	24,1	17,8	24,6	19,0	26,8	23,4	27,1	21,8	27,3	19,6	28,7	20,6	28,2	19,8	26,5

Down hair thickness on a surface area of 1 cm was similar for the groups in various topographical area (Tab. 6). There was a definitely greater density in all groups in samples 1-4. The mean down hair thickness for the groups was from 12,781 to 13,010 hairs per 1 cm fur. The number of cover hairs, also on a similar level for groups in the appropriate samples showed less differences depending on the topographical area.

Organoleptic evaluation of rough skin and tanned fur, expressed as one of 4 quality grades, is presented as follows (%):

Rough skins from group I had a mean grade of 2,2, group II - 2,2 group III - 2,0 and group IV - 2,1. After tanning the mean grades were respectively; 1,8, 1,9, 1, and 1,9.

**Discussion**

Greenland nutria furs were researched since

Table 7. Per cent of down and cover hairs in fur of nutria (%)

Group	Samples														Average from 7 samples			
	1		2		3		4		5		6		7		down	cover	down	
	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover	down	cover	down	
I	74,8	25,2	71,3	28,7	68,3	31,7	61,3	38,7	53,7	46,3	54,8	45,2	53,1	46,9	62,4	37,6		
II	75,1	24,9	72,2	27,8	69,1	30,9	62,1	37,9	54,1	45,9	54,1	45,9	53,7	46,3	62,9	37,1		
III	74,9	25,1	71,8	28,2	69,2	30,8	61,8	38,2	54,0	46,0	54,6	45,4	53,2	46,8	62,7	37,3		
IV	75,0	25,0	71,9	28,1	68,8	31,2	61,7	38,3	53,9	46,1	54,7	45,3	54,0	46,0	63,0	37,0		

they include about 70% of the total fur production. The furs were obtained from animals slaughtered during the winter at 8 months of age, which is considered to be the optimal time and age for slaughter (Oetkiewicz *et al.*, 1972, Kopanski, 1981).

The furs obtained had surfaces of more than 15 dm which indicates good nutria growth. There is a positive relationship between the skin surface area and the size of the animal before slaughter. Comparison of surface area, weight and the weight of 1 dm of rough skin between groups indicates that the nutrition coefficient of nutria fed various silages was not significantly affected. The values of the above mentioned traits in the control group and the experimental groups were on the same level and agreed with the data given by Ocewinska *et al.* (1975) for Greenland nutria and Niedzwiadek (1982) for Black and White Non Albinotit nutria. The compactness of cover hairs expressed together as the SGM value showed that this coefficient was high, indicating a high hair weight. In comparison to figures given for standard, Black or Non Albinotit nutria, the SGM values compared to, or were even higher (Oetkiewicz *et al.*, 1972; Kawinska *et al.*, 1975; and Niedzwiadek, 1982).

Down hair thickness was more than 10 microns in each topographical area which meets the requirements of the fur industry. However it should be noted that hair thickness was very even in the individual topographical areas of the fur. This of course influences the preparation of the fur. Down and cover hair thickness was on the same level in all groups and agreed with results obtained by Kaszowski and Kawinska (1960) for standard nutria and for Greenland nutria Kawinska *et al.* 1975).

One of the most important traits determining fur value is the density of the cover hairs. The results indicated that hair cover density in all groups was on the same level for both individual topographical areas and the mean for the fur. The density in the ventral part was high and was even greater than that of furs of Standard nutria (Oetkiewicz *et al.*, 1972) and Greenland nutria Kawinska *et al.*, 1975).

The high laboratory values of the skin and hair covering was confirmed by organoleptic evaluation and was expressed by the classification of fur into high quality grades. The furs of nutria fed steamed potato silage had a mean grade of 2,1. The experts felt that the hair covering of the nutria from this group had high polish.

From this it can be concluded that the use of steamed potatoes resulted in fur that was characterized by very polished cover hairs.

To summarize the obtained results it can be stated that the use of silage in nutria feeding gave fur characterized by a large surface area and high cover hair coefficients.

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*Original Report***The effect of interactions between dietary protein- and zinc content on protein- zinc utilization in young male mink**

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**Summary**

In a trial with 10-11 week old mink kits the effect of the dietary protein and zinc level on the apparent digestibility of protein and the zinc balance and zinc status of the animals was examined.

Two protein levels, approximately 25 % and 35 % of metabolizable energy in the feed, and two zinc levels, approximately 5 ppm and 25 ppm, were used in a 2 x 2 factorial trial.

The results showed, that the digestibility of protein was not influenced by the zinc content, but by the protein content of the diet. The digestibility of crude protein was 87.1% at the low protein intake, and 90.2% at the high protein intake.

The zinc balances showed, that the main part of the zinc excreted from the body was found in the feces (30-95 % of the zinc intake), while only a minor part was excreted in the urine (1-2 % of the zinc intake). There was a tendency, that the animals on the high protein intake had the highest zinc balance in mg.

The zinc concentration in liver tissue was influenced significantly by the dietary zinc concentration, but not by the protein content of the diet, while the zinc concentration in femur was influenced by both dietary protein and zinc content.

**Introduction**

Many experiments have shown, that zinc is essential for animals and humans. For example zinc is part of many enzymes involved in protein metabolism, and it is necessary for the

nucleic acid synthesis, which means that zinc is important for the protein utilisation in the body.

On the other hand it is known, that the protein supply can influence the zinc utilization. Whether it is the protein level or the amount of certain amino acids (for instance cysteine, histidine or lysine), that has the mentioned effect, is not quite clear, but it is suggested, that amino acid-zinc-complex formation is the reason why mineral utilization and excretion may be changed.

It seems though, that there is an interaction between the utilization of protein and zinc from the food. In the present experiment the effect of 2 protein levels and 2 zinc levels on zinc utilization was examined, partly as the zinc balance and partly as the zinc status of the animals expressed by the zinc content in liver tissue and femur. Furthermore the apparent digestibility of protein was measured.

**Materials and Methods**

The experiment was conducted as a 2 x 2 factorial trial as follows:

<i>Group</i>	<i>Protein level</i>	<i>Zinc added</i>
1	Normal	-
2	Low	-
3	Normal	+
4	Low	+

The two protein levels were partly a quite usual level, that is about 35 % of the metabolizable energy (ME) in the diet, and partly a low level, about 25 % of ME. The zinc levels were a very low level; about 5 ppm in wet feed, and a more usual level, about 25 ppm in wet feed, respectively.

Each group consisted of 5 male minkkits of pastel type, about 10 weeks old at the start of the experiment.

The experimental period was 14 days, of this 10 days were adjustment period and 4 days balance period (zinc balance). The technique was described by Mejborn (1986).

The composition of the diets is seen in table 1. Table 2 shows the analysed content of crude protein (N x 6.25) and zinc in the diets. By use of the found values for digestible protein (table 3) and digestibility coefficients of 94 % for crude fat and 70 % for crude carbohydrate (stated in a corresponding trial) and the energy values (ME) of 18.8 kJ, 39.8 kJ and 17.2 kJ per gram digestible

crude protein, crude fat, and crude carbohydrate respectively, one finds, that for group 1 and 3 the energy coming from protein constituted 36 %, for group 2 23 %, and for group 4 24 %. The energy from protein was reduced by increasing the fat-energy from about 45 % to about 53 %, and the energy from carbohydrate from approximately 19 % to approximately 24 %.

At the end of the balance period all animals were killed. Liver and right femur were taken out, cleaned for appendant tissue and stored at -18 C, until they were analysed.

All analyses were made at the Central Laboratory at the National Institute of Animal Science. Zinc content was determined by atomic absorption spectrophotometry. The methods are described by Jakobsen & Weidner (1973).

Differences between groups were tested by two-way variance analyses (GLM) and t-test (Least Significant Difference Method) (SAS, 1982).

Table 1. Composition of diets (%).

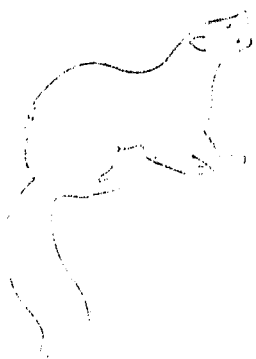
Compound	Group 1 and 3	Group 2 and 4
Codmeat	66.8	42.6
Maize starch	4.8	6.4
Vitamin mixture 1)	0.8	0.8
Mineral mixture 2)	0.8	0.8
Cellulose	1.6	1.6
Lard	4.4	4.9
Soya bean oil	0.8	1.2
Water, distilled	20.0	41.7

1) Vitamins mixed in glucose (cerelose). Content according to NRC-standards (1982).

2) Minerals mixed in glucose. Content according to NRC-standards except for Zn. Group 1 and 2 not supplemented with Zn, group 3 and 4 supplemented with 50 mg ZnCl<sub>2</sub> per kg feed.

Table 2. Protein- and zinc content in diets (wet weight basis, analysed).

Group	1	2	3	4
Protein in diet, %	9.8	6.9	9.9	6.8
Zinc in diet, ppm	5.3	4.3	26.8	22.4



### Results and Discussion

No significant interaction between protein and zinc level in the feed was found for any of the analysed parameters. The results were therefore analysed for the main effects of protein- and zinc level in the feed.

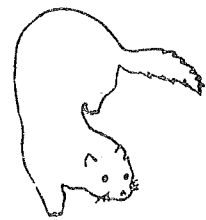
The apparent digestibility of crude protein in the 4 diets is stated in table 3.

Group 4 (7 % protein, 25 ppm zinc) differ somewhat from the other groups, but is only significantly different ( $P < 0.05$ ) from group 1 (10 % protein, 5 ppm zinc). There was no significant effect ( $P > 0.05$ ) of the zinc level in the diets. The average protein digestibility for all animals with low zinc intake (irrespective of protein level) was 89.9 %, and for all animals with high zinc intake 87.5 %.

Table 3. Effect of dietary protein and zinc concentration on the apparent digestibility of crude protein in 11 weeks old minkkits.

	Protein, %	
	7	10
Zinc, ppm		
~ 5	89.0 <sup>ab</sup>	90.3 <sup>a</sup>
~ 25	85.4 <sup>b</sup>	89.6 <sup>ab</sup>

Means not sharing a common superscript letter are significantly different ( $P < 0.05$ ).



If one on the other hand look at the effect of the protein level of the feed, then the digestibility of crude protein was on average 87.1 %, when the protein intake was low (about 7 %), while it was significantly higher ( $P < 0.05$ ), 90.2 %, at normal protein intake (about 10 %).

Table 4 shows the results from the zinc balance studies. Because of the higher zinc content in the diets, group 3 and 4 had a significantly higher ( $P < 0.05$ ) zinc intake than group 1 and 2, and the same difference was seen regarding the amount of zinc excreted in feces. It is also seen, that at any zinc intake, the main part of zinc excreted from the body was excreted in feces, while excretion in urine constituted a minor part. Zinc excretion in the urine was the same and very low in all groups, but there was a tendency, that animals with the highest protein intake (group 1 and 3) excreted a bit more zinc in the urine than animals with the low protein intake (group 2 and 4). That is in accordance with the results of Colin et al. (1983) observed in a trial with humans.

Concerning the zinc balances there was a tendency, that animals on the highest protein intake had the largest zinc balance (in mg). It is quite unusual, that animals on the low zinc intakes (group 1 and 2) have at least as high zinc balances (mg) as animals on the high zinc intakes. In percent of intake the balances were 55 % and 69 % at the low zinc intake, while they were 3 % and 13 % at the high zinc intake, which is more common values.

Zinc concentrations in liver tissue of the 4 groups is stated in table 5. There was no effect of the protein concentration of the diet on the zinc content of the liver, but there was a clear effect of the diet-zinc concentration. Thus the zinc concentration in the liver was on average 27.5 ppm in animals whose diet contained 5 ppm zinc, and 37.4 ppm in animals whose diet contained about 25 ppm. The difference is highly significant ( $P < 0.001$ ). Pedersen and Eggum (1983) found an effect of the protein level but no effect of the zinc level in the feed on the zinc concentration in the liver from rats.

Table 4. Total zinc balances in 4 days in 11 weeks old minkkits fed different protein and zinc levels.

Group	1		2		3		4	
Protein in diet, %	9.8		6.9		9.9		6.8	
Zn in diet, ppm	5.3		4.3		26.8		22.4	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
Intake (FZn), mg	3.88 <sup>a</sup>	0.89	2.44 <sup>a</sup>	1.15	17.0 <sup>b</sup>	5.93	11.4 <sup>b</sup>	4.81
Excreted in feces (GZn), mg	1.66 <sup>a</sup>	1.54	0.71 <sup>a</sup>	0.12	14.7 <sup>b</sup>	4.30	11.0 <sup>b</sup>	4.82
Excreted in urine (UZn), mg	0.09 <sup>a</sup>	0.03	0.05 <sup>a</sup>	0.03	0.16 <sup>a</sup>	0.20	0.06 <sup>a</sup>	0.03
Balance (BZn), mg	2.13 <sup>a</sup>	1.39	1.68 <sup>ab</sup>	1.14	2.14 <sup>a</sup>	1.64	0.34 <sup>b</sup>	0.67
GZn/FZn, %	42.8		29.1		86.5		96.5	
UZn/FZn, %	2.3		2.0		0.9		0.5	
BZn/FZn, %	54.9		68.9		12.6		3.0	

Means within a row not sharing a common superscript letter are significantly different (P < 0.05).

Table 5. Effect of dietary protein and zinc concentration on the concentration of zinc (ppm) in the liver from minkkits.

	Protein, %	
	7	10
Zinc, ppm	28.2 <sup>a</sup>	26.7 <sup>a</sup>
	40.1 <sup>b</sup>	34.7 <sup>b</sup>

Means not sharing a common superscript letter are significantly different (P < 0.05).

Both the protein and zinc content of the feed influenced the zinc concentration in femur. The results are shown in table 6. For animals on the low protein intake (irrespective of zinc intake) was the zinc concentration 55.0 ppm, which was significantly (P < 0.05)

less than for animals on the highest protein intake, where the zinc concentration was 60.7 ppm in femur. Pedersen and Eggum (1983) found the same tendencies in trials with rats, while Wallork et al. (1983) observed no effect on rats.

Table 6. Effect of dietary protein and zinc concentration on femur zinc concentration (ppm) in minkkits.

	Protein, %		Mean
	7	10	
Zinc, ppm	~ 5	~ 25	
	49.0 <sup>b</sup>	61.0 <sup>a</sup>	53.2
	57.4 <sup>a</sup>	64.0 <sup>a</sup>	62.5
Mean	55.0	60.7	

Means not sharing a common superscript letter are significantly different ( $P < 0.05$ ).

When the dietary zinc concentration was approximately 5 ppm, the zinc concentration in femur was on average 53.2 ppm, and it was 62.5 ppm, when the dietary zinc concentration was approximately 25 ppm. This difference is highly significant ( $P < 0.001$ ). Wallwork et al. (1983) got the same result in an experiment with rats, and also Pedersen and Eggum (1983) saw the same tendency.

However, if one looks at the individual groups, then it is only group 2 (7 % protein, 5 ppm zinc) which is significantly lower than the other groups. Group 4 (7 % protein, 25 ppm zinc) has in spite of the low zinc balance, which was measured the last 4 days of the trial, as high zinc content in femur as the 2 groups on the high protein intake.

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**Concept of Nutrient Partitioning in Diets for Mink**

*J.E. Oldfield, John Adair & Frederick Stormshak*

For many years, an objective of animal research has been to improve the productivity of animals by making them more efficient converters of dietary feeds into useful products: meat, milk, eggs, wool, or in the case of mink, fur. This has moved closer to achievement with the recent demonstration that certain chemical compounds which are catecholamine derivatives have the ability to "partition" dietary nutrients and direct them toward production of body protein rather than fat. The two such compounds that have had the most detailed investigation are clenbuterol and cimaterol, and they have been successfully used with poultry, pigs, sheep and cattle, as well as with laboratory animals. We were interested in applying this concept to mink for two reasons: (1) protein is metabolically easier to produce than fat in terms of energy expenditure - therefore improvement of the production ratio between fat and protein should result in

economies of feeding, while producing mink of equal size, and (2) no studies to date have investigated the partitioning of nutrients toward a specific type of protein. Such as fur. We were also interested, incidentally, in whether decreased fatness of mink would offer some protection against wet belly disease.

We chose cimaterol as the partitioning agent and added it to the mink diet at varying levels: 0.5, 2.0 and 5.0 parts per million in the total diet. (an attempt to investigate a much higher level, 25.0 ppm, had to be terminated, since the mink completely refused to eat the supplemented diet). Four groups of 20 mink each were used: three received the diets supplemented with cimaterol as described; the fourth, unsupplemented, served as a control. The basal diet was a common ranch mix used in the Pacific Northwest U.S., consisting of fish scrap 55%, chicken offal 25%, tripe/lungs 10% and dry cereal 10%. The mink were fed the diet once daily, to appetite, from weaning to pelting. Both standard dark and sapphire mink were included in the test groups.

As with other animal species, use of cimaterol did appear to increase the protein synthesis by mink and reduce fat formation (Table 1).

*Table 1. Fat/Protein Analyses of Entire Carcasses of Treated and Untreated Mink.*

Group	Treatment	Carcass Fat		Carcass Protein	
		%	amount	%	amount
1	Control: no supplement	24.17	412.58	15.18	265.95
2	0.5 ppm cimaterol	20.46	326.34	16.71	266.52
3	2.0 ppm cimaterol	18.38	289.49	17.56	276.57
4	5.0 ppm cimaterol	17.06	240.72	17.61	248.48

There was a decrease in size of the mink as the cimaterol levels in their diet increased; however, all mink on these experiments reached a satisfactory size at pelting. Comparison of pelt weight/body weight ratios and actual measurement of guard and underfur diameters showed no specific direction of diet protein into fur production. There were no significant advantages of cimaterol supplementation in terms of wet belly incidence.

The sensitivity of mink to presence of cimaterol in their diets suggests that the optimal level of its use may be different from those used in our experiments. This point deserves further research in view of the potential benefits of this compound.

*Blue Book of Fur Farming 1987 pp 35-38. 5 tables, 1 fig., 8 references.*

*Authors summary*

**Energy Metabolism of Raccoon Dog (*Nyctereutes Procyonoides*, Gray 1834): Applied Perspective to Common Farming Practices**

*Hannu Korhonen*

Energy metabolism and thermoregulation was studied in adult and juvenile raccoon dogs (*Nyctereutes procyonoides*, Gray 1834) under farm conditions. Some comparisons were made with the farmed blue fox (*Alopex lagopus*).

The recommended metabolizable energy (ME) supply fitted the ME needs of juveniles well. From mid-September onwards the recommended energy supply was too high which led to excessive obesity. Final body weights of animals caged alone, in pairs or by threes were of the same order of magnitude. Animals on ad libitum feeding tended to be heavier than those on restricted feeding. Higher feed intake was associated with a poorer apparent digestibility of nutrients. Social competition for feed did not induce animals to eat more than if caged alone. The shortage of feed affected all social classes equally. Hereditary factors rather than social competition for feed explained the great individual variation in growth and fur quality. Alterations in feeding frequency or intensity did not change the chemical composition of the animal carcass. With increasing age (body weight) the amount of carcass ash, protein, fat and energy increased. In adult animals, there was a positive correlation between carcass wet weight and carcass energy ( $r = 0.87$ ), fat ( $r = 0.83$ ) and protein ( $r = 0.82$ ) content. Excessive feeding increased body fat accumulation but generally failed to produce animals with bigger pelts or better fur quality. Lowering of feeding frequency or energy content of the diet did not result in any negative effects on fur quality. There existed a significant positive correlation ( $r = 0.43$ ) between the time (month) of birth and body weight gain. No significant relationships, however, were found between the time of birth and final body weight. Raccoon dogs exhibited marked seasonal changes in body weight (30%) which mainly consisted of changes in body fat content. Seasonal energy balance seemed to be more dependent on endogenous factors rather than solely controlled by external ones. Insulative value of the fur coat varied spatially. Ventral surfaces were poorly insulated even winter, and marked heat losses from these regions were evident. The lower critical temperature of the raccoon dog lies around +10°C below which metabolism ( $y$ ) increased with

air temperature ( $x$ ) according to the equation  $y=14.8 - 0.28x$ . Muscular shivering activity (integrated EMG) and heart rate increased with increasing oxygen uptake. Earlier speculations of a wide thermoneutral zone and an extremely low critical temperature seemed not to hold true for farmed blue fox. A dry sleeping plate or nest box effectively prevented heat loss from the body to the environment. As thermal insulation an ice-covered sleeping plate was even worse than a bare wire mesh floor, and thus the animals preferred to lie on the wire mesh.

ISBN 951-780-755-4, ISSN 0781-0873. 69 pp. 1 table, 4 fig., 117 references.

*Authors abstract*

**This thesis is based upon the following papers, referred to in the text by the respective Roman numerals (I-VIII), and on some recent unpublished results.**

- H. Korhonen and M. Harri (1985)* Growth and fur parameter variations of farmed raccoon dogs. Arch. Tierernähr. 35:761-772. (Vol. 10, No. 1)\*
- H. Korhonen, M. Harri and L. Nurminen (1986)* Effects of social competition for feed on growth of farmed raccoon dogs. Growth 50:340-350. (Vol. 11, No. 2)
- H. Korhonen and M. Harri (1985)* Organ scaling in the raccoon dog, *Nyctereutes procyonoides* Gray 1834, as monitored by influences of internal and external factors. Comp. Biochem. physiol. 82A: 907-914. (Vol. 10, No. 1)
- H. Korhonen and M. Harri (1986)* Effects of feeding frequency and intensity on growth, body composition, organ scaling and fur quality of farmed raccoon dogs. Acta Agric. Scand. 36:410-420. (Vol. 11, No. 1)
- H. Korhonen, M. Harri and E. Hohtola (1985)* Response to cold in the blue fox and raccoon dog as evaluated by metabolism, heart rate and muscular shivering: a re-evaluation. Comp. Biochem. physiol. 82A: 959-964. (Vol. 10, No. 1)
- H. Korhonen and M. Harri (1986)* Heat loss of farmed raccoon dogs and blue foxes as evaluated by infrared thermography and body cooling. Comp. Biochem. physiol. 84A: 361-364. (Vol. 10, No. 3)
- H. Korhonen (1987)* Significance of sleeping plate as a thermal protection for farmed

raccoon dogs (*nyctereutes procyonoides*).  
Comp. Biochem. physiol. (in press)

H. Korhonen (1987) Relationship between seasonal energy economy and thyroid activity in farm-raised raccoon dogs. Comp. Biochem. physiol. (in press)

(\*) Issues of SCIENTIFUR in which the actual reports have been abstracted.

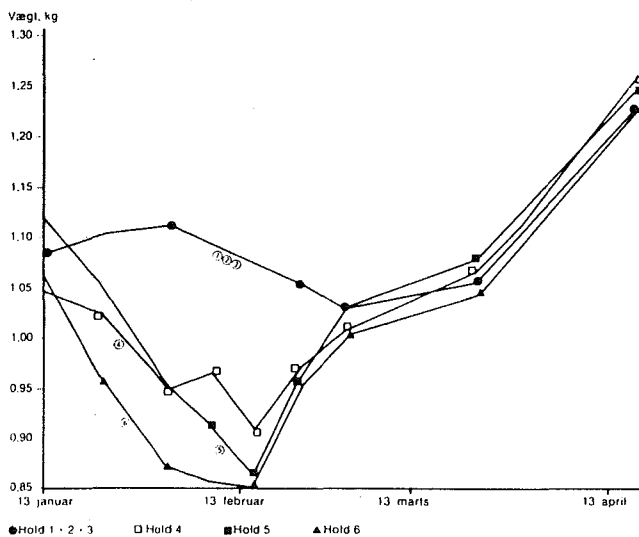
### Flushing Experiments

(Flushing forsøg)

Rudolf Sandø Lund

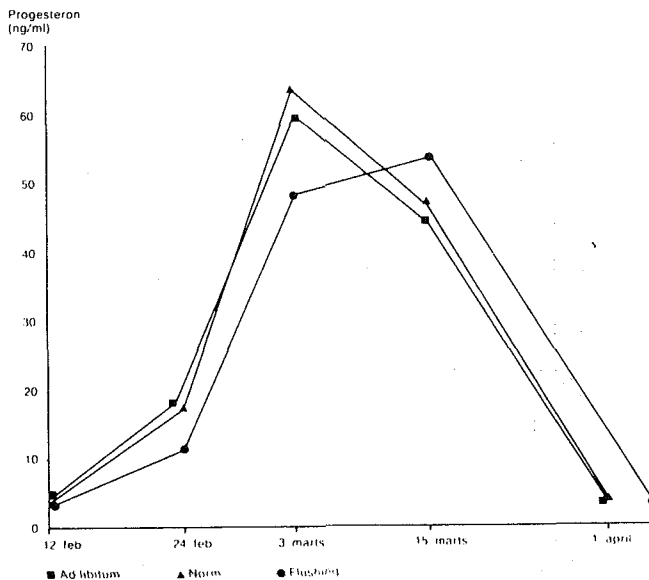
For 300 standard mink females (1) fed ad lib. from 1 January to 15 June, (2) fed ad lib. except from 7 to 20 April, when they received 10% less feed than group 1, or (3) fed ad lib but given 10% less than group 1 from 25 March to 7 April, the percentage of infertile fema-

Fig. 1. Tævernes vægt gennem avlsperioden. Standard + pastel.



les was 11, 7 and 7 resp., litter size at birth 6.2, 6.2, and 6.2, and litter size on 10 May 5.4, 5.5 and 5.3 vs. 3, 4 and 3%, 6.5, 6.4 and 6.6, and 5.5, 5.5 and 5.6 for 300 Pastel mink fed the same diets. In the 3 groups resp., gestation length averaged 55.7, 56 and

Fig. 3. Progesteronniveauer i blodet hos tæverne gennem forsøgsperioden.



58 days. Blood progesterone concentration from 12 february to 1 April. Was highest in females in group 3, closely followed by those in group 1; it was lower in group 2 than in the other 2 groups from the end of February to mid-March.

Dansk Pelsdyravl: 49(12): 847-849, 1986.  
2 tables, 4 fig.  
In DANH.

CAB - abstract

### Feed - Related Factors Affecting Water Turnover in Mink

Maria Neil

Effects of some feed-related factors on the water turnover of adult mink males were studied in a series of comparative short-term experiments. The factors investigated were addition of some water absorbants in the feed, severe or gentle drying of the feed, extruded or cooked cereals in the diet, and some commercial dry diets for mink-fed dry or soaked. Water consumption by feed and drinking-water, water output in urine and faeces, and urinary osmolality were measured. An increase in faecal water output with subsequent reduction of



urine volume was observed when dry diets were fed. Soaking of the dry diets tended to increase water consumption and decrease urinary osmolality. Feeding the several dried diet resulted in diarrhoea and, compared with feeding the fresh or gently drier diets, almost doubled the amounts of faecal water. Comparing cooked or extruded cereals in the feed, gave no differences in water intake or faecal water output but the total and urinary water output was slightly decreased in the group fed cooked cereals. When water absorbants were added to the diet, water consumption and faecal water output increased, and there were at least tendencies for reduced urine volume and inc-

reased urinary osmolality. The water bound to the absorbants added had low availability to the mink.

*Swedish J. agric. Res. 16:81-88, 1986. 6 tables, 1 fig., 21 references.*

*Authors abstract*

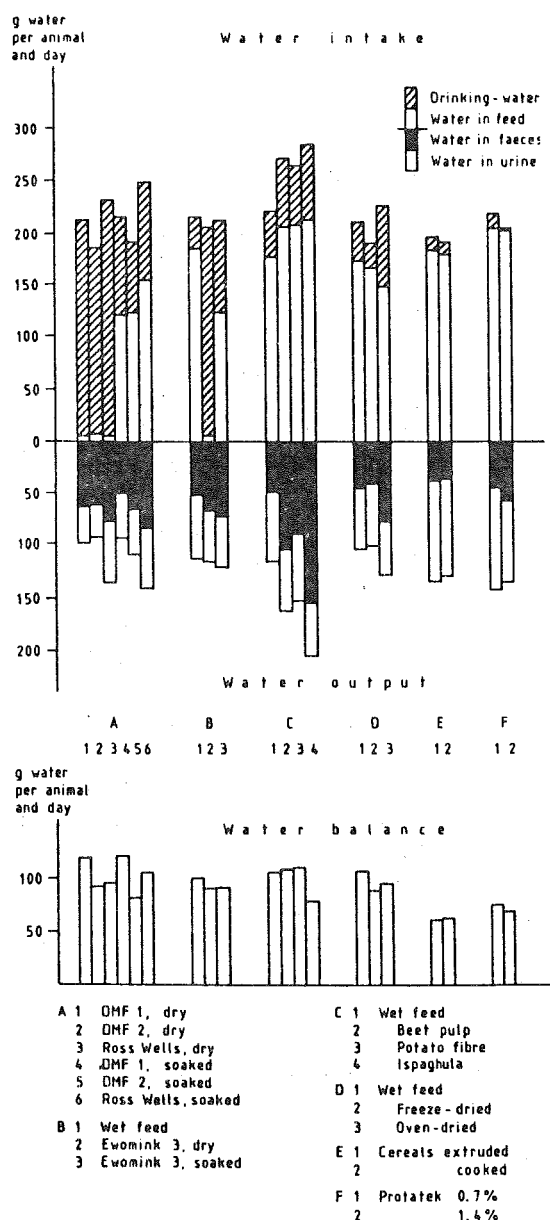


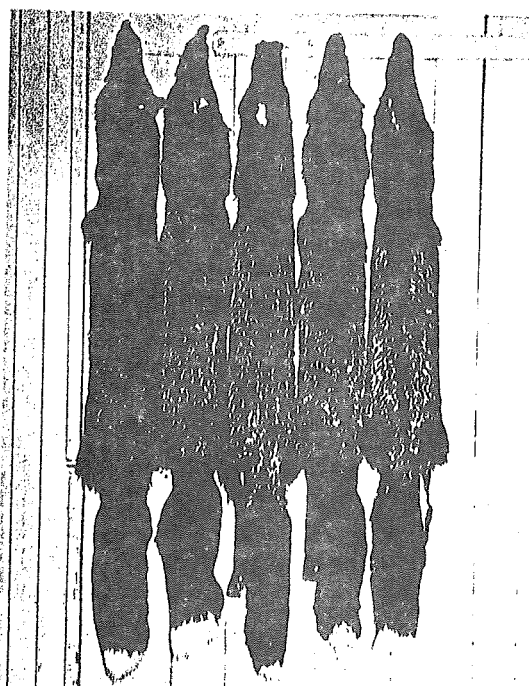
Fig. 1. Water turnover.

### Biotin in the Treatment of Dogs and After Administration in Breeding Foxes

(Zastosowanie biotyny w lecznictwie u psow i lisow hodowlanych)

Z. Rolinski, M. Duda.

The effect of biotin administered in breeding foxes - polar and silvery ones - and its use in case of dermatitis of dogs was assessed. The drug Biotyna ad usum vet. and Rovimix H were given pregnant females (group I) foxes after weaning (group II), and in the period of



Fot. 5. Zestaw 5 skórow lisow srebrzystych, 3 gorne biotynowe, różnice w długości i szerokości skórow, gęstości okrywy.

fur coat change (group III). The following parameters were taken into consideration: the number of animals living up to weaning, liability to infection and poisonings, weight gains, and the length and quality of furs. It was found that biotin influenced profitably the state of health, vitality and liveliness.

The furs of the foxes characterized by better quality and length of the fur. Biotin administered in dogs resulted in good effects particularly in case of seborrhoea dermatitis and in the course of skin diseases due to high proteinic diet.

*Medycyna Weterynaryjna: 42(4): 223-226, 1986.*

*5 tables, 10 fig., 6 references.*

*In POLH Su. ENGL, RUSS.*

*Authors abstract*

#### Evaluation of Thiamine Status of Wild Animals

*V.A. Berestov, G.G. Petrova, S.P. Izotova*

Blood was taken from mink and arctic foxes for the estimation of transketolase, and from the value of transketolase the thiamine diphosphate (TDP) effect was estimated, TDP effect up to 15% indicated normal thiamin status, from 30 to 40 moderate deficiency, and above 40% extreme deficiency. Animals in group 1 were fed at the start of a four-month period on a diet containing meat and thiaminase-containing fish (capelin) which provided 14 to 30% of the protein, and during the 2nd period on the diet with the thiaminase-containing fish providing 34% of the protein. Each animal was given daily during the 1st and 2nd periods thiamin 0.33 to 1.2 and 1.0 mg. Of the animals 50, 17 and 5% had very slight, slight and large deficiencies of thiamine, respectively. The 2nd group of animals was given for 3 weeks a diet containing the thiaminase-containing fish at 50% of dietary protein without supplementary thiamin, and on the 4th week the fish provided 70 to 9% of the dietary protein. After the first 20 days of the trial some of the animals lost appetite; all showed signs of slight to serious thiamin deficiency, the extent of deficiency increasing with the duration of feed-

ing. Group 3 animals were fed on horse-meat and boiled fish and given daily thiamin 1.0 mg/head. TDP effect of 14% indicated normal thiamin status in all the animals. The animals up to 2 months old had normal thiamin status; vitamin deficiency appeared as the animals became older.

*Krolikovodstvo i Zverovodstvo: (No. 4): 6-7, 1986.*

*1 table.*

*In RUSS.*

*CAB - abstract*

#### Feed Meal From Hide Wastes

*A.D. Sobolev; O.A. Komov*

A feed meal was prepared from cattle hide wastes and contained moisture 10.4, protein 62.5, fat 7.9 and ash 19.2%. The amino acid composition was not inferior to that of meat-and-bone meal or fish meal. Digestibility trials on mink showed that the meal contained 44 g digestible protein and 6 g digestible fat per 100 g. In a feeding trial 3 groups each of 50 male and 45 female mink were fed for 123 days on a control diet of fish meal 14 to 23, non-edible beef 10, ox head 4, blood 2 to 4, fish meal 2.7 to 3.0, extruded grains 8.8 to 10.0 and skimmed milk 5 g/100 kcal; protein-and-vitamin concentrate 2 and mixed fat 3.5 to 4 g/head; or that control diet with 20 or 30% of the protein from the fish meal and meat replaced by the hide meal. At the end of the feeding trial the average body weight of the males was, respectively, 2290, 2360 and 2270 g; and that of the females 1250, 1260 and 1210 g. Average sale price of the pelts from both sexes was 58.89, 59.60 and 58.00 r. A repeat of the feeding trial produced results which appeared to support those of the first trial.

*Krolikovodstvo i Zverovodstvo: (No. 3): 6-7, 1986.*

*3 tables.*

*In RUSS.*

*CAB - abstract*

**Toxic Effects of Food-Borne Flouride in Silver Foxes**

*Richard H. Eckerlin, Lennart Krook, George A. Maylin and Daniel Carmichael*

Chronic ingestion of excessive amounts of flouride from commercial fox food is associated with agalactia in vixens resulting in the starvation deaths of large numbers of kits in three fox herds. Evidence of infectious disease or poor management could not be found and a causal relationship between flouride and high kit mortality is suggested.

*Cornell Vet. 1986, 76:395-402. 3 tables, 3 fig., 14 references.*

*Authors abstract*

**Feeding of Coypu**

*(Zur Fütterung der sumpfbiber)*

*Dr. R. Cholewa and Prof. Dr. Rose-Marie Wegner*

Traditional feeding practices at small units, based on farm-produced components plus good-quality garden or orchard waste or byproducts from the brewing, baking and sugar industries, are examined. Juicy basal feed and concentrate including both vegetable and animal protein could provide a balanced and easily digested high-quality diet low in fibre, in keeping with natural eating habits of coypu. Roots and tubers, steamed potato, legumes, fodder yeast and cereal are suggested. The advantages of using complete feed containing 12 or 17% crude protein supplied to appetite is described. Free choice of meal or pellets with 2 drinking system is given.

*Deutsche Pelztierzüchter: 59(12): 196-198, 1985. 6 references. In GERM.*

*CAB - abstract*

**Results of Feeding Experiments in the 1986 Breeding Season**

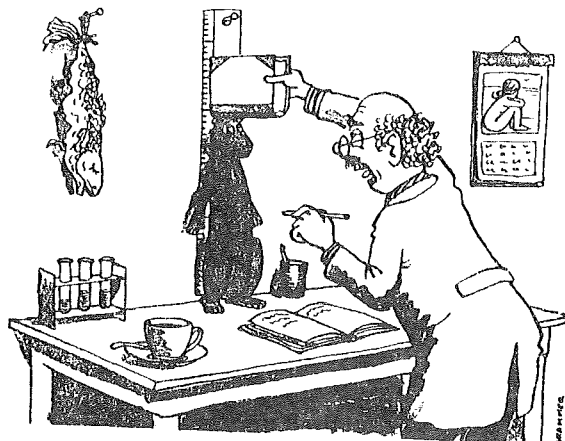
*(Resultat från utfodringsförsöken avelsperioden 1986)*

*Jaakko Mäkelä & Tuula Dahlman*

For mink females at Kyrkslätt, fed from mating to weaning of their litters on (1) a standard diet, (2) diets with 2% wheat molasses or (3) diets with 0.5% formic acid, the percentage of infertile females was 19, 25 and 30 resp., and the number of kits born per mated female averaged 4.04, 3.68 and 3.20. Weaning weight of male kits in the 3 groups averaged 454, 493 and 487 g resp., and that of females 389, 408 and 411 g. For mink females at Maxmo, fed during the breeding season on a standard diet (group 1), diets low in carbohydrates (group 2 and 3), a diet high in carbohydrates (group 4), a diet high in fibre (group 5), or a concentrated "fish silage" diet (group 6), the percentage of infertile females was 16, 15, 10, 19, 19 and 8 resp., and the number of kits born per mated female 3.61, 3.91, 4.05, 3.61, 3.90 and 4.55. For fox females fed a diet containing 35% offal plus 5% blood, or a high-fibre diet, the number of young born per mated female averaged 6.60 and 5.23 resp. vs. 3.28 for females fed standard diets.

*Finsk Pälstidskrift: 20(10): 544-545, 1986. 3 tables. In SWED.*

*CAB - abstract*



**Diet of Foxes and Martens in Central Poland**

*Jacek Goszczyński*

The diet of foxes and martens was examined on the basis of the composition of their faeces (1139 and 813 portions, respectively) collected from the same area in central Poland. Although the mean density of the common vole was low in the study area, an increase in the number of these rodents was followed by a functional response of both foxes and martens. This response, however, was weaker than in the areas with a high abundance of voles. The proportion of voles in the diet was more variable in the study area than in the areas of their high densities. In the diet of foxes, three groups of food items were found in similar proportions (about 26-33% by weight): small

mammals, birds, and hares. In foxes a compensatory response was found between the consumption of small mammals, on the one hand, and birds and hares, on the other. Martens consumed the same three groups of prey; but also fruits were an important component of their diet (37%). Except for small mammals preyed upon by martens throughout the year, the other food items (hares, birds, insects, and fruits) were consumed from time to time. Martens showed a compensatory response between preying on small mammals and eating fruits in summer and autumn months, and also between preying upon small mammals and birds in winter and spring months. The diet of foxes was characterized by a small annual variation and a high seasonal variation in the study area as compared with areas supporting high vole densities.

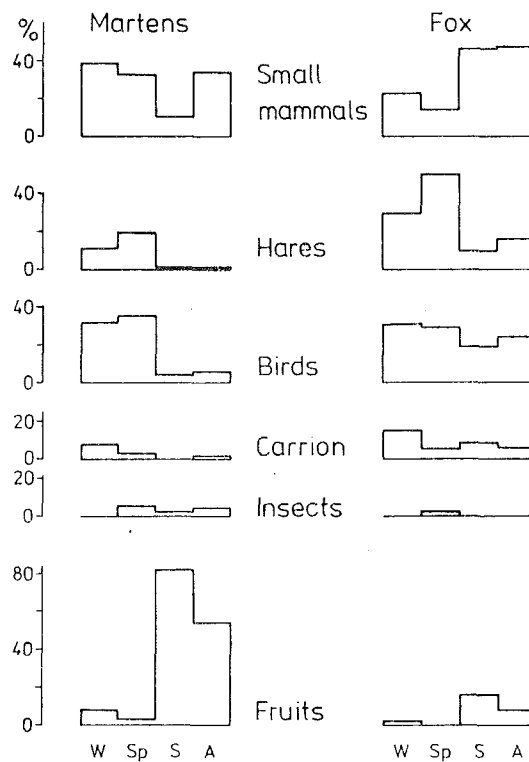
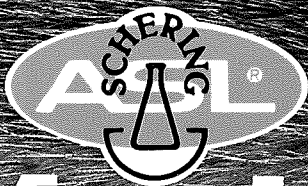


Fig. 7. Seasonal variation in the proportions (percentage by weight) of different components in the diet of martens and foxes (W — winter, Sp — spring, S — summer, A — autumn).

*Acta Theriologica, Vol. 31. 36: 491-506, 1986.*  
 2 tables, 8 fig., 9 references.  
 In ENGL Su. POLH.

*Authors summary*



# Mink Vaccines

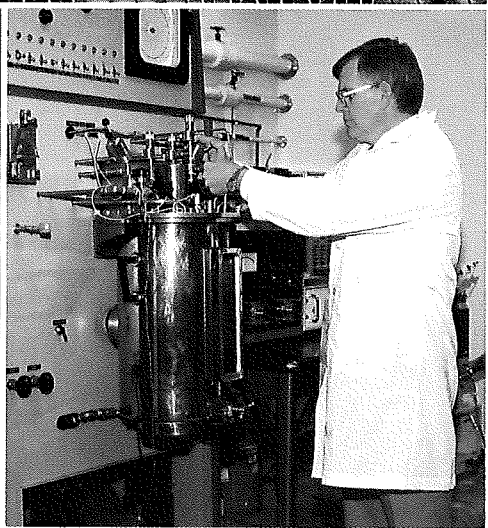
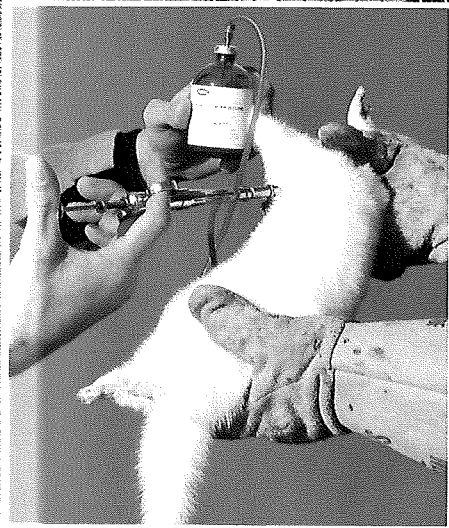
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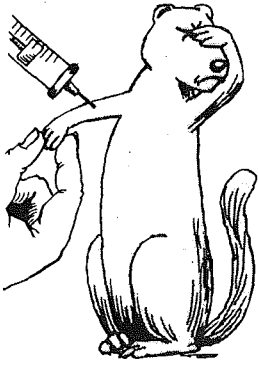
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## Aleutian Disease of Mink. Virology and Immunology

*Bent Aasted*

Aleutin disease (mink plasmacytose) is caused by infection with a persistent parvovirus, Aleutin disease virus (ADV). Virus interferes with the immune system with resulting increased gammaglobulin production (hypergammaglobulinemia), which is followed up by immune complex formation and finally often fatal immune complex disease.

The studies have focused on the following aspects of Aleutin disease 1): Purification of virus and physico/chemical- and serological characterization of virus. 2): Introduction of new serological methods for analysis of antiviral antibodies, and finally 3): Analyses of quantity and quality of the antibodies produced during disease.

Ad 1): Virus is found in vivo in the form of immune complexes. For virus purification it is necessary to dissociate the antibodies from virus. This is called "virus activation". A systematic study on virus activation methods concluded, that acid activation was the method of choice. Later in the purification procedure 2 new methods were introduced, preparative electrophoresis and hydroxylapatite chromatography. Purified virus showed parvovirus related polypeptides, a finding which supported the classification of ADV as a parvovirus. Virus showed a fast electrophoretic migration in crossed immunoelectrophoresis and in isoelectric focusing the isoelectric point of virus was measured to 4.0-4.4. Polypeptides from different ADV isolates were studied by immune blotting and immune precipitation. It was shown that in vivo produced virus expressed intact parvovirus proteins (with molecular weights of 85000, 75000 and 71000). In vivo produced virus almost always showed smaller polypeptides (molecular weights 30000 and 27000). Additional studies indicated, that virus in vivo had been modulated by proteolysis, so that the virus polypeptides were broken down. This treatment does not change the ic-

ohedral structure of virus, and virus is fully infectious. In the same study structural differences were shown between the polypeptides from in vivo produced and in vitro produced virus. It was shown, that polypeptides from in vivo produced virus are 2000-3000 dalton larger than those of in vitro produced ADV.

Virus DNA was isolated and 3 segments representing 80% of the genome was cloned in either bacteriophage M13mp9 or plasmid pUC8 (the cloning was performed by *Dr. Mayer and Dr. Bloom*, NIH, NIAID, USA). A recombinant plasmid (called pBM1) introduced expression of virus related polypeptides in *E. coli* (molecular weights 55000, 34000 and 27000).

Serological analyses with both conventional as well as hybridoma antibodies were done on 4 different virus isolates. Serological differences were found, but it was concluded, that the differences should not be taken as evidence for strain variation, but should be seen in the light of different in vivo proteolytic modulation. In the same study it was shown that in vitro produced virus (ADV-G) had a lower electrophoretic migration rate than several in vivo produced virus isolates.

Ad. 2: Two new methods for measuring antibody against ADV were found introduced. One called the indirect counter current electrophoresis was shown to have a sensitivity 32 times higher than the traditional counter current electrophoresis. The other method, a radio immune assay (RIA) was very sensitive and could measure as little as 5 ng of antibody to virus. This RIA was also used to measure virus antigen with a sensitivity of 3.2 ng. When 4 different diagnostic methods for measuring antibody to ADV were compared, RIA was shown to be approximately 10 times more sensitive than any of the other methods. Antisera from mink with strong hypergammaglobulinemia could be diluted more than 1 million times and still be positive in RIA.

Virus antigen was measured in organ extracts from experimentally infected animals. Intestine and kidneys were the first two organs to contain virus antigen. This was pos-

sibly virus antigen taken up from the inoculum. Spleen, liver, lymph nodes, peritoneal exudate- and bone marrow cells (i.e. lymphoid cells and organs) were next to be positive for virus antigen. This antigen was produced in higher amounts and corresponded probably to actively produced virus.

Ad. 3: The humoral immune system in virus infected mink is out of control during infection with ADV, with resulting often extreme production of gammaglobulin. The quantity and quality of produced antibodies to ADV were investigated. It was found that from 4-57% of the hypergammaglobulinemia consisted of antibodies to virus depending on which virus strain the mink were infected with (low or high virulent). The quality of the antibodies (binding energy towards viral antigens) were also analysed and found between  $2 \times 10^{-2}$  to  $2 \times 10^{-1}$  mol. These values indicates good binding capacity of the antibodies. During the development of the disease a slight decrease in antibody affinity was observed in standard mink, which was not observed in Aleutian genotype mink. In certain instances restricted heterogeneous antibodies were observed in mink sera .

**The summary is based on the following previous publications:**

*Aasted B.:* Purification and characterization of Aleutian disease virus. *Acta path. microbiol.scand. sect. B.* 88, 323-328, 1980a. (Vol. 4, No. 5)\*

*Aasted B. and Cohn A.:* Inhibition of precipitation in counter current electrophoresis. A sensitive method for detection of mink antibodies to Aleutian disease virus. *Acta path. microbiol. immunol. scand. Sect. C* 90, 15-19, 1982. (Vol. 7, No. 1.)

*Aasted B. and Avery B.:* An easy method for comparing antibody affinities to related antigens. *Acta path. microbiol. immunol. Scand. Sect. C* 91, 65-67, 1983. (Vol. 11, No. 3.)

*Aasted B. and Bloom M.E.:* Sensitive radioimmuno assay for measuring Aleutian disease virus antigen and antibody. *J. Clin. Microbiol.* 18, 637-644, 1983. (Vol. 8, No. 3.)

*Aasted B., Bloom M.E., Cohn A., Race R.E. and Wolfenbarger J.B.:* Preparation and optimization of in vivo produced Aleutian disease virus (ADV) antigen. *Scientifur* 7, 72-77, 1983. (Vol. 7, No. 3.)

*Mayer L.W., Aasted B., Garon C.F. and Bloom M.E.:* Molecular cloning of the Aleutian Disease Virus genome: Expression of Aleutian Disease Virus antigens by a recombinant plasmid. *J. Virol.* 48, 573-579, 1983. (Vol. 11, No. 3.)

*Aasted B., Avery B. and Cohn A.:* Serological analyses of different mink Aleutian disease virus strains. *Arch. Virol.* 80, 11-22, 1984a. (Vol. 9, No. 3.)

*Aasted B., Tierney G.S. and Bloom M.E.:* Analysis of the quantity of antiviral antibodies from mink infected with different Aleutian disease virus strains. *Scand. J. Immunol.* 19, 395-402, 1984b. (Vol. 11, No. 3.)

*Aasted B., Race R.E. and Bloom M.E.:* Aleutian disease virus, a proteolytically degraded during in vivo infection in mink. *J. Virol.* 51, 7-13, 1984c. (Vol. 9, No. 2.)

*Aasted B. and Bloom M.E.:* Mink with Aleutian disease have high-affinity antiviral antibodies. *Scand. J. Immunol.* 19, 411-418, 1984. (Vol. 11, No. 3.)

(\*) Issues of SCIENTIFUR where abstracts of the report have been published.

*Acta Pathologica, Microbiologica et immunologica Scandinavica, C: 93(supp. 287): 47pp., 1985.*

*Thesis; Royal Vet. Agric. University, Copenhagen.*

*2 tabels, 1 fig., 144 references.*

*Authors summary*

**An Easy Method for Comparing Antibody Affinities to Related Antigens**

*Bent Aasted and Birthe Avery*

Four different Aleutian disease virus (ADV) isolates were coated to 1/4" polystyrene balls. The binding capacity of these balls against different mouse hybridoma antibodies prepared against each of the ADV isolates was investigated in two ways. The different ADV-coated balls were either mixed in a tube (competi-



tion) between balls for antibody), or they were allowed to react separately with antibody (no competition). The difference in competitive and non-competitive binding values allows a comparison of antibody affinity against the four ADV isolates. Examples are given, where two hybridoma antibodies react better with the Danish isolate than with the three American isolates.

*Acta path. microbiol. immunol. scand. Sect. C, 91:65-67, 1983.*

1 tables, 6 references.

*Authors summary*

**Molecular Cloning of the Aleutian Disease Virus Genome: Expression of Aleutian Disease Virus Antigens by a Recombinant Plasmid**

*Leonard W. Mayer, Bent Aasted, Claude F. Garon, and Marshall E. Bloom*

Three nonoverlapping segments representing ~80% of the 4.8-kilobase pair Aleutian disease virus (ADV-G) duplex genome were molecularly cloned into either bacteriophage M13mp9 (M113bm2 = 0.07 to 0.15 map unit; M113bm1 = 0.15 to 0.54 map unit) or plasmid pUC8 (pBM1 = 0.54 to 0.88 map units). In addition, the 0.54- to 0.88-map unit segment of a Danish isolate of ADV (DK ADV) was also cloned into pUC8 (pBM2): The recombinant plasmids pBM1 and pBM2 induced expression of several polypeptides in *Escherichia coli* JM103 that were specifically recognized by sera from mink infected with ADV. The same three proteins with approximate molecular weights of 55,000, 34,000, and 27,000 were detected both by immune blotting and by immunoprecipitation of [<sup>35</sup>S] methionine-labeled JM103 (pBM1). None of these proteins were recognized in JM103 (pUC8), nor were they detected by sera from normal mink. Purified pBM1 and pBM2 DNA appeared identical in size by gel analysis and contour length measurement, and electron microscopic heteroduplex mapping showed that pBM2 was different from pBM1, indicating that this segment of the ADV genome was similar but not identical for two strains of DVA (ADV-G and DK ADV). Furthermore, when cloned DNA relatedness to several field strains of ADV (Utah I, Pullman, and DK), but not to mink enteritis virus or cellular DNA, was shown by Southern blot hybridization.

*Journal of Virology, Dec. 1983, p. 573-579*  
*Vol. 48, No. 3.*  
 5 fig., 41 references

*Authors abstract*

**Analysis of the Quantity of Antiviral Antibodies from Mink Infected with Different Aleutian Disease Virus Strains**

*Bent Aasted, G.S. Tierney & M.E. Bloom*

Mink persistently infected with Aleutian disease virus (ADV) develop hypergammaglobulinaemia and immune complex disease. Radiolabelled antibodies from mink infected with ADV-G, DK, Pullman, and Utah I strains of ADV were reacted against all four ADV strains in radioimmunoassay (RIA). The amount of anti-ADV antibody in two equally hypergammaglobulinaemic serum pools varied from 13% (anti-Pullman) to 57% (anti-Utah I). Serum pools from two other sources (anti-DK and anti-ADV-G), although less hypergammaglobulinaemic, had 5% and 13%, respectively, indicating that 43-95% of the Ig in the sera of the mink with AD was not specific antibody to ADV structural antigens. The possibility of a general polyclonal activation of the humoral immune system is being discussed. Comparison of plateau RIA binding levels for the four serum pools against the four viral antigens suggested three patterns of reactivity: DK and Utah I reacted similarly, but Pullman and ADV-G reacted serologically differently.

*Scand. J. Immunol. 19, 395-402, 1984*  
 2 tables, 3 fig., 23 references.

*Authors summary*

**Mink with Aleutian Disease Have High-Affinity Antiviral Antibodies**

*Bent Aasted & M.E. Bloom*

Mink persistently infected with Aleutian disease virus (ADV) develop plasmacytosis (hypergammaglobulinaemia) and immune complex disease. Mink of different colour phases were

infected with different strains of ADV and bled at different times after infection. The average antibody affinity ( $K$ ) were measured in the sera and found to fall in the range of  $2 \times 10^6 - 2 \times 10^7 M^{-1}$ , thus indicating good-quality antibodies. In sera of non-Aleutian genotype mink a decline in ( $K$ ) during development of plasmacytosis was observed. Moreover, the antibody heterogeneity (a values) tended to decrease during the disease progress. In contrast, the  $K$  values in sera of infected Aleutian genotype mink remained relatively high after hypergammaglobulinaemia developed, and the antibody heterogeneity for certain of the mink sera indicated restricted heterogeneity (high values). In agreement with the clonal selection theory, low virus burden (for instance, during infection with a low-virulence ADV strain) generated relatively higher affinity antibodies than a high virus burden (for instance, the highly virulent Utah I strain of ADV). Furthermore, antibodies present in low concentration affinity antibodies found in this study indicate that if the immune complex disease seen in AD is caused by virus-anti-virus antibodies, good-quality antibodies are likely to be responsible for the pathological findings.

*Scand. J. Immunol.* 19, 411-418, 1984.  
1 tabel, 3 fig., 23 references.

*Authors summary*

### Toxic effects of the antiparasitic compounds fenchlorphos and trichlorfon during foetal development

*Gunnar Nicolay Berge*

#### Summary

##### paper 1

The experiments were carried out in order to examine the possible effect of therapeutic doses of the organophosphorus insecticide fenchlorphos during the breeding season in the blue fox. It was found that the compound was highly teratogenic and findings was a narrowing of the granular and molecular layers in addition to a loss of purkinje cells in the cerebellar cortex.

##### paper 2

The purpose of this paper was to examine the effect of fenchlorphos upon some reproductive parameters and male fertility in the blue fox during the breeding season. No alterations in the reproductive hormones or organs were observed, but in treated males there was an apparent decrease in their libido.

##### paper 3

The rabbit being a well established model for teratogenic studies was chosen for comparative purposes and for further examination of the embryotoxic and teratogenic effects of fenchlorphos. In contrast to the findings in the blue fox there was no indication of an adverse effect of fenchlorphos on fertility. There was, however, an increased incidence of various malformations including cerebellar hypoplasia.

##### paper 4

The organophosphorus insecticide trichlorfon has been reported to give cerebellar hypoplasia in piglets when used for the treatment of sarcoptic mange in the pregnant sows. This paper gives a detailed examination of the neurotoxic effects of trichlorfon in the pig. The brain damage in the piglets was produced without simultaneous malformation of other organs, and involved not only cerebellar but also cerebral hypoplasia. The events occurred in the period of maximal brain growth and were clearly associated with alterations in some of the transmitter markers and sporadic loss in purkinje cells.

##### paper 5

In order to examine a potential neurotoxic effect of trichlorfon during the postnatal period in the pig, repeated dosages of trichlorfon were given during this period. However, only small changes in brain weights, morphology and transmitter enzyme activities were observed. The ability of presumptive hypoplastic cerebellum and cerebrum at birth, following prenatal exposure to trichlorfon, to regenerate was also investigated. The brain weights increased during the postnatal period, but did not reach control values. The study indicated that the pig brain was much less vulnerable to trichlorfon in the postnatal period.

##### paper 6

The main brain damage of trichlorfon in piglets occurred during the prenatal part of the maximal brain growth period. In the guinea pig

this period is mainly prenatal. For this reason, and in order to establish a possible suitable laboratory animal model for further investigation, the prenatal effects of trichlorfon in the guinea pig were examined. It was found that the brain damage and the pattern of transmitter markers after trichlorfon administration in the guinea pigs, were very similar to those in piglets, with the exception that the medulla oblongata was more and the cortex slightly less affected than the piglets. As in piglets few alterations occurred outside the brain. One very characteristic exception was, however, a symmetrical atrophy of the hindquarters in the guinea pig.

paper 7

This experiment was carried out in order to reveal a possible relationship between the previously described teratogenic effects and the distribution pattern as well as the placenta transfer of trichlorfon. Transplacental transfer of c-trichlorfon was demonstrated by autoradiography, but no particular site of accumulation in the brain was found.

paper 8

The foetal cerebellar morphology was investigated at selected intervals after the administration of trichlorfon to pregnant guinea pigs in late gestation. No clearcut changes, either macroscopically or microscopically, were observed.

Thesis based on the following 8 papers:

1. *Gunnar N. Berge and Inger Nafstad*: Teratogenicity and embryotoxicity of orally administered fenchlorphos in blue foxes. *Acta vet. scand.* 1983, 24, 99-112. (Vol. 8, No. 1, 1984).\*
2. *Gunnar N. Berge, Michelle Mondain-Monval, Adrian Smith and Ordin Møller*: Ovarian and testicular function in the blue fox (*Alopex lagopus*) after oral administration of fenchlorphos during the breeding season. *Acta vet. scand.* 1983, 24 200-210. (Vol. 8, No. 3, 1984).
3. *I. Nafstad, G. Berge, E. Sannes and A. Lyngset*: Teratogenic effects of the organophosphorus compound fenchlorphos in rabbits. *Acta vet. scand.* 1983, 24, 295-304.
4. *Gunnar N. Berge, Frode Fonnum and Per Brodal*: Neurotoxic effects of prenatal trichlorfon administration in pigs. From the

Norwegian College of Veterinary Medicine, Department of pharmacology and Toxicology and Department of Internal Medicine, Oslo, Norwegian Defence Research Establishment, Division for Toxicology, Kjeller, Norway, and University of Oslo, Anatomical Institute.

5. *Gunnar N. Berge, Frode Fonnum, Erling Søyen and Nils E. Søli*. Neurotoxicological examination of piglet brain after prenatal and postnatal exposure of trichlorfon. From The Norwegian College of Veterinary Medicine, Department of pharmacology and Toxicology, and Department of Internal Medicine, Oslo, Norwegian Defence Research Establishment, Division for Toxicology, Kjeller, Norway.
6. *Gunnar N. Berge, Inger Nafstad and Frode Fonnum*: Prenatal effects of trichlorfon on the guinea pig brain. The Norwegian College of Veterinary Medicine, Department of pharmacology and Toxicology. Norwegian Defence Research Establishment, Division for Toxicology, Kjeller, Norway.
7. *Gunnar N. Berge and Inger Nafstad*: Distribution and placental transfer of trichlorfon in guinea pigs. The Norwegian College of Veterinary Medicine, Department of pharmacology and Toxicology.
8. *Gunnar N. Berge and Per Brodal*: A morphological study of the guinea pig cerebellum following prenatal administration of trichlorfon. The Norwegian College of Veterinary Medicine, Department of Pharmacology and Toxicology.

(\*) Vol. and No. of SCIENTIFUR in which abstract have been given.

*Thesis:*

*From the Department of pharmacology and Toxicology, and Department of Internal Medicine,*

*The Norwegian College of Veterinary Medicine, Oslo, Norway.*

*28pp., 62 references.*



**Changes in the Mineral Composition of Bones caused by Osteodystrophia Fibrosa in Standard Mink and Arctic Foxes.**

(Zmeny v Mineralni Skaldbe Kosti Pri Fibrozni Osteodystrofii u Standardnich Norku a Pescu)

Jiri Mouka, Jaroslav Konrad

Laboratory characteristics of a metabolic diseases (*Osteodystrophia fibrosa*) in standard young minks and arctic foxes is described. In comparison with the control group, while the biochemical characteristics of the blood samples of arctic foxes was not very different from the control group in the contents of macroelements (calcium, phosphorus, magnesium), significant differences were revealed by the analyses of the bone samples of *os femoris*. In young minks ash weight in 1 g of fat-free

dry matter made only 321.94 mg (52.45%), while in the control group 613.82 mg. A similar decrease ( $P < 0.01$ ) was observed, in comparison with the control, in the contents of calcium and phosphorus (44.75% and 56.90%). A slight increase in the magnesium content is not statistically significant. Evaluation of ash content in *os femoris* in young arctic foxes gave similar results. Biochemical characteristics of their blood showed a significant increase in the activity of alkaline phosphatase. An application of the chemical analyses of bones to diagnosing metabolic disturbances in fur animals is discussed.

*Veterinarni Medicina: 31(3): 181-188, 1986. 2 tables, 2 fig. 22 references. In CHEC Su. ENGL, RUSS, GERM.*

Authors summary



1. Mládě pesce s klinickými příznaky osteodystrophia fibrosa — Young arctic fox with clinical symptoms of Osteodystrophia fibrosa  
2. Mládě norka s klinickými příznaky osteodystrophia fibrosa — Young mink with clinical symptoms of Osteodystrophia fibrosa

**Primary and Secondary Toxicity of Warfarin, Sodium Monofluoroacetate, and Methyl Parathion in Mink**

R. J. Aulerich, R.K. Ringer, J. Safronoff

The primary and secondary toxicity of warfarin, sodium monofluoroacetate (Compound 1080) and methyl parathion were assessed in the mink, a representative surrogate mammalian wild life carnivore. In a 28-day test, a LC50 value for mink fed warfarin *per se* (primary toxicity) was calculated to be 11.7 ppm (mg/kg) with a 95% confidence interval of 9.2 to 15.0 ppm (mg/kg) and a slope of 2.03. Feeding mink warfarin-contaminated rabbit (minus digestive tract contents) incorporated into diets to provide warfarin residue levels equivalent to the warfarin concentrations fed in

the LC50 primary toxicity test did not produce secondary toxicity, suggestion that warfarin may be readily bound and/or metabolized into non-, or less-toxic metabolites by a primary consumer. Toxic residues of sodium monofluoroacetate for mink (as in secondary toxicity) were not produced in rabbits fed a lethal dose of this compound when the gastrointestinal tract contents were removed from the rabbit carcasses. These results suggested that reports of secondary toxicity from sodium monofluoroacetate may be primarily due to consumption of the unmetabolized compound from the gut of prey species. Attempts to produce primary and secondary toxicity in mink by feeding methyl parathion *per se* (primary toxicity) or via contaminated rabbit (containing the gastrointestinal tract contents), as in secondary toxicity, were unsuccessful, as the mink rejec-

ted the methyl parathion-treated diets.

*Arch. Environ. Contam. Toxicol.* 16, 357-366 (1987).

3 tables, 31 references.

*Authors abstract*

**A Comparison of Different Methods for Determining Elastase Activity of *Pseudomonas Aeruginosa* Strains from Mink**

*Laila Elsadig Elsheikh, Rune Bergman, Stanley J. Cryz, Jr. and Bengt Wretling*

We have characterized 20 *Pseudomonas aeruginosa* strains isolated from pneumonic mink lungs with regard to elastase production and serotype. *P. aeruginosa* PA 01, a well-characterized elastase-producing strain, and two elastase-deficient mutants of PA01 were used for comparative purposes. Elastase activity was assayed on elastin agar and by using C-elastin coated microtiter plates. Elastase antigen was measured using a double antibody sandwich ELISA (enzyme-linked immunosorbent assay). Total proteolytic activity was determined on skim milk agar plates. The results from ELISA showed that all strains produced antigenically similar elastase, although the amounts produced varied considerably between strains. There was a good correlation regarding elastase assays between ELISA and C-elastin, elastin agar and total proteolytic activity on skim milk agar. No correlation was found between serotype and elastase activity. The results showed that the C-elastin assay is a simply and sensitive method of determining elastolytic activity of *P. aeruginosa* strains.

*Acta path. microbiol. immunol. scand. Sect.B*, 94: 135-138, 1986.

1 tables, 22 references.

*Authors summary*

**Pathology of Aujeszky's Disease in Mink**

*T.G. Kimman and J.T. van Oirschot*

Lesions in 21 mink which died of Aujeszky's disease included hemorrhages in lungs, heart mediastinum, thymus, diaphragm, gastric wall, pancreas, and enteric wall. Microscopically, hyaline and fibrinoid degeneration and necrosis of vessel walls were present in cardiac muscle, brain, gastrointestinal wall and occasionally elsewhere in the body. Hemorrhages, exudation of plasma proteins and necrosis were associated with the angiopathy. Inflammation was minimal or absent. Other findings were congestion and extravasation of blood (lungs, liver), necrosis of lymphoid cells, and hemoglobinuric nephrosis. Aujeszky's disease virus was isolated from all but three animals. After experimental infection of three mink, similar though less pronounced lesions were found to those observed in the field cases.

*Vet. Pathol.* 23:303-309 (1986).

1 tables, 10 fig. 27 references.

*Authors abstract*

**Detection of Mink Enteritis Virus in Mink Feces, Using Enzyme-Linked Immunosorbent Assay, Hemagglutination, and Electron Microscopy**

*David T. Shen, PhD; Alton C.S. Ward, PhD; John R. Gorham, DVM, PhD*

Twenty-five mink were inoculated with mink enteritis virus (MEV). Fecal specimens were collected daily and were simultaneously evaluated for MEV antigen by use of a direct enzyme-linked immunosorbent assay (ELISA), hemagglutination (HA), and electron microscopy. Results of the evaluations indicated that MEV was shed in the feces on postinoculation days 5 and 6. The virus was not detectable by ELISA or HA after postinoculation day 6, although viruses were found in reduced numbers by use of electron microscopy. The ELISA was specific for MEV, and the sensitivity of the ELISA for MEV was comparable with that of HA.

*Am J Vet Res*, Vol 47, No. 9, September 1986. 8 fig., 12 references

*Authors summary*

**Study of Properties of Mink Enteritis Virus for Selection of Commercial Strains**

*E.Yu. Zelenov*

The basic biological and physiochemical properties of the epizootic L strain of mink enteritis virus were studied in comparison with those of the standard P strain. It was established that the properties of strain L conform to those of strain R, with some variability of buoyant density, hemagglutinative activity, and virulence.

*Translated from: Vsesoiuznaia akademiia sel'skokhoziaistvennykh nauk, Doklady, p. 46-48 (20 AKI).*

UDC 578.835. 1:578.1, N.Y. Allerton Press, inc, 1985 (7) 67-70.

1 tables, 5 references.

*Authors summary*

**Acute Interstitial Pneumonia in Mink Kits: Experimental Reproduction of the Disease**

*S. Alexandersen*

Organ homogenates from kits that died of interstitial pneumonia were inoculated into adult Aleutian disease virus (ADV)-negative mink and shown to contain infectious ADV-positive dams did not develop interstitial pneumonia, but later developed of defined ADV isolates and on purified organ homogenates from kits with spontaneous or experimental interstitial pneumonia. In kits from both groups a virus, morphologically resembling the defined ADV antigen in alveolar type-II cells in affected lungs and the lack of fimmunologically mediated lesions suggest that lung lesions result from primary viral injury to alveolar type-II cells. Experiments also showed that infection with ADV in mid-pregnancy caused fetal death, fetal resorption, or abortion.

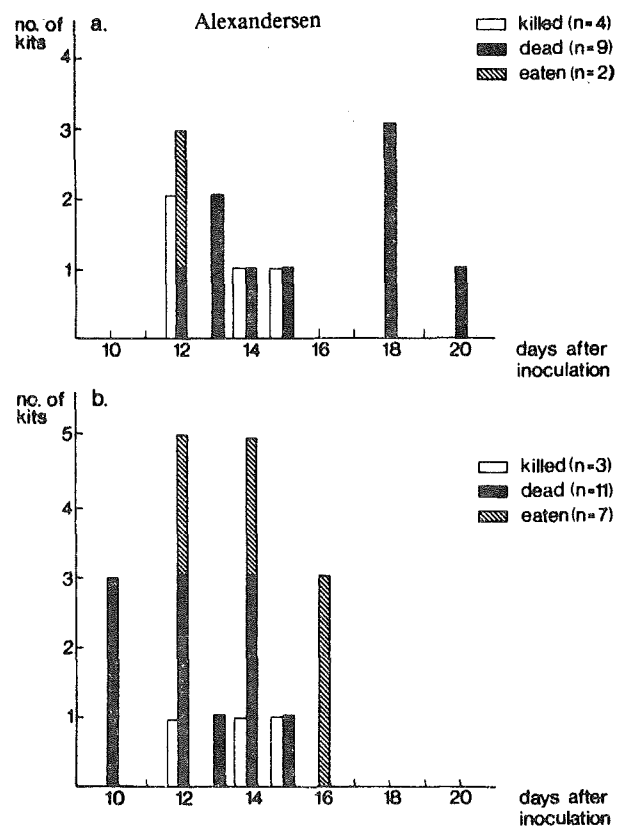
*Vet. Pathol. 23:579-588 (1986)*  
2 tables, 16 fig., 23 references.

*Authors abstract*

**Interferon Response in Normal and Aleutian Disease Virus-Infected Mink**

*Danny L. Wiedbrauk, William J. Hadlow, Larry C. Ewalt and Donald L. Lodmell*

Studies were done to determine whether differences in interferon production are responsible for the resistance of pastel mink to Aleutian disease. The abilities of normal pastel and sapphire mink to produce interferon when inoculated with either Newcastle disease virus or a synthetic polyribonucleotide, poly (I): poly(C), were identical, even to the production of a novel, acid-labile interferon. The resistance of pastel mink Aleutiandisease did not correlate with interferon production because neither sapphire nor pastel mink produced detectable amounts of interferon when infected with either the Pullman strain responded normally to polly (I):poly(C) early in the course of the disease, but interferon production was impai-



**Fig. 1.** Number of kits which died or were killed related to days after inoculation and route of exposure. a) Intraperitoneal inoculation, mean value for death day (only counting dead or eaten kits):  $15.00 \pm 2.97$  (mean  $\pm$  SD,  $n = 11$ ). b) Inoculation by aerosol, mean value for death day (only counting dead or eaten kits):  $13.22 \pm 2.07$  (mean  $\pm$  SD,  $n = 18$ ).

red late, when the mink were hypergammaglobulinemic and had renal, vascular, and hepatic lesions. These data suggest that ADV Pullman neither stimulates nor interferes with interferon production in infected mink and may represent a mechanism whereby ADV can more readily establish infection.

**Experimental La Crosse Virus Infection of Red Fox (*Vulpes Fulva*), Raccoon (*Procyon Lotor*), Opossum (*Didelphis Virginiana*), and Woodchuck (*Marmota Monax*)**

Terry E. Amundson, T.M. Yuill and G.R. DeFolliart

J. VIROL.

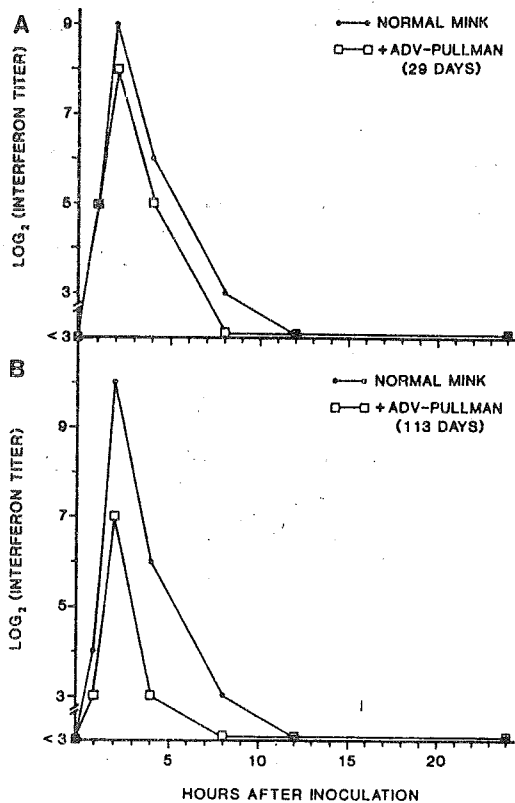


FIG. 3. Kinetics of interferon production in normal and ADV Pullman-infected sapphire mink after intravenous injection of poly (I):poly (C). Four sapphire mink were inoculated with ADV Pullman on day 0. On days 29 and 113, two infected mink and two normal sapphire mink were challenged with poly (I):poly (C), 30 mg/kg of body weight. Sera were obtained at various times afterward and assayed for antiviral activity. Serum interferon responses (A) 29 days after ADV Pullman inoculation and (B) 113 days after similar inoculation are shown. All points represent mean interferon titers. The variability of the interferon assay is one twofold dilution.

Susceptibility to infection, resulting viremia and antibody responses, and potential to provide infectious blood meals for *Aedes triseriatus* were determined and compared for the red fox (*Vulpes fulva*), raccoon (*Procyon lotor*), and opossum (*Didelphis virginiana*) exposed to La Crosse (LAC) virus transmitted by mosquitos, *Ae. triseriatus*. Woodchucks (*Marmota monax*) were infected with LAC virus by needle and syringe. All 5 red foxes became viremic following the bite of a single LAC virus-infected female *Ae. triseriatus*. Maximum viremia titers were at or above the threshold of infection for *Ae. triseriatus* in 4 of 5 red foxes for 1-3 days. Biological transmission of LAC virus from infected red foxes to chipmunks (*Tamias striatus*) was accomplished by *Ae. triseriatus*. Neutralizing antibody titers in red foxes peaked between day 13 and 27 and were still detectable 3 months post-infection. Woodchucks became viremic. Maximum viremia titers were consistently above the experimentally determined threshold of infection for *Ae. triseriatus*. Raccoons and opossums were not as susceptible to LAC virus infection as were red foxes or woodchucks. Only 1 of 5 raccoons became viremic. The viremia titer was low and was detected on only 1 day. Four of 5 raccoons developed LAC virus-neutralizing antibody titers, however. None of the opossums became viremic and only 2 developed LAC virus--neutralizing antibody titers.

*Am. J. Trop. Med. Hyg.*, 34(3), 1985, pp. 586-595

4 tables, 2 fig., 30 references.

Authors abstract

*Journal of Virology*, vol. 59, no.2. Aug. 1986, p. 514-517.

1 tables, 3 fig., 38 refernces.

Authors summary



**A Case of Granulosa Cell Tumor with Cystic Endometrial Hyperplasia in a Blue Fox Vixen (*Alopex lagopus*)**

(Et tilfelle av granulosa-celle-tumor med cystisk endometrie-hyperplasi hos en blårevtipe)

*Adrian Smith, Ordin Møller, Knut Nordstoga and Michelle Mondain-Monval*

A case of granulosa cell tumour with accompanying cystic endometrial hyperplasia in a blue fox vixen is described. Clinical signs included failure to grow a complete winter coat, chronic hypertrophy of the vulva and aggression during oestrus. High plasma levels of oestradiol-17 $\beta$  were present, and measurements of vaginal electrical resistance during anoestrus were consistent with those normally found during oestrus. After ovariectomy, the vixen grew a normal winter coat which was shed normally the following spring.

*Nord. Vet.-Med. 1986, 38, 80-84*  
*1 tabel, 7 fig., 9 references.*  
*In NORG Su. ENGL.*

*Authores summary*

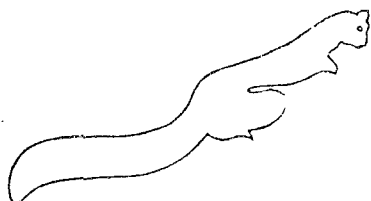
**Muscular and Myocardial Degeneration in Silver Foxes (*Vulpes vulpes*)**

*Knut Nordstoga*

On a silver fox farm, 4 of 140 young foxes died during one month. Degeneration changes were present in skeletal and myocardial muscle. The feed contained adequate amounts of Se, but may have been deficient in vitamin E because it contained a high proportion in of polyunsaturated fatty acids and rancid fat.

*Nord. Vet. Med. 1986, 38, 190-191.*  
*2 fig. 7 references.*

*CAB-abstract*



**Examination on Specific Prophylaxis Against leptospirosis in Breeding Foxes**

*S. Woloszyn, J. Andrychiewicz*

The purpose of the work was to assess the immunogenic features of the experimental batches of a combined vaccine Canivac FHL prepared by Biowet-Pulawy. The leptospiral component constituted of *L. icterohaemorrhagiae* and *L. canicola* serotypes inactivated with phenol, the addition of aluminium hydroxide served as an adjuvant. The examinations were performed in 3 farms free from leptospirosis and in 9 farms where parturitions and the disease was observed in young foxes due the strains of *L. icterohaemorrhagiae* and *L. canicola*. Out of 735 females immunized with Canivac FHL only 2,3 per cent of the animals aborted, while of 220 females vaccinated with Canivac FH (lack of leptospiral component) abortions were noted in 14,4 per cent. The vaccine Canivac FHL protected young foxes exposed to natural infections from the disease caused by *Leptospira* sp. The findings indicated that the vaccine possessed good immunogenic properties. The level of specific agglutinins disappeared between 60 and 120 days since vaccination. It was observed during the studies that leptospirosis could persist in a farm for several years giving rise to the disease in young foxes, abortions or giving birth to weak offspring.

*Medycyna Weterynaryjna: 42(4): 203-207, 1986.*  
*4 tabels, 15 references.*  
*In POLH Su. ENGL, RUSS.*

*Authors abstract*

**A Congenital Toxoplasma-like Disease in Ferrets (*Mustela putorius furo*)**

*R.N. Thornton and T.G. Cook*

Approximately 30% of 750 neonatal farmed ferret kits died without observed clinical signs. The presence of multifocal necrosis associated with *Toxoplasma*-like organisms in the liver, lung and heart suggested a diagnosis of toxoplasmosis. Surviving animals from affected litters were stunted but showed no histological or serological evidence of *Toxoplasma* infection, nor could infection be demonstrated by mouse inoculation. The involvement of ani-



mals at one day of age indicated congenitally acquired disease.

*N.Z. vet. J.* 34:31-33.  
5 fig. 11 references.

*Authors abstract*

**Canine Distemper Virus Infection in the Domestic Ferret**

*Michael Davidson*

The host range of canine distemper virus spans many species of carnivores, including the domestic ferret. Infection usually occurs

through contact with infected ferrets or dogs and is characterized by specific cutaneous, ocular, and respiratory signs. Antemortem diagnosis of infection is based on clinical signs, fluorescent antibody studies on blood smears or conjunctival scrapings, and serum antibody levels. Widespread viral inclusions are noted on histopathologic examination. The use of chick embryo vaccines at 7 and 10 weeks of age, at 1 year, and every 3 years thereafter is effective in prevention of the disease and is recommended despite reports of vaccine-induced disease in some wild carnivores.

*The Compendium on continuing education for the practicing veterinarian. Princeton junction, n.j. Veterinary Learning Systems July 1986 v. 8 (7): p. 448-453*  
5 fig., 43 References.

*Authors summary*



Figure 1—Blepharitis and conjunctivitis with mucopurulent ocular discharge in a one-year-old ferret with distemper.



Figure 3—Characteristic chin rash often seen in ferrets with distemper.

**Campylobacter-like Organisms isolated from Gastric Mucosa of Ferrets**

*J.G. Fox, DVM; B.M. Edrize, PhD; E.B. Cabot, MD; C. Beaucage, MS; J.C. Murphy, DVM, PhD; K.S. Probst, PhD.*

*Campylobacter* - like organisms (CLO) were isolated from gastric lesions in 1 ferret and gastric mucosa of 2 healthy ferrets. The organism was not isolated from biopsies of gastric mucosa of 14 other healthy ferrets, 1 of which had a small gastric lesions located at the pylorus. Lesions from which clo were isolated were located in the antrum of 1 ferret and were classified as inflammation with repair. Affected gastric tissue was highly vascularized with fibrous connective tissue surrounding irregularly shaped glands. Necrosis and ulceration of adjacent mucosa also were seen on and in the glandular epithelium of the ferret with gastric lesions from which clo were isolated.

*Am J Vet Res, Vol 47, No. 2, February 1986. 1 table, 2 fig., 26 references.*

*Authors summary*

### Suspected Foreign Body Peritonitis in Fitch (*Mustela putorius furo*)

H.V. Brooks

A severe, fatal, exudative peritonitis was investigated in a flock of 100 breeding fitch *Mustela putorius furo*. The presence of enteric flora within the lesions and steel spicules within the stomach contents suggested that this disease may have been caused by fragments



Fig. 2: Photomicrograph of metallic fragments (mean dimensions 116 x 12  $\mu$ m).

perforating the intestine. Scoring and pitting of a steel particles found in the mincer plate used for food preparation consistent with the size and shape of the steel particles found in the stomach, further supported this hypothesis. There were no further cases when the feed source was changed.

*N.Z.vet. J.* 34:109-110.  
3. fig., 4 references.

Authors abstract

### The Biology of *Dirofilaria Immitis* in Experimentally Infected Ferrets, *Mustela Putorius Furo*

Prasit Supakorndej PhD.

The ferret (*Mustela putorius furo*) was studied

as an experimental host for heartworm infection. In the first experiment, each of 24 female ferrets was experimentally infected with 60 third-stage infective larvae of *D. immitis* from infected *Aedes aegypti* (liverpoolstrain) mosquitoes and early migration and development of *D. immitis* were studied. After subcutaneous inoculation, third-stage larvae grew in the subcutaneous tissues and muscles and started to molt to the fourth stage at day 3 postinoculation (PI) and to the fifth stage at 56 days PI. These young adults began migrating to the heart at 70 days PI. Migration to the heart was completed by 119 days PI, but a few worms remained in the subcutaneous tissue and muscle through 140 days PI. Percent worm recovery for individual ferrets ranged from 1.6 at 7 days PI to 79.3 at 119 days PI.

Hematological tests, serum biochemical analyses and urinalyses were done in 5 female ferrets inoculated with 15 thirdstage infective larvae of *D.immitis* from mosquitos and in 5 male and 5 female noninfected ferrets. Eosinophil counts in infected male and female ferrets were generally higher than those in the noninfected controls beginning at week 22 PI, with peak values at week 34 PI. There were no dramatic changes in other hematologic values, serum biochemical values or urinalysis values in infected ferrets. Two female ferrets had a few microfilariae in their blood at 34 weeks PI. No male ferrets had microfilariae in the blood but microfilariae were seen in utero in female worms taken from male ferrets at necropsy. The infected ferrets that lived longer than 13 weeks had 1 to 12 adult worms in heart.

Radiography and angiography were done in the 10 infected and 10 noninfected ferrets mentioned above. Dorsoventral and lateral radiographs were taken before infection and every 8 weeks thereafter. Angiograms were done on all ferrets at necropsy. Enlargement of the heart was not clearly evident in radiographs of infected ferrets until 32 weeks PI, and then it involved primarily the right atrium. Enlargement of the cranial vena cava could be seen only by angiography, and worms in this vessel and other vessels could be delineated using this technique. No changes in the pulmonary arteries were detected by radiography, angiography or histological examination.

*Dissertation Abstracts International, B (Science and Engineering):* 45(12):3742,1985

Only abstract received

**Pathological findings in the digestive system of coypu**

(Contributii la studiul morpopastologiei aparatuluidigestiv la nutrie (Myocaster coypus))

*I. Paul, Otilia Cotofan*

Morphological investigations were made on 30 subjects of different ages. There were present hematopoietical islets and megacaryocytes in liver of sucklings, granular and fatty hepatitis, interlobular lymphoplasmocytic proliferations and inconstant, passive congestion and hemosiderosis in young ones. Mucoid enteritis, clostridial enterotoxemia, balantidiosis, cryptosporidiosis, enteromycosis and salmonellosis have been diagnosed. Toxemia of pregnancy, atrophic cirrhosis, colangitis with obstructive jaundice, postcalculosis, were present too.

*Lucrari Stiintifice Institutul Agronomic "Ion Ionescu de la Brad", Iasi, Zootehnie-Medicina Veterinara: 27/28:83-84, 1984.*  
*In. ROMN. Su. ENGL.*

*Authors abstract*

**Salmonellosis in the nutria**

(Salmonellose der sumpfbiber)

*Dr. G. Albert and VR Dr. Ulf D. Wenzel*

In the nutria salmonella infections occur rather frequently, if the animals are fed poorly and kept under unfavourable conditions, and may cause considerable losses.

It is demonstrated how salmonella may enter a nutria population, and clinical signs are described.

In case of salmonellosis, diagnosis is made after autopsy and bacteriological examination of perished animals, with regard to clinical signs.

Autopsy examinations in nutrias revealed salmonellae in 27.4 percent of the animals between 1979 and 1985. Most frequently *Salmonella typhi-murium* was identified, followed by *Salmonella thompson* and *Salmonella anatum*. Most salmonella findings occurred between December and February.

Possibilities of drug therapy and hygienic and organizational measures required in the farms for combatting salmonellosis are described.

*Brühl, no. 6, 1986, 35.*

*2 tables.*

*In GERM.*

*Authors summary*

**Clinical, laboratory and therapeutic observations on dermatomycoses in chinchilla.**

(Observatii clinice, de la laborator si terapeutice asupra unor dermatomicoze la chinchilla.)

*Dr. Virginia Onet, dr. E. Onet, dr. Y. Dieme*

Ringworm lesions (*Trichophyton* and *microsporum* infection) were present in 29 of 65 chinchillas. Treatment was attempted with buclosamide and griseofulvin.

*Rewista de Cresterea Animalelor: 35 (9):*

*44-50, 1985.*

*5 tables, 11 fig.*

*In ROMN.*

*Cab abstract*

**Toxicity of Thiram (Tetramethylthiuram Disulfide) to Mink and European Ferrets**

*T.C. Hornshaw, R.J. Aulerich, and R.K. Ringer*

The widespread use of thiram has generated concern regarding its possible contamination of the environment and potential toxicity to mammalian species, including man. Few studies have investigated the toxicity of thiram to nontargeted wildlife species. This study was, therefore, conducted to investigate the toxicity of this compound to mink (*Mustela vison*) and European ferrets (*Mustela putorius furo*).

For the mink LC test, dramatic signs of intoxication were seldom noted. Mink fed 82 ppm thiram showed reduced feed consumption, loss of body weight, and subsequent bloody stools, while animals in the 147 and 265 ppm groups avoided the diets after approximately two weeks.

No mortality occurred in the treated mink.

No significant differences were found between organ weights of treated and control mink. Hematocrit values for the mink fed the thiram-treated diets (45 and 82 ppm) were, however, significantly ( $p < .01$ ) less than controls.

In the ferret LC test, signs of intoxication were first observed on day 4, when two animals fed the 312 ppm diet were found to have bloody stools.

Clinical signs of toxicity were only noted in the 312 ppm group. These signs included inanition, bloody stools, listlessness, incoordination, and occasional convulsions accompanied by intense vocalizations. All animals fed the 312 ppm diet died between days 11-16, while no deaths were noted in animals on any other dietary concentration.

No signs of intoxication or thiram related mortalities were noted in either species. No gross lesions were noted at necropsy for mink or ferrets, and no birth defects were observed.

The only significant reproductive effect noted in the mink was a decrease in average birth weight at 40 ppm, although the number of females that whelped on the 40 ppm diet was also quite low. The other reproductive indices were within the normal range for mink.

None of the ferret females fed 64 ppm thiram whelped and kit body weights at three weeks were significantly decreased at 16 ppm.

Analyses of the hematologic data for both the mink and ferrets at the termination of the reproduction tests showed significant decreases in RBC count ( $P \leq .01$ ), hemoglobin concentration ( $P \leq .01$ ), and hematocrit percent ( $P \leq .05$  for mink and  $P \leq .01$  for ferrets) at the highest dietary concentration of thiram.

In the LC tests in this study, a dietary no-effect level was not found for mink, since a decrease in hematocrit was noted at the lowest concentration (45 ppm) fed. The no-effect level of thiram for rats has been reported to be 38 ppm.

In our 28-day LC tests, mink fed 147 ppm thiram, or more, were removed from the test (to prevent the animals from starving)

and all the ferrets fed 312 ppm died by the 16th day of the test.

*Fragments of the report selected by G. Jørgensen.*

*Bull. Environ. Contam. Toxicol. (1987) 38:618-626 1987 Springer-Verlag New York Inc. 4 tabels, 18 references.*

#### **The Frequency of Occurrence of Antibodies Against Some Leptospira Serotypes in Foxes**

*H. Kovacic, Z. Lipej, M. Lackovic*

As part of an investigation of the frequency of occurrence of antibodies against leptospira serotypes in the serum of wild animals, 196 samples of fox blood were examined. A total of 75 foxes originated from the Zagreb municipal area, 37 from Sisak, 27 from Bjelovar, 25 from Rijeka, 15 from Karlovac, 12 from Varazdin, 3 from Osijek and 2 foxes from Gospic. The blood samples were taken for analysis between 1982 and 1984. Antibodies against 9 serotypes of leptospira were found in the blood of 36 foxes. Among these, 24 foxes exhibited antibodies for one serotype, while 6 foxes each exhibited antibodies for 2 and 3 serotypes respectively. Antibodies against serotype icterohaemorrhagiae were found in 17 foxes, saxkoebing in 10, sejroe in 8, australis in 6, gripotyphosa and ballum in 4 each, pomona in 3 and tarassovi and canicola in one each. The antibodies were detected in blood diluted 1:100 to 1:1000. The presence of antibodies against leptospira serotypes in a large number of foxes (18,36%) suggests that they form a natural reservoir of leptospira which plays an important role in the spread of leptospirosis among wild and domestic animals.

*Veterinarski Glasnik: 39(12):1305-1310, 1985. 1 tabel, 18 references.*

*In Yogo Su. ENGL, RUSS.*

*Authors summary*



NORDISKE  
JORDBRUGSFORSKERES  
FORENING

Scandinavian Association of Agricultural Scientists  
Fur Animal Division

Preliminary program for NJF-Seminar No. 128.  
Tromsø - Norway, 28-30 September 1987.

Secretary: *Terje Smith* The Norwegian Fur Breeders Association  
Økern Torgvej 13  
Postboks 145, Økern  
0509 Oslo 5, Norway

Phone: 02-644150

- Lagerkvist Gabrielle:* Preliminary results from selection experiments with mink.
- Børsting Ejnar & Clausen Jesper:* The use of index for litter size in practical minkbreeding.
- Blomstedt Leena & Joutsenlahti Ulla :* The woolness of Blue fox fur.
- Lohi Outi, Børsting Ejnar, Joutsenlahti Ulla, Einarsen Einar J. & Johannesen Kai-Rune:* The use of prize analysis of skin as information in the breeding work.
- Kenttämies Hilikka:* Grading of living blue foxes.
- Hofmo Per Ola:* Experiences from freezing of fox semen.
- Jalkanen Liisa & Valtonen Maija:* Adaption of AI at foxes in Finland.
- Neil Maria:* Is the digestibility of carbohydrates depending of the total content in the feed?
- Elnif Jan:* Comparison of the nourishment digestibility in mink kits and adult mink males.
- Mäkelä Jaakko, Kiiskinen Tuomo, Valtonen Maija & Eriksson Lea:* Modified starch as binding material in fur animal feed.
- Hillemann Georg:* Use of flotation offal in fur animal feed.
- Ruud Morten:* Ensiled chicken offal as feed for blue foxes and mink.
- Näveri Anne:* New aspects in biotechnological preserved fur animal feed.
- Tauson Anne-Helene:* Flushing experiments with mink - continued studies.
- Rouvinen Kirsti:* Different fats in fur animal feed.
- Työppönen Jouko, Smeds Erik & Pölönen Ilpo:* Some biochemical aspects in fish induced anemia in mink.
- Åsted Bent & Hansen Mogens:* Curative treatment of mink kits with plasmacytosis pneumonitis.
- Wallenius Marja-Liisa:* Wet fox pups.
- Mejerland Torbjørn, Treiberg L. & Englund Lena:* Rinworm in foxes.
- Brandt Asbjørn & Henriksen Per:* Prevention of nursing disease.
- Harri Mikko, Fors Fjalar, Haaranen Tuula, Korhonen Hannu & Nydahl Kjell:* Some results from experiments regarding cages and nesting boxes for foxes and finnraccoon.



International Scientific Conference

Nutrija 87  
Coypu 87

During the days 24. to 27. of June 1987 there were held an international scientific conference on Coypu in Novi Sad, Yugoslavia.

The conference which was attended by more than 100 persons was dealing with nearly all aspects from the habitat in the wild over production figures and policy, different aspects in coypu breeding, veterinary protection, skin knowledge and processing and fur clothing production, marketing and use of by-products.

The conference was very inspiring and stimulating for the participants and for the further international cooperation regarding coypu-production.

The International Scientific Conference - Coypu '87 was extremely well arranged both from a professional and a social point of view. The organization board, and not least the hard working executive secretary Ing. Arpad Dudas and the interpreters did a job which was appreciated of all participants.

With this acknowledgement to our new friends in the coypu world we will bring the namelist, some addresses and the titles from the proceedings who was on the table at the start of the conference in 3 languages; Serbo-croatian, English and Russian.

In a later issue we hope to bring abstracts from the reports given at the conference, but if you prefer to get the important information as soon as possible we are sure that the proceedings in one of the 3 mentioned languages can be obtained (prize unknown) from:

Faculty of Agriculture  
Livestock Research Institute  
21101 Novi Sad, Yugoslavia



Reports given at The International Scientific  
Conference - Coypu 87 - Novi Sad, Yugoslavia.

- Restek, J., Ph.D.* The Yugoslav Fur Industry. (Union of Leather Processing Industry Associations, Zagreb, Yugoslavia).
- Dudas, A., Ing.* Ten years of Coypu Breeding in Yugoslavia. (Industrija Usnja, 61360 Vrhnika, Jugoslavia).
- Cholewa, R., Ph.D.* The Postg Precence, and plans in Coypu Breeding and skin production in Poland (Faculty of Agriculture, 60-637 Poznan, Poland).
- Calvo, J.O.* Presented by *Eva S. de Rona.* Argentina. (EEA Balcarce (INTA), Argentina). Nutria breeding in the Argentina.
- Chabreck, Robert H., Prof.* Nutria in the USA History and Environmental Consequences. (School of Forestry, Wildlife and Fisheries, Louisiana Argicultural Experiment Station, Louisiana State University agricultural center, Baton Rouge, Lousiana 70803 USA).
- Simacek, J. Dir.* Development of coypu breeding and skins buy-up in C.S.S.R. (KARA, ZNUS Brno, Czechoslovakia).
- Kux, J., Ph.D.* The organization of coypu breeders in C.S.S.R. (Cesky Svaz Chovatclu, Maskova 3, 18253 Praha 8-kobylisy, Czechoslovakia).
- Kralik, G., Petricevic, A., Dudas, A.* Industrial Breeding of coypus on individual farms (Faculty of Agriculture, Osijek).
- Berestov, V.A., Prof.* The nescesity of different laboratory controls in industrial coypu breeding. (Institute of Biology, USSR Academy of Science Korelian Branch, Petrozavodsk, USSR).
- Kukla, F., Prof.* Reproduction of coypu in breeding in C.S.S.R. (Cesky Svaz Chovatclu, Praha, Czechoslovakia).
- Barta, M., Jakibicka, I.* Electroejaculation technique in Nutrias) Livestock Institute, Nitra, Czechoslovakia).
- Zwierchowski, J. Ph.D.* Papilonaceae in coypu feeding and their influence on health and general condition of coypus (Dept. of Epizootiology and Clinic for Infection Disease of the Veterinary Faculty, Argricultural cultural Institute, Wroclow, Poland).
- Savic, S., Latkovska, M., Sreckovic, A.* Methionine Influence on coypu body weight gain, Growth and hair quality. (Faculty of Argricultural, Livestock Research Institute, 21000 Novi Sad, Yugoslavia).
- Wenzel, V.D., Ph.D.* Nitrate/nitrite poisoning in the nutria. (V.E. Kombinat Aufbereitung Tierische Rohstoffe und Pelztierproduktion, Leipzig, GDR).
- Scheuring, W., Vet. Dr.* Characteristic and specific veterinary problems and their solving in coypu production. (PZLZ w. Zbaszynku ul. Topolowa 20, 66-310 Zbaszynek, Poland).
- Dousek, J. Ph.D.* The health situation in coypu farms in the Czech Socialist Republic (State Veterinary Institute Liberci, Bohemian Breeders Union, Prag, C.S.S.R.)
- Patrek, A.* Preventive protection, diagnostic, curing and providing and applying of remedies in coypu breeding. (Veterinary Station, Mali Idjos, Yugoslavia).
- Albert, G., Wenzel, U.D.* Virus Hepatitis in the nutria. (Institute for Veterinary Medicine, Leipzig, GDR).
- Albert, G., Wenzel U.D.* Intestinal disease of the nutria caused by the pathogenic agents. (Institute for Veterinary Medicine, Leipzig, GDR).
- Mouka, J., Konrad J.* Fixing techniques and blood sampling for diagnostic, scientific and research purposes. (The High Veterinary School, Brno, Czechoslovakia).
- Konrad, J., Prof.* Health and technological negative factors of fur quality (The High Veterinary School, Brno, Czechoslovakia).
- Gruija, R., Pastirnac, N., Ursutiv, D., Dogariv, A.* The objectivization of the determination of several coypu characteristics. (Intr. Agricultre of state Prejme, Jud. Brasov, Romania).
- Janda, R., Editor.* Influence of standards on coypu breeding and skin quality (Ceskolo-vensky Kozesinar, 61200 Brno, Domzalieca 2, Czechoslovakia).
- Pastirnac, N., Gruia R.* Considerations concerning the age and season variability at

- nutria fur. (Depart. Agric. of state, I. - A.S. Prejmer, jud. Brasow, R.S. Romania).*
- Cik, V.* Raw coypu skins handling from slaughter to the beginning of processing. (Gunduliceva 25, Zagreb, Yugoslavia).
- Niedzwiadek, S.* Quality Parameters of amber gold nutria fur. (Inst. Zootechnics, Dept. of Fur Animal Breeding, 32-083 Balice K/Krakowa, Poland).
- Hahn, H.-G., Dir.* Nutria an interesting fur-skin (V.E.B. Edelpelz Leipzig Schkeudiz Leipziger strasse 34, Schkeuditz, 7144 GDR).
- Sinigoj, J.* Processing possibilities of fur looks improving. (Industrija Usnja Vrhnika, Vrhnika Yugoslavia).
- Szaloki, G.* Processing of coypu skins in Hungary ("Pannonia", Szormekeijesztó konfekcionale es kereskedelmi Vall, Vaciu't., 1325 Budapest Hungary).
- Ramsey, Paul R., Maum, Donald D.* Measurements of pelt quality for nutria from coastal marshes of Louisiana (Gulf of Mexico, USA). (Dept. of Zoology, Louisiana Tech University Ruston, Louisiana 71272 USA).
- Petricovic, A., Kralik, G. Komendanovic, V.* Some parameters of coypu meat quality characteristics. (Faculty of Agriculture, Livestock Institute, Osijek, Yugoslavia).
- Kowalski, J.* Slaughter and meat value of nutrias (Inst. of Zootechnics, Dept. of Fur Animal Breeding, 32-083 Balice K/Krakow Poland).

There were a few more reports given at the conference. The reports listed above are present in the proceedings.



Prof. Berestov, Dr. Dudas and Danish Beer.





NORDISKE  
JORDBRUGSFORSKERES  
FORENING

Scandinavian Association of Agricultural Scientists

NJF Seminarium Nr. 120  
Fur development and fur characteristics in fur  
animals and sheep.

Espoo, Finland 8-10 April 1987.

Abstracts of the reports given at the seminar  
is given in the following.

Proceedings in original languages can be  
ordered at:

Nordiske Jordbrugsforskeres Forening  
Økernveien 145  
N-0580 Oslo 5, Norway

**Fleece development and fibre structure in  
sheep**

*Alan Waller*

The skin and hair of terrestrial animals is a protective system wich continually renewed cell layers are specially adapted, displaced outwards and abandoned. The STRATUM GERMINATIVUM which surrounds the organism and gives rise to the cells of the epidermis, invaginates to form FOLLICLES with a central PAPILLA whose various areas yield the cells comprising hair and wool. The main mass of the fibre is made up of CORTEX cells filled with bundles of KERATIN fibrils in an amorphus matrix which become KERATINIZED by cross-linking. Cells from the centre of the papilla can desintegrate leaving a vacant MEDULLA.

The circumference of the papilla forms: 1. The CUTICLE scales. 2. The temporary HUXLEY and HENLE layers which desintegrate leaving the fibre shaft as a separate structure. 3. the cells of the outer sheath continuous with the surrounding skin.

*The Follicle Group.*

At an age of 45 to 90 days the sheep foetus develops about a million evenly distributed CENTRAL PRIMARY follicle anlage. Between 60 and 100 days each becomes flanked by a pair of LATERAL PRIMARIES. The follicles deepen and receive sweat glands, sebaceous glands and muscle fibres. Between 90 days and birth SECONDARIES arise between the primaries in each group. The primaries yield guard hairs (cover hairs) and the secondaries underwool (inner coat). The proportion (S/P RATIO) varies between races from 2-20. Fiber diameter and growth rate increase with papilla size, possibly through competition for nutrition within the follicle group.

*Fiber structure*

The main mass of the fibre comprises overlapping CORTEX CELLS 4µm in diameter and 90µm long filled with some hundred MACROFIBRILS of about 300nm. These consist of a couple of hundred MICROFIBRILS of about 8nm in an amorphous tyrosine-rich protein matrix. These in turn are assumed to be bundles of 2+11 PROTO-FIBRILS of about 2nm, each built of three helix polypeptide chains in a 3-strand rope. The stratum germanitivum is invaded by MELANOCYTES from the embryonic neural crest, which can implant MELANIN pigment into the hair or skin cells.

*The cuticle*

The approximately 400nm thick scales overlap with between 5 and 90% of their area and form together a 0,4-4µm thick covering layer. The shape of their free edges determines the fibre's felting ability. The surface configuration determines silkiness and fiber/fiber friction and thus experienced softness. Together with the number of scale layers it determines lustre. Their outermost layer (EPICUTICLE) is impregnated with bound fat and covered with a layer of wash-resistant cell debris and LANOLIN.

*Crimp.*

The cortex shows two forms, ORTHO and PARA, often one in each half of the cross-section so that the fibre becomes curved. After a genetically determined number of days the ortho/para sides switch roles simultaneously over the whole animal, and the fibre receives its highly-valued crimp.

**Hair structure and development of fur in young mink, silver fox blue silver fox, and blue fox**

*Leena Blomstedt*

*The structure of hair.*

The coat of fur animals consist of guard hairs and down. Guard hairs can be classified into distinct types, but intermediate forms are also found. The hair surface is made up to scales (cuticle) overlapping each other. By counting the number of overlapping layers, which is possible on a high magnification of a cross section, resistance to wear and tear can be estimated. In the thickest part of a long guard hair the number of layers may exceed 40 in mink, being only about 10 in tanuki (Japanese raccoon dog). Beneath the cuticle is always nonpigmented, contrary to the cortex and the medulla.

*The development of pelt.*

The development of pelt was followed by taking skin samples during the growing season from mink (born May 1., 1984), blue fox (born May 22., 1985, and between May 1. and May 15., 1985), silver fox (born April 19., 1985) and blue silver fox (born between May 1. and May 15., 1985). Most samples were taken from the hip region, some from the shoulder region. The number of growing, and of mature hair in each bundle was counted on histological skin slides. In all species the guard hairs began to develop, and reached maturity earlier than the down.

*Mink.*

During its first year of life the mink has a whelp coat, a summer coat, and a winter coat. The whelp coat moulted by the end of July, and the summer coat was mature by the end of August. In the females (4 animals) the summer coat had moulted by mid October, in the males (4) some three weeks later. The winter coat was mature by the end of November. At that time, the number of hairs per bundle varied between 14 and 23.

*Silver fox.*

A young silver fox has a whelp coat. The whelp coat moulted by the end of September. The guard hairs of the winter coat were mature by the end of November, while some 50% of the down hairs were still growing. The time of pelting was standard (Dec. 12., 1985). Skin samples taken at that time proved that from 4

to 33% of the hairs were still growing. Only one fox (out of 5) had a mature winter coat. Thus, the pelting was done too early, and should have been done about two weeks later.

#### *Blue fox.*

During the first year, the blue fox has a whelp coat, a summer coat, and a winter coat. The summer coat never reaches a stage with mature hairs only, in the first year. The guard hairs of whelp coat, and summer coat moulted totally, the former around July 15, and the latter by the beginning of September. The down hairs of the summer coat moulted to some extent only. The number of growing hairs increased from July, reaching a maximum in late October. The time of pelting was standard (Nov. 11., 1985). At that time a mature coat was not found in a single animal. The guard hairs were mature in two animals (out of 10), and in all animals the down hairs were mature slightly in excess of 50% only. The coat would probably have been mature three weeks later. The hair bundles were big, and had up to more than 60 hairs (average 35). The study concerning the right pelting time continues.

#### *Blue silver fox.*

The blue silver fox has a whelp coat, and a winter coat, but evidently no summer coat. The moulting of the whelp coat begun in mid August, and lasted about four weeks. Part of the down hairs moulted in September. The number of new growing down hairs increased considerably from the beginning of August, and until mid October. The guard hairs of the winter coat were mature by mid November, as was about 50% of the down hairs. At the time of pelting (Nov. 28., 1985), the coat of not a single animal (out of 4) was physiologically mature for pelting. To establish the maturity of down, the pelt of one female, and one male has been examined so far. In the female 75% of the down hairs, from the hip region, were mature, in the male 30%. There was a mean of 26 hairs per bundle in the male. The studies continues.

These studies show, that pelting of foxes is done too early. Hair in the growing stage tend to come off the pelted skin, sooner or later. We do not know yet how much growing hair can be accepted, before it reduces the quality of the skin as raw material for fur coats.

#### **The genetic control of hair growth in mice**

*Dr. K.A. Raphael*

Over 70 mutations have been recorded which affect hair structure in the mouse, most of which have been mapped to 21 chromosomes (1). Three of these mutations will be described and discussed in relation to the site of gene action in the hair follicle. The naked (N) gene causes weakness in the hair fibre which results in hair breakage after the hair has reached full length in the case of N/t mice, and breakage every few millimetres in the case of N/N mice. In mice homozygous or hemizygous for the tabby (Ta) gene (Ta/Ta or Ta/Y) all hairs are straight, resembling awls from the normal mouse, but thinner than normal awls. In angora mice (Go/Go) the hairs are 40% longer than in normal mice (2). The site of gene action was determined by making dermal-epidermal recombinations between normal and mutant embryonic skin (3). All three genes were found to affect hair morphology through action in the epidermal component of the hair follicle (2,3,4). The knowledge gained from these studies will be useful in understanding hair follicle function in economically important animal breeds.

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#### **Gene transfer as a means of improving animal production**

*Dr. K.A. Raphael*

Cloned genes can be incorporated into mammalian chromosomes by microinjection DNA into

the pronucleus of one-celled eggs (1,2). This technique can be used as a means of improving the characteristics of economically important animal breeds without going through many generations of selective breeding. Recombinant DNA technology also offers the ability of conferring new regulatory mechanisms to cloned genes. For example our laboratory is working on genes for increasing growth rate, wool growth and improved disease resistance.

We have introduced the sheep growth hormone gene into one-celled mouse eggs and have obtained 8 mice with the foreign gene incorporated into the chromosomes. One of these animals is 1.7 x larger than its siblings, and the amount of sheep growth hormone is more than 25 x the level of endogenous mouse growth hormone. We have also succeeded in transferring the cloned sheep growth hormone gene into 4 lambs. However, it is not yet known whether the gene is expressed.

We have isolated 2 genes from bacteria which encode an enzymatic pathway of cysteine biosynthesis. Since cysteine is a limiting factor to improved wool growth in sheep, and sheep are unable to synthesize cysteine, the introduction of these two genes into sheep may be a way of increasing the rate of wool growth.

We are also working on the isolation of immunoglobulin genes for specific pathogens as a means of transferring disease resistance genes into the genome of susceptible sheep breeds.

This technology is still in the research phase; however it offers the possibility of transferring useful genetic characters from one organism to another and the means of controlling the expression of introduced genes.

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#### Judgement of fur quality in lambs and in fur skins

*Agneta Brasch*

In the Nordic countries there are about 5 million sheep. Sweden has about 10 per cent of

the totally amount. The most important product from the sheep is mutton. Wool and skins are valuable by-products. The most common breed in Sweden is the Swedish pelt-sheep. This breed originates from the island Gotland and Baltic. Originally the pelt-sheep had a very varying appearance. In 1920's the interest in the breed increased when the skins from the 4-5 months old lambs became attractive for making fur coats and jackets. Grey skins with good curl became soon most popular.

About 50000 ewes of the pelt-sheep are affiliated to the sheep recording. All lambs are inspected at about 4 months of age. During the inspection all the lambs are weighed and the fur characteristics are recorded. Following fur characteristics are registered in sheep recording. Fleece colour and the distribution of the colour. The size of the curl and the distribution and tightness of curl, quality of hair and density of hair. The fleece colour and the size of the curl are described in words, while the rest are evaluated by using a sixpoint scale, with six as the highest value. Ram lambs selected for breeding at the inspection have their fur characteristics reviewed once more (National review). About 100 ram of the pelt-sheep are progeny tested each year. The ram indexes are based on the results which the offspring have in the sheep recording.

The lambs are slaughtered when they are 5-6 months old. The lambskins are prepared and then sold at auctions. Before the auction the skins are classified into 7 different nuances and into the several quality classes. About 75% of the skin is marketed by the Swedish farmers organisation Kontrollhudar at auctions in Copenhagen. The rest of the skins is marketed by Hudson's Bay and Annings at auctions in London.

It is the grey colour, the curl, the lustre and the size which make the fur skins from the Swedish pelt-sheep unique.

#### Objective methods to measure factors determining fur-quality

*Kaj Thorhaug*

Sorting of hides in the quality-groups: Saga select, Saga, I and II is primarily done by evaluation of uniformity, fullness and cover.

Evaluation is influenced if the fur is silky, cross-haired or the guardhairs seem long or short.

Fur scientists have agreed, that fur-qua-

lity might be partly described by objective measurements, if several measurements on each hide are available.

Physical principles are chosen because it is claimed, that the measurements should be quick, quantitative and non-destructive. Specific volume and compressibility are expected to express, what is "seen" and "felt". This might be supported by measuring amount, length, diameter, shape and surface of hairs. Colour and colour-intensity should be measured, as they might influence the visual impression.

Physical gauges and electronics prepared for PC-connection are being manufactured, and pilot-investigations look promising.

#### **The furrier's view of some skin defects, occurring in farmed mink skin**

*Erkki Seppäläinen*

Presently, two common characteristics occurring in sorted skin lots, unnecessarily make the buyer's work difficult, namely dirty, uncleaned skins or carelessly sorted skin.

Fat or unclean skins make it very difficult, most often impossible to detect some defects.

Badly sorted skins make the bulk purchasing a risk, above all when it is a matter of small quantities, because even in Saga Selected or Saga lots there are often defected skins.

Latent defects. Visible defects. Skin defects.

*Latent defects* in raw skins are difficult to detect on the hair and often hidden enough even on the leather side. The defects often get more visible in the dressing process and still worse when the fur garment has been used for a while. Most often it is not possible to improve badly prepared pelts, at the worst they may become totally worthless for production. These defects are incorrect scrubbing, too slow or hot drying.

*Visible defects* are easily detected from the hair side and do usually not get worse during the dressing, but some of them may shorten the life of the pelt considerably. Most often nothing can be done for the defect. If these defects occur abundantly in the lot it is impossible to use the pelts for production of valuable furs, f.x. "metallskimmer", known as crow silver, curly hair etc.

Skin with defects are often sorted in quality group III, but occur now and then in all quality groups. During the dressing, many of these defects increase considerably, but if not too visible, some of them vanish in tanning. However, we must remember that even if the defect can be mended, too many repairs in a skin, f.x. hole or bite defects, will lower the value and the applicability of the skin.

#### **What do furdressers expect about the quality of raw skin?**

*Kalevi Holm*

Lecture by Seminar No 120 "Pälsutveckling och pälskvalitetssegenskaber hos pälsdjur och får" 9.4. 1987 Hotel Leopoldampi.

This article will discuss about thickleatheriness of male mink and fitch skins. This leads to question if it is possible to breed mink or fitch race which hairroot is not so deep in the leather.

For thinleathered animals f.ex. foxes killingtime must be chosen so that wintercoat is complete. Otherwise the roots of coarsehair will be in the subcuticular parts of the skin. That will make it impossible to flesh leather without damaging hairroots.

Further more it will be discussed about developing a new cheap, simple and effective conservingmethod for skins. Development must be done co-operative with furdressers and furriers so that dressing and dressed skins furtechnical properties will be taken into consideration. In this article pickling will be suggested as an alternative conservingmethod.

A very important research object is drying of raw skin, specially the effect of different drying parameters to dressingproperties.

Finally there are comments about using chemicals, f.ex. household textilewashingpowders, in handling of raw skin. This might cause permanent damage to hair and leather.

#### **Properties and quality in wool**

*Alan Waller*

Wool quality is a complex concept for the wool user in craft or industry. Apart from heritable characteristics, both the condition of the fleece (non-fibre content and coting) and its presentation on the market (packaging, uniformity and availability) have great importance. The most significant heritable characteri-

stics are the distribution of diameters, the distribution of lengths (a function of growth rate and choice of shearing intervals in different husbandry systems), crimp, pigment, and fiber surface properties (lustre, handle and felting).

Sheep in Scandinavia consist to a large extent of geographical variants of the Northern Short-tail and their various crosses with imported breeds. They are characterized by hardiness, moderate size, early sexual maturity and high fertility. Their fleece differs from the usual world market types in almost all the characters mentioned above.

Lustre is significant in Scandinavian textile tradition. The soft handle of lustrous fleece (silkeness and low bulk) yields garments with greater softness and drape than the fibre diameter distribution would imply. It is unclear to what extent this may be due to the elastic properties of the individual fibre or to increased motility between fibres. Their low mutual adhesion causes processing difficulties on machinery designed for normal industrial fleece types. The pronounced ease of felting leads to a pronounced decrease in fleece quality through crotching if shearing intervals approaching a whole year are attempted. These properties can presumably be correlated with details in the shape of the cuticle scales. In contrast to the properties mentioned below, they cannot be simulated by compounding blends of other fleece types.

The oscillatory period for fibre crimp is rather large at 10-14 days. This implies the possibility of introducing genes for faster crimp oscillation in order to achieve a smaller radius of curvature in the crimp of coarser fibres in fur production with Gotland sheep.

The difference in diameter and length between primaries and secondaries is rather large. In variants such as Spelsau (N) and Rya (S), differences between lateral and central primaries can cause the phenomenon of tangled sewn staples with ensuing difficulties in carding. In Finnish Landrace and Swedish Gotland, primaries and secondaries can co-operate in a common staple crimp by means of the primaries making deeper crimp curves. It is possible during inspection of live animals to stretch a staple of this kind in order to see the presence of a difference in length, and thereby in diameter. In light to medium grey Gotland fleece it is usual that only the primaries carry pigment. Breeding for shade of grey can thus imply a change of S/P ratio and thereby even follicle density.

### Genetic variation in hair quality of Icelandic sheep.

*Emma Eythórsdóttir*

Wool samples from 1023 Icelandic lambs (4 1/2 months old), from 15 herds over 2 years, were analysed for fibre length of outer coat and undercoat, diameter of outer coat and undercoat, frequency of medullated fibres in outer coat and degree of hair in undercoat. Point scores were given for wool quality on lambs before slaughter, fleece weight recorded and processed skins were scored for pelt quality.

Fleece weight, staple length, fibre diameter and % medullated fibres are increased with increased body weight. Fleece weight and staple length increase with age.

Mean values for staple length of outer coat were 20.7 - 21.2 cm and for undercoat 6.4 - 8.9 cm. Mean diameter of outer coat was 54.4 - 56.8 microns and of undercoat 22.8 - 23.3 microns. Per cent medullated fibres in outer coat were 40.1 - 47.8 % and degree of hair in undercoat 1.16 - 1.23 on a scale of 0 to 3. The values are comparable with earlier results from measurements of wool from adult sheep.

Heritability estimates are as follows: length of outer coat 0.49 - 0.54, of undercoat 0.11 - 0.40; diameter of outer coat 0.25 - 0.46, and of undercoat 0.06 - 0.37; % medullated fibres in outer coat 0.37; hair in undercoat 0.10 - 0.19; fleece weight 0.33 - 0.59 and for pure white wool (vs wool with tan fibres) 0.17 - 0.26.

Genetic correlations between wool traits are generally positive, except for correlations between hair in undercoat and other traits. Standard errors of genetic correlations are high for most values. Phenotypic correlations have the same sign as the genetic correlations. Correlations (genetic and phenotypic) between scores for wool quality on lambs before slaughter and wool measurements, indicate satisfactory results from the scoring. Heritability estimate for lustre of wool is 0.28 - 0.40, for extent of curl in processed skins 0.16-0.23 and for type of curl 0.0.

It is concluded, that genetic variation in hair quality of Icelandic sheep is rather high, and possibilities of improving wool quality through selection programs are good.

### Studies on fur skin characteristics in Swedish Peltssheep

*Kicki Ahlén*

The Swedish Peltssheep comprises about 60 per cent of the total number of 425 000 sheep in Sweden and is the breed which has increased most. It is an indigeneous breed belonging to the North European short-tailed group. The main income comes from the meat production but, as the name implies, pelts are also an important source of income. Lambs are ready for slaughter after 5 months at which time they also yield the best fur skins.

The main means of assistance in the breeding work is the Sheep Recorded Scheme to which about 60 per cent of the peltssheep ewes in Sweden belong. Based on data from the Sheep Recorded Scheme research and development work is carried out.

In the sixties efforts were made to develop different methods of evaluating fleece and to follow up the processed pelts at auctions. Another area of research was to study how fleece colour changes with age of lambs and how colour is inherited. With the introduction in 1976 of the so-called *Superprocess method* a new study was made of the relationship between pelts judged on living lambs and processed fur skins. The wool fibres were also examined in more detail with the aid of photomicroscopy. As fleece characteristics have improved attention has been focused on other pelt qualities such as purity of the colour and weight of the pelts. Another question of present interest is whether the estimates of the genetical and environmental parameters, used in the practical breeding evaluation, are adequate or need to be changed.

### Experiences about Finnsheep as fur animal

*Marja-Leena Puntila*

The number of sheep (ewes) in the beginning of the 1960's was 186 000. Now it is estimated to be under 60 000, and about 15% of that number takes part in the field testing. The lowest level has been passed and the number has slowly begun to grow again. Sheep farming is practised now on 6000 farms and a half of the flocks has the farm size under 10 ha of arable land. 95% of the sheep population belongs to the Finnsheep breed and it is mainly white.

Improvement of sheep farming has recently come up, when other branches in animal husbandry are struggling against overproduction. -The selfsufficiency of wool is only 3-5% and the use of domestic sheep skins for furs in 5-6%, lamb is eaten only 300g/capita.

It was already in the 1930's and 1940's when an effort was made, to aim our sheep breeding at skinproduction. There were natural preconditions for sheep skin production, for the Finnish landrace produced fairly good skins. Some karakul lambs were also imported for crossbreeding. The requirements on good skins set up by then are justified as well today. The characteristics of importance were lustre of wool, the uniform formation and quality of curls, thinness and elasticity of the skin. In those times it was also established so called co-op for fur sheep to organize the payment system according to quality in fur trade. The objectives in fur sheep breeding to improve the quality of skins, however, were never carried out, because the selfsufficiency of wool decreased strongly after the war. It had as a consequence that small flocks disappeared in the 1950's. Meat became the main product.

Profitability in sheep production has not been reached without many attempts so firm that it could have competed with other production alternatives. For this reason it has been important to find a by-product, to be placed at the side of meat, that could add the profitability and selfsufficiency of the Finnsheep fur production. In this decade breeders have purposefully bred the Finnish landrace for fur production. They have achieved already visible results.

The main problem in sheep skin production is, however, the unorganized field. The annual sheep slaughter covers 80 000 lambs and sheep. Practically nearly 60% of all raw skins remain in slaughterhouses. A quarter of the sheep breeders let the fur-dressing factories to dress the skins to market themselves, close to a fifth of the skins is taken to the own use.

### Preliminary test results

The first fur studies were carried out in 1981 at the Experimental Station of Agricultural Research Centre and were connected with feeding studies. There were three feeding groups with varying energy and protein levels. It was stated that 96% of the lambs in the control group had good or excellent size of curl. The form of curl was most uneven on the lambs from the higher intensity group, only satisfactory

or adequate on 30% of the lambs in the low intensity group.

One year later in the same flock the results from fur evaluation with the following criteria - the size of the curl, density of hair and the overall impression showed that excellent fur skins appeared on 12-15 per cent of the ram lambs and good ones on 35-40 per cent. Corresponding figures on ewe lambs were respectively 28 and 34 per cent.

Sheep breeding, with an objective to develop the fur type Finnsheep, has recently started. It has been found an experimental farm where there are the possibilities for sheep breeding on a large scale. Preliminary fur evaluation studies were carried out during last fall. The material consisted of 178 lambs. It was shown that about 30 per cent of all scored lambs were so called fur types and that 80 per cent of them were progeny from fur type rams. The characteristics which were pointscored were the size of curl, density and extension of hair, hair quality and the thickness of neck-skin. Fur type lambs had the curl size 0.8, density 0.3 and shine 0.5 points higher than the average point in the whole test material. Hair fineness was evaluated subjectively from three positions on the animal. The results showed that fleece scale was 53-54's, which corresponds a medium fine fleece quality. There were no significant effect of sex and litter size on the size and similarity of the curls, hair density and shine, not even on fleece fineness. There were no differences between litter sizes in fur traits. Sex exerted a significant effect on the thickness of neck skin ( $p < 0.001$ ). There were significant sire ram differences within fur types for thickness of neck skin. The relationships between the size of curl and shine as well between hair density and shine were highest of all ( $r = 0.50$ ).

Performance testing of the ram lambs has been carried out in Finland during some years. At present the test is a combined performance and half-sib one. The rams are kept in individual pens and fed pelleted rations to appetite. At the end of the test all rams are scanned and scored for fleece and fur traits. The best 25% of the rams are sold in an auction. It seems that the rams with good scores for fur traits will be more and more demand in future.

The criteria for fur evaluation is still searching for its form. It is needed a lot of cooperation between sheep breeders, fur industry, fur manufacturers and designers. Fur

skin has many uses and that means also different quality requirements. The unequal skin quality is the biggest problem today, however.

### Wool and pelt quality in Icelandic sheep

*Sveinn Hallgrímsson*

In this short paper is to be found a brief description of the breeding goals for wool and pelt quality in Icelandic sheep.

A very fundamental fact in Icelandic sheep industry is the breeding for coloured sheep. An investigation on the frequency of colours and patterns are given. It is also pointed out that the wool is a mixture of fine undercoat fibres and a coarse overcoat fibres. In table 3 there are some figures on the Icelandic wool.

At last some future goals in breeding for wool and pelt quality are given. The main goals are:

- Maintain all colours and breed for quality of the coloured wool.
- Breed for finer wool, especially the overcoat fibres.
- Get rid of pigmented fibres in white wool.
- Lower the frequency of kemp.

### Nutritional influences on fur quality

*Anders Skrede*

Numerous nutritional factors have been reported to influence fur quality in mink and foxes. Some fur defects may be caused by nutritional deficiencies, for instance cotton fur in mink with iron deficiency anemia. Also normal variations in fur quality may be associated with nutrition. However, this is not yet sufficiently clarified by research, partly because of the lack of objective quality criteria. Besides, effects on fur quality may be indirect responses and not related to one specific nutritional factor.

Malnutrition may reduce the number of active hair follicles in fur animals. There is a need for more research to study the effects of more moderate nutritional deficiencies, and relationships with factors as energy intake,



amino acids, fat levels and quality, and hygienic quality of feed. The importance of amino acid levels and balance is still a promising research area, because of the role of protein as the major component of fur, and because of the peculiar amino acid composition of the fur. Little is known about nutritional effects on the hair proteins and whether or not changes in the amino acid composition of fur are associated with fur quality. Effects of variable nutrient supply caused by cold weather or poor absorption during gastrointestinal disturbances also needs to be further investigated.

It seems necessary to adopt new methods in the the future work towards a better understanding of the effect of nutrition on fur quality. Since most of the present knowledge is obtained in studies with mink, more research work with foxes is urgently required.

#### **Mineral content in mink hair related to the mineral content of mink feed**

*Lone Vejgaard*

For illustration of a possible correlation between the mineral content in mink hair and mink feed, 130 feed samples and hair from 300 mink skins have been examined.

The skins - graded in the qualities: Saga Selected, Metallic, Quality I/"weak hips" - are collected from 20 mink farms. Mink feed is supplied from 5 feed producers. Feed samples have been taken out currently - totally 26 samples from each producer. The sampling took place in the period late May - beginning December, 1985.

Mink hair and feed samples have been analysed for the minerals Ca, P, Mg, Na, K, Fe, Zn, Cu, and Se.

Presently, the variation per day and variation per week for mineral content have been examined in feed from the 5 feed producers.

Our future plans comprise further calculating of a possible correlation between the mineral content of hair and feed to see whether there is a relation between these.

#### **The mineral content in mink hair in relation to the fur characteristics**

*Outi Lohi*

In several investigations with other animals, it has been proved that the mineral content of the hair varies concurrently with the state of health, hair colour, feeding, topographic position and type of hair of the animal.

In this investigation, the relation of several factors to the mineral content in mink hair has been analyzed.

Results from these investigations with scanblack type are presented.

1. Investigation of topographic variation and correlation between colour intensity and mineral content.
2. Correlation between the fur defect "metallic" and the mineral content in hair and correlation between individual minerals in hair.
3. Correlation between the mineral content and the fur characteristics.

#### *Topographic variation:*

The mineral content was highest in the hair of the tail. On the back the mineral content decreases from the tail towards the shoulders. On the belly the mineral content was lower than on the back.

#### *The degree of darkness of the colour and the mineral content of hair:*

The content of most of the minerals was higher the darker the hair colour was.

#### *The fur defect "metallic":*

In scanblack mink, which have been receiving the same feed, the correlation between the degree of metallic and the mineral content was significant in regard to selenium and mercury ( $p < 0.01$ ) and iron, phosphorus and sodium ( $p < 0.05$ ).

#### *The mineral content and the fur quality:*

No correlation was found between the general fur quality (subjective selection) and the mineral content, when the effect of feed was excluded.

#### *Conclusion:*

In order to investigate the influence of other factors on the mineral content of the hair, following factors have to be stabilized: feed, topographic position, the colour type of the mink and colour intensity of the hair.

## Light, hormones and hairdevelopment

*Maija Valtonen*

The coat of mammals adapts to climatic seasonal changes by moult. Hair is replaced in the hair follicle according to cycles. After an active growth phase, anagen, the follicle passes through a phase of regression into a resting or telogen phase. Duration of anagen is characteristic for each animal species and hair type and genetically determined. The duration of telogen, induction of a new anagen and the number of underhair growing can be modified by environmental factors, primarily photoperiodism. Decreasing day length stimulates growth of the winter fur while increasing day length induces moult and growth of the summer fur. The effect of day length on the pineal gland and the role of melatonin in the neuroendocrine control of seasonal moult by the involvement of the pituitary gland is well known. However, the specific endocrinological regulation of moulting periods is still poorly understood.

Prolactin is claimed to be the main hormone controlling coat renewal. It has been shown in several species that spring moult coincides with seasonal increase of plasma prolactin and that inhibition of prolactin secretion by melatonin is requisite for induction of growth of winter fur. Thyroxine stimulates hair growth and increased thyroid hormone levels are demonstrated during moulting periods although moulting can not be induced with thyroxine. In addition of thyroxine hair growth and moult are related to breeding seasons and testosterone cycles. Moulting periods begin only after the end of the reproduction period and the following year's cycle of reproduction begin only after the moult is over. Sex hormones seem to have an inhibitory effect on the moult. Also the glucocorticoids has been shown to suppress hair growth. Still there seems to be an increase of serum glucocorticoids at the beginning of moult. Changes in MSH, the melanocyte stimulating hormone, secretion appears also to be an intergral part of the regulation of moult. Plasma MSH levels are high during moulting periods and low during testicular development and breeding.

Thus the pineal and pituitary glands are both involved in the neuroendocrine control of moult and hair growth by photoperiodism. Melatonin seems to be at least the intergrator of decreasing day length, but there may be other pineal substances involved with photoperiodic

stimuli in the regulation of season-dependent functions. And the specific role of adrenals, thyroid and gonads in the relationship between the pineal and pituitary glands and the hair follicles needs more elucidating.

## The temperature and its influence on the fur quality

*Mikko Harri*

Wild fur-bearing animals living in the North have a much thicker and warmer fur than animals of the same species living in a more southern climate. Therefore, it seems logical that the temperature affects the fur quality. The reason may also be that the animals which have a warm and prime fur coat, already when the cold weather sets in, can survive while the other ones die. In nature, light and temperature change simultaneously, and it is difficult to estimate whether it is the influence of the temperature or the light. Evidence can be found of the influence of light on the fur quality. A cow or a fitch developed winter coat in the summer when the light rhythm was changed. Soay-sheep develops winter coat two times a year, when having two dark periods.

There is also experimental evidence that the temperature without light may affect the fur quality. The cat and the swine developed a thicker fur in the cold than in the warmth. A mouse also reacted similarly, but the rat needed darkness in order to obtain the same result. The Beagle-dogs of Alaska, being outside all the year round, did not have particular difference between winter- and summer coat. A cold temperature may f.x. retard the hair growth of the Grey-dog.

Concerning the traditional farm-bred fur animals the information varies. It is said that a warm autumn hinder the maturing of the winter coat of fox and finn raccoon, but stimulates on the mink. In Nutria, which has a slowly advancing moult, cold prolongs the resting stage of the prime hair at the same time as new ones regenerate. The result is a thicker fur in the winter.

It is quite obvious that the influence of the cold on the skin does not stimulate the hair growth. A local cooling down may even delay it, the reason being the contraction of blood circulation caused by the cold. In other

words, the cold is a bad stimulant for hair growth. Every stimulant needs at least two weeks before the hair reaches the skin surface and after that it takes several weeks before the hair has any effect as an insulator. The protection against the cold is thus not ready before the end of the autumn.

It seems more probable that the influence of the temperature is indirect. The cold stimulates the metabolism. The feed consumption of the animal increases, stimulating in return the thyroxin secretion. Thyroxin stimulates the hair growth as well as activates the resting follicles. If the animal does not get feed, the cold cannot stimulate these mechanisms. At the same time, the light affects different hormones. In general, the hair growth is the result of several factors cooperating and influencing each other.

#### **Fur defects in mink - incidence, importance, causes**

*Anne-Helene Tauson*

Due to defects, about 20% of the total mink production is sold as low-grades, the selling price of which is considerably reduced compared with the regular qualities. The annual loss of income, due to fur defects, is here estimated to at least 150 million Danish kroner for the total Nordic production and the cause of some important fur defects is discussed.

*Clotted hair* is caused by feed or faeces. Feed consistency and cage design are factors affecting the frequency of this defect.

*Hippers* is due to incomplete shedding of the summer-fur. Genetic factors are considered important but restricted feeding during the shedding of the summer-fur has reduced the incidence of the defect.

*Bitten and damaged skins* are a quantitatively large group with complex causes. Fur chewing is not considered heritable, but might be an effect of biotin-deficiency. Other feed-related factors are unclear but possibly energy allowance and feeding routines are important. When more than two animals are kept per cage, the frequency of bitten animals has increased.

*White underfur* is caused by fish-induced iron deficiency anemia and biotin-deficiency and a few other less important factors.

*Weak belly* is a defect on skins from animals suffering from wet belly disease (WB). Factors causing WB are fat content in the feed, total energy allowance, Ca/P-ratio, genetic factors, ambient temperature, shortage of water and possibly infectious agents.

#### **The fur defect metallic on mink**

*Leena Blomstedt and Outi Lohi*

This report summarizes results of several investigations in regard to the fur defect "metallic". The investigations were carried out in Finland in the period 1972-1982.

##### *The distribution of the defect.*

The defect became obvious in the beginning of 1970's especially on scanblack pelts, but it can today be noticed even in other colour types. Incidence of the defect varies from farm to farm more than between feed kitchen areas or geographical areas. The difference in the incidence of metallic between two scanblack populations was not altered when the populations were placed under the same climate conditions.

##### *Feed.*

In normal feed conditions other factors seem to be more decisive for the incidence of metallic than the feed. In some feeding trials, however, differences have been noticed between the feeding groups.

##### *Cage- and nestbox materials.*

According to a Swedish investigation vinyl coated wire in cages and nestboxes increased the incidence of metallic.

##### *Metallic and other fur characteristics.*

Defect appears to be most common in dark colour faces especially in scanblack. Within scanblack it is far more common in the darkest colour groups.

##### *Inheritance of the defect.*

The defect seems to have a strong genetical background. The heritability based on several investigations varies from 0.3-0.8.

*Mineral content of the hair and fur defect metallic.*

A significant correlation in animals which have been fed the same diet was discovered between the content of mercury and selen in the hair and the fur defect metallic. For mercury the correlation was positive and for selen negative.

*Curved guard hairs.*

The most visible differences in the hair morphology between metallic and normal hairs is that in the metallic pelts guard hairs are curved. Both the number of curved hairs and how curved the lancet is were positively correlated to the severeness of the defect.

*Shape of hair cross sections and number of cuticula cells.*

Cross sections of metallic hair are more rounded than the ones of the normal hairs. More deformed cross sections, squared or triangled were found in metallic hairs. The cuticula layer of the hair is thinner in the defected hairs.

*The growth rythm and density of the hair.*

Hair growth and priming of the hair seem to advance more unevenly in metallic animals. There were less follicle bundles but the size of them was larger than in normal animals.

*Blister follicles.*

These are deformed large follicles which include pigmented and completely keratinized hair parts. In metallic pelts the number of blister follicles varied from 3 to 10% whereas in normal pelts the incidence was from 0.1 to 0.8%.

**The defect "thin furred hips"**

*R. Sandø-lund*

The defect thin furred hips in mink has probably existed for many years, but since the late seventieth it has increased very much.

The defect is recognized on pelts from all over Scandinavian countries, but is presumably most extended among Danish pelts.

During the last couple of years Danish Fur Sales has made special gradings of Danish scanblack male skins in quality groups Saga, I and II, size 0 and 1. The experiment showed, that between 25% and 50% of all skins had been classified one quality group down because of the thin furred hips. There was a tendency that the fresh skins was thinner around the weak area compared to skin without the defect. The difference increased in drying process.

The reasons for, and factors affecting the defect, are unknown, but among other things the composition (especially fat content and fatty acid composition), and energy concentration of the diet, plus feeding intensity (the fattening degree of the animals) can have some influence. Heredity can not be excluded, and a connection to the strong selection for silkyness, which has taken place during the last years is suspected.

**The possibilities of changing fur characteristics in mink and fox through selection**

*Einar J. Einarsson*

The effect of selection on fur characteristics is obvious when comparing farm-bred animals to wild ones. The selection of breeding animals has allways been conducted within all farms, without specialized nucleus herds.

Important assumptions for effective breeding strategies are well defined breeding goals and accurate registrations. The most important contribution to further genetic improvement is precise estimation of the breeding value, which is done through selection indices based on traits registrated on live animals and/or on skins. By the use of artificial insemination through foxcircles, the males are progeny-tested for fur quality. The genetic parameters, together with variation in the traits, selection intensity and generation interval gives a good basis for further genetic improvement of fur characteristics.

# EL VISON

## SU CRIA EN CAUTIVIDAD

**RAFAEL  
GARCIA MATA**

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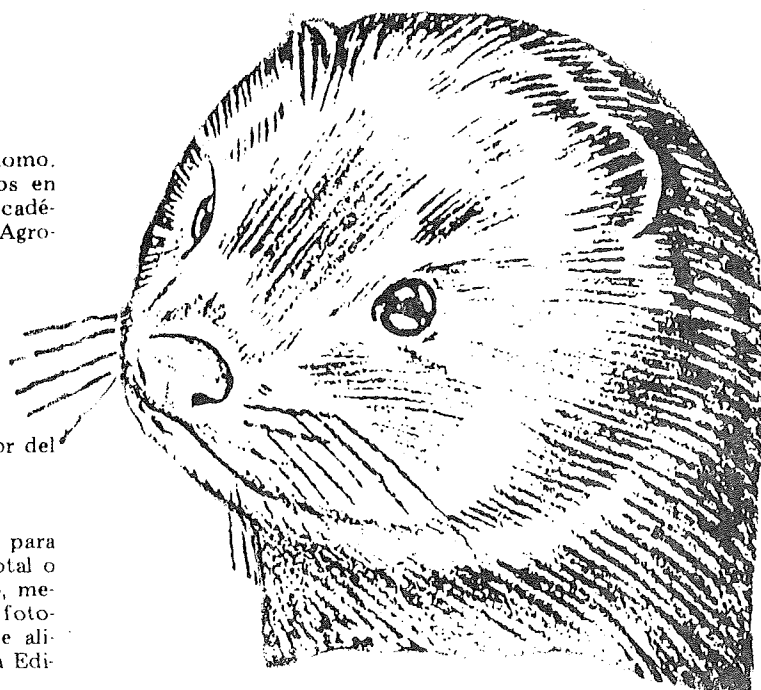
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### New (revised) Book

The book is written in Spanish by *Rafael Garcia-Mata*, Argentina and consist of 226 pages. The first edition came out in 1982 and the actual book is a revised edition published in 1987.

The book is dealing with all aspects in mink production, it is rich illustrated and with 231 references. I am not able to read the book, but with my knowledge to *Rafael Garcia-Mota* I am sure that the book is giving relevant upto date knowledge regarding mink production and in the spanish language.

*Gunnar Jørgensen*

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