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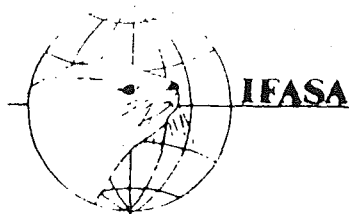
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Notes

SCIENTIFUR

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May 1990

There is a real economic crisis in fur animal production. Now more than 2 months after sending out invoices for subscription to SCIENTIFUR, more than 50% of the individual subscriptions are still unpaid.

We are very sorry for this sign of resignation, also from institutions and companies only partly dependent upon fur animal production.

We believe that this economic crisis is only temporary - and that the future of fur animal production will be as glorious as the past - perhaps at a lower production level as regards number of farms and of produced skins, but surely at a higher and more professional level, because:

- A. The effect of the very pronounced scientific and technical development in fur animal production obtained under very accelerated circumstances during the last decade will secure a stabilized and maximized production in nearly all regards.
- B. The international cooperation in science, production, sales and promotion will be

increased considerably, simply because more and more persons, associations and/or institutions have realized - especially during this period of crisis - that everybody in such a small industry as fur animal production and the fur industry must necessarily cooperate in all matters possible.

Looking into the future can therefore help us overcome our disappointment in the unpaid subscription invoices.

We are convinced that the first year of IFASA and IFASA/SCIENTIFUR will also be the year when the very deep crisis in the fur industry reaches its climax and the glorious future comes into sight.

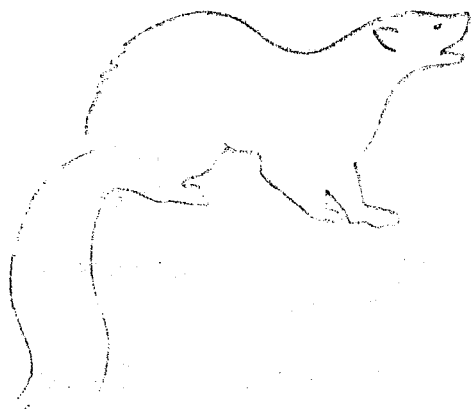
We therefore welcome you as member of IFASA which will be the scientific locomotive of the future fur animal production.

To ensure that the working groups within IFASA can be established and begin to function well ahead of the International Congress in Oslo in 1992, we ask all of you to fill in the enclosed application card and return it to us.

Have a good summer,

Your editor,


Gunnar Jørgensen



Social influences on productive performance in farm-raised polecats

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Summary

The aim of the present work was to evaluate to what extent various group compositions with different sexes and group sizes affect body weight gain, fur quality and organ size of farmed polecats (*Mustela putorius*). Additionally, attempts were made to estimate the effects of different group combinations on tameness score and occurrence of social hierarchies within the cages. Conventional one male-one female groups were compared with groups in which from one to three animals (males, females) were kept per cage. The results showed that males housed with a female cage partner were the biggest, while the pure male groups did not differ significantly from each other. The heaviest males had the longest pelts. The single males exhibited the poorest fur quality parameters (except for the purity of fur), whereas no significant differences existed between the females of any group. In the all males sex, group, litter, social status and tameness explained 82.2% of the total variance of the final body weight. The type of rearing group emerged as the most important single predictor. The predictive value of litter was even poorer than that of the social status. In females, the predictors altogether could explain 59.9% of the body weight variation, and no single predictor was found to be significant. The rearing group also affected to some extent the size of the internal organs (heart, liver) of the animals. The results support the conclusion that the traditional group composition (male-female pair) produces superior growth performance.

Introduction

On farms adult fur animals are housed singly in the cages which they seem to consider as their territory (Korhonen, 1988). Thus, adults generally do not have any direct contacts with their species partners. Whelps, on the other hand, are kept together with their mothers until weaning at an age of 7-8 weeks. After weaning there are various possibilities to house the animals, i.e. to put from one to several animals with various sex combinations into a cage. In farmed canids (foxes, raccoon dogs) there exists no sexual dimorphism which makes it possible to house within the same cage animals of same or different sex (Korhonen *et al.*, 1986; Korhonen and Harri, 1988). However, in farmed mustelids, polecats and minks, there typically exists marked sexual dimorphism the male being about two times bigger than the female (Moors, 1980; Korhonen and Harri, 1986). After weaning both minks and polecats are conventionally housed by keeping one male and one female within the same cage. This means that the male, due to its bigger body size, is dominant to the female (Korhonen *et al.*, 1985).

In farmed minks there are studies in which various group compositions with different sexes have been tested (Jørgensen, 1961; Saharov and Kazakov, 1967; Venge, 1969; Shirotov and Akkuratov, 1975; Alden and Tauson, 1979; Neil, 1984; Jonge *et al.*, 1986). Although the conclusions of those studies partly are controversial there is evidence that also other than the conventional combination can be used. However, those studies only evalua-

ted body growth and fur quality of the animals, but social hierarchy and animals' character (tameness) in various combinations were not estimated. Since especially in large groups social hierarchy with mutual conflicts or aggressive behaviour might be present, it is important to clarify that, too.

The aim of the present study was, firstly, to evaluate to which extent farming of growing polecats with various group combinations affect their weight gain, fur quality and organ sizes, and secondly, to estimate the effects of different group combinations on tameness score and occurrence of social hierarchy within the cages, and thirdly, to evaluate the possible correlation between productive performance and ethograms of the animals.

Materials and methods

General procedures

The experiments were undertaken on the research fur farm of Kuopio University during July-December in 1987. Experimental animals were all farmborn, and they were caged in standard rearing cages measuring 40 cm wide x 60 cm long x 40 cm high. A wooden nest (22 cm wide x 30 cm long x 40 cm high) was connected to each cage.

The animals were fed twice a day by the hand. The feed was manufactured by the local central feed kitchen of Koillis-Savon rehu Ltd. It was mainly composed of slaughter-housed offals, fish and cereals. The diet was formulated as far as possible according to the standards of the Finnish Fur Breeders' Association (c.f. Korhonen and Harri, 1986). Water was freely available by an automatic water system.

Experimental arrangements.

At the beginning of July the whelps were weaned, sexed, identified by earmarks and allocated to the experimental treatments. The following experimental groups were formed: (1) MALE-1, one male per cage (N=11), (2) MALES-2, two males per cage (N=18), (3) MALES-3, three males per cage (N=21), (4) FEMALES-2, two females per cage (N=14), (5), FEMALES-3, three females per cage (N=21), and finally (6) MALE-1 AND FEMALE-1, one male and one female per cage, i.e. the conventional system (N=22).

The animals were weighed about every third week with an accuracy of 1 g by the Mettler PE 12 electric averaging balance. The weighings each time occurred before feeding. Each time when the animals were weighed, also their tameness was subjectively estimated. Estimation was done always by the same person, and based on the following point scale: 1=very tame, 2=tame, 3=normal, 4=fearful, 5=very fearful. Fear animal

means also an angry animal; these two characters are linked together. Social status within the cage was estimated according to within cage body weights by assuming that a big body size is an indication of social dominancy: in each cage the biggest individual of each sex was ranked as the most dominant one (=1), the smallest one as the most subordinate one (=3). Within a group of three animals the mediumsized ones were rated by 2. In male-female combinations both individuals were ranked by 1.

The animals were killed in December, after which their pelts were conventionally skinned and dried. The pelts were graded subjectively by professional fur graders of the Finnish Fur Sales Ltd. on a 10-point scale (10=poorest, 1=best) according to mass, quality, overall impression, cover and colour purity. Soon after pelting, the organs were removed, carefully cleaned and weighed. The gall-bladder was removed from the liver before weighing. The heart was split, and the coagulated blood carefully removed before weighing. The dissections and organ handlings were performed by one person.

Statistics

The results are expressed as mean \pm SD. Statistical analyses were computed by analysis of variance combined with Student's t-test. The multiple classification analysis of variance (MCA) was used to evaluate the fraction of the total variance which can be explained by each independent variable included in the analysis. Pearson's product moment correlations were computed for the data. Data were processed by the VAX 11/780 computer and the SPSS (Statistical Package for Social Sciences) program.

Results

Table 1 shows that on July 13 when the animals were allocated to the experimental groups there already existed weight differences between the groups both within males and females. With advancing age the weight differences between the male-groups increased while those of the females disappeared. The males grown with a female cage partner were the biggest while the pure male groups did not differ significantly from each other.

As expected the heaviest males had longest pelts (table 2). However, despite normal weight gain, the lonely males had the shortest pelts, an indication that their weight gain was due to fat deposition rather than deposition of lean tissue.

Table 1. Body weight and tameness score of experimental groups.

VARIABLE MEASURED	MALES-1	MALES-2	MALES-3	FEMALES-2	FEMALES-3	MALE-1 AND	FEMALE-1	S _M	S _F
Body weight, kg									
Jul 13th	522 ± 50	470 ± 46	515 ± 46	358 ± 44	391 ± 44	509 ± 55	412 ± 69	*	*
Jul 24th	738 ± 62	653 ± 71	692 ± 52	495 ± 49	510 ± 55	706 ± 73	512 ± 99	**	NS
Aug 10th	1064 ± 71	923 ± 74	974 ± 56	688 ± 54	696 ± 49	991 ± 81	718 ± 78	***	NS
Aug 31th	1291 ± 99	1253 ± 99	1321 ± 74	892 ± 97	898 ± 67	1427 ± 133	925 ± 101	***	NS
Sep 15th	1500 ± 98	1474 ± 98	1483 ± 78	987 ± 99	976 ± 68	1655 ± 134	998 ± 93	***	NS
Oct 4th	1695 ± 110	1609 ± 111	1654 ± 83	100 ± 128	1015 ± 222	1885 ± 124	1179 ± 325	***	NS
Nov 16th	2078 ± 130	1852 ± 161	1941 ± 95	1141 ± 148	1059 ± 235	2227 ± 206	1208 ± 140	***	NS
Tameness									
Jul 13th	3.0 ± 0.8	2.9 ± 0.3	3.1 ± 0.2	3.1 ± 0.7	3.3 ± 0.5	2.9 ± 0.7	3.0 ± 0.5	NS	NS
Jul 24th	4.5 ± 0.7	2.9 ± 0.3	3.0 ± 0.1	3.1 ± 0.7	3.2 ± 0.4	2.6 ± 0.7	2.3 ± 0.5	***	***
Aug 10th	4.5 ± 0.7	2.9 ± 0.3	3.0 ± 0.2	3.1 ± 0.6	3.1 ± 0.2	2.4 ± 0.5	2.7 ± 0.5	***	NS
Aug 31th	4.3 ± 0.9	2.9 ± 0.3	3.0 ± 0.2	3.0 ± 0.7	3.1 ± 0.2	2.6 ± 0.5	2.8 ± 0.4	***	NS
Sep 15th	4.3 ± 0.8	2.9 ± 0.3	3.0 ± 0.2	2.9 ± 0.5	3.1 ± 0.3	2.8 ± 0.4	2.8 ± 0.4	***	NS
Oct 4th	4.3 ± 1.0	2.3 ± 0.5	2.9 ± 0.4	2.6 ± 0.6	3.1 ± 0.3	2.9 ± 0.6	2.8 ± 0.4	***	*
Nov 16th	4.3 ± 1.0	2.3 ± 0.5	2.9 ± 0.4	2.5 ± 0.7	3.2 ± 0.4	2.9 ± 0.6	2.8 ± 0.4	***	*

Significance: *p<0.05, **p<0.01, ***p<0.001, NS=Not significant (analysis of variance).

Table 2. Fur quality characteristics of experimental groups.

VARIABLE MEASURED	MALES-1	MALES-2	MALES-3	FEMALES-2	FEMALES-3	MALE-1 AND	FEMALE-1	S _M	S _F
Pelt length, cm	60.8 ± 2.9	62.3 ± 1.7	62.9 ± 1.5	55.3 ± 1.7	53.7 ± 2.2	66.0 ± 2.2	54.7 ± 1.4	***	NS
Purity of fur	6.2 ± 1.2	6.6 ± 1.2	6.5 ± 0.9	7.5 ± 1.0	6.5 ± 2.2	6.4 ± 0.9	7.7 ± 0.9	NS	NS
Mass of fur	3.6 ± 1.7	6.1 ± 1.6	6.6 ± 1.7	5.0 ± 2.0	5.3 ± 2.4	6.4 ± 2.9	6.2 ± 1.8	*	NS
Overall impression	3.8 ± 2.1	6.8 ± 1.6	7.7 ± 1.3	5.5 ± 1.0	4.7 ± 1.0	7.0 ± 2.0	6.3 ± 1.6	***	NS
Quality of fur	5.8 ± 1.3	7.9 ± 0.5	8.3 ± 0.9	8.0 ± 1.0	7.7 ± 1.4	7.0 ± 1.9	8.6 ± 0.5	***	NS

Significance: *p<0.05, ***p<0.001, NS=Not significant (analysis of variance).

The lonely males also differed from the other male groups on the basis of fur quality parameters. With the exception of the purity of fur, all other parameters describing pelt quality were significantly poorer for these.

If the data on pelt quality parameters were grouped into different social classes regardless of the group, the only significant difference was a lower overall impression of pelts in the most dominant social rank (p<0.05). However, this rank also includes the animals caged alone, which as a group had the poorest pelt quality. After removing these lonely males from the sample, there no more existed any significant differences.

In females, quality or number of cage partners failed to affect either pelt length or quality.

Table 3 shows a detailed analysis on background variables as the predictor of final body weight of the animals. It is interesting to note that in males all the predictors altogether could explain as much as 82.8% of the total variance. The type of rearing group emerged as the most important single predictor.

It is interesting to note that the predictive value of litter was even poorer than that of the social status. The tameness score was not ranked as a significant predictor in this test. In females, the predictors altogether could explain 59.5% of the body weight variation, and no single predictor was found to be significant (table 4).

Correlation analysis with different parameters revealed many interesting associations. In males

Table 3. Statistical summary of factors influencing the final body weights of male polecats.

Variable	n ²	B	Class mean, g	P
Group	0.69	0.65		<0.001
MALES-1			2078	
MALES-2			1852	
MALES-3			1941	
MALE-1 AND FEMALE-1			2227	
Litter (1-16)	0.63	0.40	(1853-2381)	<0.01
Social status	0.67	0.47		<0.001
1			2051	
2			1974	
3			1834	
Tameness score	0.18	0.39		NS
2			1946	
3			1995	
4			2059	
5			2035	
R ² =0.828				<0.001

Multiple classification analysis. n²=proportion of variance explained by a single predictor. B=proportion of variance explained after adjusting for the effects of other predictors. R²=proportion of variance explained by the complete model.

the tameness score determined in July 13 correlated already significantly with the tameness score in November 16 (r=0.31, p<0.01), while correlation between the values in July 24 and November 16 was even stronger (r=0.64, p<0.01). Correlations between subsequent evaluations of the tameness were good ranging from 0.65 to 0.97. Generally there was a significant correlation between the social status of the animals and their tameness score (r=0.33, p<0.01), the most tame animals being the most dominant ones.

In females, however, the tameness score in July 13 did not predict their tameness score in November (r=0.07, N.S.). The consistence of the

Table 4. Statistical summary of factors influencing the final body weights of female polecats.

Variable	n ²	B	Class mean, g	P
Group	0.31	0.38		NS
FEMALES-2			1141	
FEMALES-3			1059	
MALE-1 AND FEMALE-1			1208	
Litter (1-16)	0.66	0.63	(1000-1449)	NS
Social status	0.17	0.17		NS
1			1145	
2			1121	
3			1070	
Tameness score	0.05	0.08		NS
2			1135	
3			1114	
4			1106	
R ² =0.599				NS

Multiple classification analysis. n²=proportion of variance explained by a single predictor. B=proportion of variance explained after adjusting for the effects of other predictors. R²=proportion of variance explained by the complete model.

tameness score was also much poorer than in the males. It was not earlier than by the end of August that the tameness could to some extent predict the tameness of the same animal in November (r=0.026, p<0.05). There was also no correlation between the tameness and social status in females (r=0.03 N.S.) if both were evaluated in November, while in July the most dominated females were ranked as the most fearful ones (r=0.43, p<0.001). Note that in males the situation was just the opposite.

The rearing group also affected the size of some internal organs of the animals (table 5). After adjusting the data to the common body weight by

Table 5. Comparison of organ size between the male groups.

VARIABLE MEASURED	MALES-1	MALES-2	MALES-3	MALE-1 AND FEMALE-1	P
Liver, g	59.0 ± 5.2	54.8 ± 5.2	50.2 ± 4.8	55.0 ± 6.6	<0.001
Adrenals, mg	294 ± 60	262 ± 66	270 ± 65	277 ± 50	NS
Heart, g	7.6 ± 0.8	7.0 ± 0.5	7.5 ± 0.6	7.1 ± 0.5	<0.05
Spleen, g	6.8 ± 1.6	7.4 ± 1.6	6.6 ± 1.6	6.2 ± 1.1	NS
Kidneys, g	8.2 ± 0.5	8.1 ± 0.6	8.0 ± 0.6	7.8 ± 0.5	NS

The data were adjusted to the common body weight by analyses of covariance.

analysis of covariance, there still remained significant group differences in the weights of liver and heart. The lonely males had the biggest liver while the group-3 males had the smallest. The lonely males also had the biggest heart.

Discussion

The present results show that the growth performance of polecats can be predicted to a great extent by factors already known at time of weaning. Altogether 82.8% of the variance in final body weight can be explained by predictors, like group organisation, litter, social status and tameness score of the animals. The most important predictor was group organisation within a cage during the time of weight gain. The traditional group organization, the male-female pairs resulted in the most superior growth performance, while the performance of the pure male groups did not differ from each other.

However, regarding pelt quality, the males kept alone in cages had the shortest and poorest pelt while the other groups had pelts of an indential quality. Assuming that pelt quality reflects the stress the animals experience, than growing male seen to be social creatures to whom social competition is not a stressful situation, but rather the lack of social competition is.

Other significant predictors for the final body weight in male polecats were the social status within the cage, and the litter emerged as the third significant predictor. Tameness was not a statistically significant predictor.

This result differs considerably from that of the raccoon dogs. In this species the social status was the most important, and actually the only significant predictor of final body weight (*Korhonen & Harri, 1988*). This difference is unexpected because the raccoon dog is a social animal which lives in small family groups while the mustelids, including the polecats, generally are solitary animals.

With the exception of lonely males, there existed no significant differences between the mean values of the different groups having two or three animals. However, it was expected that most dominant individuals in each group would least suffer from stress and, as a result of this, would have the best pelt quality. The result in males was just the opposite: the highest social rank had the poorest pelt quality. A more detailed analysis revealed, however, that their low pelt quality was not due to the influence of social status per se, but rather to the presence of the animals kept singly in the sample. This result again confirms that social status does not affect pelt quality if the animals have one or more cage partners of the same species. It is the absence of

the partner that affects harmfully the pelt quality.

The concept social status needs special attention. In this study the social status was not determined by testing dominance ranks of the partners in a competition situation but by assuming that the biggest animal within a cage is the most dominant one. This is usually the case, as has been shown for arctic foxes (*Wakely and Mallory, 1988*) but this is not necessarily the situation. However, weight dependent social status in July 13 predicted the final body weight in November 16 with a rather good correlation coefficient ($r=0.67$, $p < 0.001$). It should be stressed that this weight-dependent social status is somewhat different from body weight calculated for the whole material. A particular small animal within a cage may attain a high within cage body weight if its cage partners are smaller than it, while among the whole set of animals this particular individual may be ranked low in the weight scale. However, assuming that there exists social competition, then this particular animal must compete with its cage partners which are smaller, not with all animals on that particular farm. To which extent this weight-dependent social rank is equivalent to social ranks based on ethological tests must be confirmed by further experiments. The importance of the present result is in that it supports the concept that social status may be an important predictor for growth performance, and that in future experiments more attention should be paid on this phenomenon.

The tameness (fearfulness) of the animals was evaluated by using a subjective scale. The evaluation seemed to be rather reliable. Subsequent evaluations blindly for the same animals gave consistent results. Actually each farmer has been, and always is, performing this kind of tameness evaluation at least unconsciously when selecting breeding animals. Generally the most fearful animals are culled out from the breeding stock of the next generation. This gradually leads to increased tameness of the stock, i.e. to domestication. The present results show that tameness in itself did not bring about any harmful effect on growth performance or fur quality. Thus there exists no reason why the farmers should change their praxis.

It is interesting to note that for female polecats the results were different from those for males. None of the predictors significant in males was significant in females. All predictors altogether could explain only about half of the body weight variance of the females. However, we did not have a group of single females. Thus we do not know whether or not absence of a cage partner is harmful to the females as it was to the males. The most important finding is, however, the fact that females raised together with a male, which of

course, is the stronger and most dominant part of this coalition, did not suffer from this situation; actually their growth performance was the best one among the female groups. Rather it is tempting to conclude that females may suffer from the competition with other females; growth performance of the three females in a cage-group tended to be the poorest (although not significantly).

In this study as well as in our earlier studies for raccoon dogs (Korhonen & Harri, 1985; 1988) we measured the weights of some internal organs of the animals in an attempt to find out an indicator of animal's experiences. Some statistically significant group differences were found but these differences could not be logically associated with any particular group configuration. The only conclusion we can draw is that more experiments are needed before the importance of the organ size as a diagnostic tool can be verified.

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Original report

The need for nest boxes and drop-in bottoms in the whelping period of female mink.

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Summary

The importance of nest boxes and their design has been examined during the nursing period of mink.

A total of 170 pastel females were divided into 3 groups with nest box with drop-in bottom, nest box without drop-in bottom and without nest box, respectively.

No difference was found in number of kits alive at birth or barren females in the 3 groups. The smaller and better physically defined the nest was, the better the kits managed with regard to survival and weight gain in the first weeks after birth.

A natural explanation may be found in the thermo regulation of the kits, which only starts working around the age of 25 days. Younger kits go into a sort of cold rigor and will die after some hours, if they are not warmed up again.

The easier the kits get away from the nest, the more often this cold rigor will set in. The rigor reduces milk intake and gain and increases mortality, if the kits are not brought in by the female.

Increase in weight of kits from 4 to 6 weeks was not affected by nest box conditions.

No difference was found in the quality of nest building of the females nor in the time of nest building in relation to birth between the three groups.

Background

A large number of different drop-in bottoms and screens for use in the whelping period exists. Based on experiences with small changes from year to year, most breeders have found a system that is working for them. Large differences are, however, found in the systems the breeders have finally chosen, without any obvious differences in production results.

It is therefore an open question which general importance the nest box and various nest box devices have to whelping result and weight gain. The importance of the ability and possibility of the females to build a nest under various conditions is also unknown. A test of all types of nest boxes is impossible, but the effect of three degrees of nest box design illustrates the importance of this question.

The objective of the experiment was to investigate the significance of nest box design on whelping result, weight gain and nest building.

Material and methods.

In week 16, shortly before whelping is expected, 163 pastel females were divided into three groups. Group A of 70 females was offered drop-in bottom with screen and a hollow with a confined space of approximately 400 cm² for nest building. Group B, also of 70 females, was offered a solidly packed nest box without drop-in bottom, leaving approximately 600 cm² for nest building. Group C with 23 females was shut out from the nest box by a division plate, providing

no confinement but leaving all 2700 cm² for nest building. The females were distributed in sections in a two-row house. All three groups were given straw in the cage daily, but not on top of the nest box. The number of kits born was recorded daily, and the loss of kits until two weeks after birth was recorded.

Females and kits were weighed four and six weeks after birth. The kits were weighed by the sex.

Nest building of the females was evaluated according to scores from 1 to 5. Score 1 was given to nest boxes entirely without straw, 3 was given for a loose but closed nest, and 5 was given for nest boxes completely filled out. In group C nest building was evaluated in 3 categories, where 1 was given if the female did not use the straw, 2 if she was lying in a hollow on top of the straw and 3 if she made a closed nest in the straw. For group C, scores 1 and 2 almost correspond to the scores of groups A and B, whereas 3 corresponds to the scores 3 to 5.

Statistical data processing was done by PC-SAS. Due to lack of homogeneity of variance between groups, breeding results have been compared with non-parametric models. Number of kits lost and barren females in the 3 groups was compared with a chi² test.

Results.

Kits.

In all tables groups A, B, and C refer to the three experimental treatments described. A = 70 pastel females with drop-in bottom, B = 70 pastel females without drop-in bottom, C = 23 pastel females without nest box.

Whelping results for the three experimental groups are shown in table 1.

It appears from table 1 part I, that quite a lot of living kits were born in all three groups. There is no statistically significant difference in litter size between the three groups. At the age of 2 weeks there are approximately two kits less in group C than in groups A and B. The difference in litter sizes at the age of 2 weeks is significant ($p < 0.01$). There is no difference in number of kits at the age of 2 weeks between groups A and B (Wilcoxon test). Part II of table 1 shows that more kits were found, if less had been done with regard to nest box conditions, but the difference is not statistically significant. The difference is made up by the number of stillborn kits, which is significantly different between the 3 groups ($p < 0.05$).

Distribution of lost kits and barren females is shown in table 2 for the three groups.

Table 1.

Kits per litter of mink females with and without drop-in bottom and without nest box.

I. Number of kits alive per fertile female:

Group	Females	at birth	at the age of 2 weeks
A	66	5.68 ± 2.00	5.17 ± 2.12
B	64	5.92 ± 2.29	4.97 ± 2.51
C	19	5.74 ± 2.56	3.05 ± 2.20
Kruskal-Wallis test:		ns	$p < 0.01$

II. Total number of kits per fertile female:

Group	Females	at birth	stillborn
A	66	6.06 ± 1.86	0.38 ± 0.84
B	64	6.55 ± 2.43	0.63 ± 1.02
C	19	7.11 ± 1.41	1.37 ± 1.74
Kruskal-Wallis test:		ns	$p < 0.05$

From table 2 part I it appears that more kits were lost, the larger the area for nest building was. A chi² test of the distribution of lost kits in relation to living kits at the age of 2 weeks shows that there is a significant difference between the three groups ($p < 0.001$). It is seen directly that the loss of kits is considerably larger in the group without access to nest boxes than in the two groups with nest boxes. The difference between groups A and B is also considerable, and a chi² test shows that the loss of kits is largest in group B without drop-in bottom ($p < 0.01$).

It appears from table 2, part II that the percentage of barren females is largest in the group without access to nest boxes. In all three groups there are only 4 to 6 barren females, and a chi² test shows no statistically significant difference between groups.

Weight gain

Females and kits were weighed at the age of four and six weeks. The kits were weighed by sex, and the results are shown in table 3. As litters with only one kit develops badly in general, these have been excluded from the calculations.

There is no difference in the weight of females between the three groups. Both male and female kits in group C weigh considerably less than in groups A and B. There is no full homogeneity of variance between groups, and a non-parametric

Table 2.
Loss of kits and percentage of barren females of mink females with and without drop-in bottom and without nest box.

I. Total number of kits:

Group	Birth	2 weeks	Lost	In percent
A	375	341	34	9.1
B	379	318	61	16.1
C	109	58	51	46.8
Chi ² test:			p<0.001	

II. Total number of females:

Group	Mated	Fertile	Barren	In percent
A	70	66	4	5.7
B	70	64	6	8.6
C	23	19	4	17.4
Chi ² test:			not significant	

Table 3.
Weight at the age of 4 and 6 weeks of male and female kits with and without drop-in bottom and without nest box.

Group	A	B	C
<u>Male</u>			
4 weeks	159 ± 22	162 ± 28	123 ± 32
6 weeks	338 ± 44	339 ± 67	295 ± 33
Gain in g	179	177	172
Gain in %	112	109	140
<u>Female</u>			
4 weeks	146 ± 17	146 ± 22	108 ± 38
6 weeks	295 ± 31	302 ± 55	261 ± 42
Gain in g	149	156	153
Gain in %	102	107	142

model must be used. A Kruskal-Wallis test confirms that there is a difference in the groups at the age of 4 weeks ($p<0.001$). At the age of 6 weeks the variation is so large that there is no certain difference in weights between groups. Weight gain in grammes is almost identical for the three groups, and weight differences at the age of 6 weeks is therefore an effect of the difference found already at 4 weeks. This is confirmed by an analysis of covariance with weight at 4 weeks as covariate. Weight at 4 weeks is of great importance ($p<0.001$), whereas there is no difference in groups. As mentioned above the use of this parametric model is not without problems.

A regression of kit loss on kit weight shows that a few more kits have been lost in the litters with kits with the lowest weight at the age of 4 weeks.

Nest building

Scores for nest building were analysed for the three latest days before birth and until one week after birth. Percentage of observations of each group at each degree of nest building has been shown for the three groups in table 4. The percentages express the distribution of nest building scores for all animals in the 11 days around birth.

It will be seen from table 4 that most observations show a medium to good nest in all three groups. Most of the time the majority of females have a nest fully covered with straw. There are only minor differences between groups A and B, and even though the scale is different, the tendency in group C is the same.

Table 4.
Percentage distribution of degree of nest building in the 11 days around birth for mink females of groups A, B, and C.

Group	Scores for nest building				
	1	2	3	4	5
A	1.2	14.2	55.0	26.3	3.3
B	1.7	13.4	54.0	27.6	3.3
C	10.4	12.8	76.8	-	-

Nest building in groups A and B is also very similar in relation to time of birth. To make things clearer they are therefore presented together. The percentage distribution of scores for nest building in relation to time of birth is shown in table 5.

Table 5.
Percentage distribution of degree of nest building in the time before, around and the week after birth, for mink females in groups A, B, and C.

Part I. Groups A + B.

Time in rel. to birth	Scores for nest building				
	1	2	3	4	5
Three days before	5.0	17.3	48.8	24.5	4.4
On the day of birth	0.9	13.7	51.3	30.7	3.4
One week after birth	0.0	12.2	57.2	27.6	3.0

Part II. Group C.

Time in rel. to birth	Scores for nest building		
	1	2	3
Three days before	20.4	20.0	54.4
On the day of birth	6.7	20.0	73.3
One week after birth	2.9	1.6	95.5

It appears from table 5 that the majority of the females with and without nest box are building a closed nest at the latest at the time of birth and maintain this nest after birth. Otherwise the nest is only changed very little from day to day.

In order to evaluate whether nest building is of importance to kit mortality, correlation between kit loss and the average score for nest building in the week after birth has been investigated.

The correlation has been illustrated for each group in table 6. Scores are shown for females which have lost 0, 1-2, and more than 2 kits, respectively.

Table 6.
Scores for nest building grouped according to kit loss for mink females with and without drop-in bottom and without nest box.

Scores for nest building at kit losses of			
Group	0	1-2	more than 2
A	3.3	3.1	2.9
B	3.2	3.3	3.4
C	3.0	2.3	2.5

The table does not leave the impression that nest building is of any significant importance to the loss of living kits. This is confirmed by the correlation between kit loss and nest building which for all three groups was lower than 0.2 and not with certainty different from 0. On the scale for nest building from 1-5, the females from groups A and B were a little above medium, regardless of loss of kits. For group C the scale went from 1 to 3, and the females that did not lose any kits had all had a good, closed nest the entire week after birth.

There was no correlation between score for nest building and kit weight at the age of 4 weeks.

Discussion.

The experiment was started immediately before whelping, and an impact on whelping result was therefore not expected. This is confirmed by the uniform number of living kits in the three groups. Percentage of barren females in groups A and B was below the national average of 10.6%. On account of the low number of females, the apparently high percentage of barren females in group C does not with certainty differ from groups A and B.

Number of mink kits born is practically impossible to determine exactly, as stillborn kits will

often be eaten before the last kits are born. The smaller the area for the nest was, the fewer dead kits were found. This may be due to the fact that dead kits are eaten more quickly, if they take up room in the nest. Dead kits in group C were scattered in the cage and were not "in the way" of the female and the living kits. Discovery of more stillborn kits in group C may therefore be due to the fact that they were not eaten rather than a real difference in number of stillborn kits.

The differences in loss of kits and kit gain between the three groups show that the smaller the nest is, and the better physically limited it is, the better the kits will manage. The decisive factor seems to be, whether the kits are kept together in the nest or not. The reason may be that newborn mink kits cannot maintain their body temperature by themselves. This ability is primarily depending on age (Segal, 1967, cf. Setal, 1975), and only at the age of approximately 25 days, mink kits are in a position to slow down the fall in body temperature, if they are exposed to cold (Kostron et al., 1970). The younger kits will therefore go into a sort of cold rigor, if their body temperature drops below 15-17°C. At 10-12°C the kits are almost lifeless, but they can survive for several hours, and their body function can be rapidly restored on return to warmth (Kostron et al., 1970, Segal, 1967 cf. Segal, 1975).

The purpose for wild mink kits should be to save energy and thus survive as long as possible in the nest, while the female is seeking food outside the nest. The motivation of the female to go and get the kits is probably highest when they are active and "call" for her, whereas kits in cold rigor are rarely collected outside the nest. This is the reason for the use of couveuses in the nursing period, where cold kits that the female has not collected are warmed up and "revived" before they are returned to the nest box. Kits that are not warmed up will therefore die from cold even though the temperature is normal for the season. Only at the age of 40-50 days the mink kits are fully capable of regulating their body temperature (Segal, 1967 cf. Segal, 1975).

The percent of losses for the three groups shows that the more confined the space for nest building is, the less kits are lost. The increased kit mortality in group C may be due to the fact that the kits will easier get away from the nest and be cooled off more quickly, because the bottom of the cage is not insulated as well as the bottom of the nest box. As described above, these kits will more easily go into cold rigor and die if the female does not come and get them.

This explanation is supported by the fact that some of the females in group C did not manage to keep the kits together in a nest in the straw. These females often lost kits that had moved

outside the nest and several females lost all their kits in a few days. Females that knew how to keep their kits together, managed all right, and some females from group C weaned 7-8 kits without having lost any. The ability of the female to keep the kits together is therefore of greatest importance in group C which is illustrated by the fact that the females that lost kits lost on average 4.3 kits in group C against 1.6 and 2.3 kits in groups A and B, respectively.

At the age of 4 weeks only very few percent of the kits have started eating by themselves. The significantly lower weight at the age of 4 weeks of kits in group C must therefore primarily be a result of a lower gain in the suckling period. A reduced gain in the suckling period may be due to: 1) the female giving less milk, 2) the kits drinking less milk, 3) the kits using a smaller proportion of the energy for gain.

As milk production has a very high priority, the milk yield of the female is not likely to be reduced because of nest box conditions. It is known, however, that in general small litters do not manage well, maybe because the female is not stimulated enough to maintain a high milk production. The small litter size in group C may therefore be the reason for the weight difference, even though litters with only one kit have been excluded from the weight calculations.

Kits from group C that get away from the female and go into cold rigor will absorb less milk. The energy is used for maintaining the basic metabolism and there will be less energy for growth. The lack of physical limitation of the nest and the poorer insulation are therefore the most likely reasons for the weight differences observed.

The gain of the kits from 4 to 6 weeks is similar in all groups, and the weight difference at 6 weeks is an effect of the difference that already existed at the age of 4 weeks. This is surprising, as great importance is attached to the possibility of the kits to absorb feed early. Only the kits in groups A and B have had an opportunity to eat feed from the lid of the nest box, and only group A has had a block to climb on to. Nevertheless, the gain has been the same, and the possibility of the kits to reach the feed has in this experiment been of no importance.

Nest building does not differ considerably between the three groups. The majority of the mink build a closed nest, at the latest in connection with the whelping and keep up this nest in the week after whelping. The purpose of the nest is among other things to secure a suitable temperature for the kits. As the temperature of the air varies from day to day, the density of the nest is not always an expression of the quality of the nest. On warm days the best nest can be very

open, and on cold days it is dense and closed. Nest building does not give any specific explanation of the differences found in kit mortality between the three groups. More likely, the differences are due to the fact that the larger the nest area is, the larger the risk is for the kits to get away from the female.

The state of cold rigor described which sets in when the kits are cooled down, offers a good explanation of the differences found in loss of kits as well as in gain.

The crucial point is that the nest keeps the kits together and then that the female goes out to collect kits that have moved away before they stop "calling" and go into cold rigor.

Conclusion.

The experiment confirms the need of mink females and kits to have a nest box in the whelping period. The nest box keeps the kits together and insulates so that they will not get cold. It will reduce the number of kits that get away from the female, go into "cold rigor" and die from cold in the first weeks of the nursing period. As there is no insulation, this process progresses more quickly out in the cage, where the risk that the kits will get away from the female is also larger. Females that cannot keep their kits together, lose many kits, especially if they are without nest boxes. The nest box also improves the gain of the kits in the nursing period. A drop-in bottom in the nest box reduces the loss of kits further but does not affect the gain of the kits. When the kits have started eating by themselves, nest box conditions no longer affect the gain.

More stillborn kits are found with females without nest boxes, as fewer of the dead kits will be eaten, when they are not lying in the nest.

Neither the density of the nest nor the time of nest building by the females have been influenced by the nest box conditions. There is no correlation between the quality of the females' nests and the whelping result.

It is therefore worth while to give the females an insulated nest box designed to keep the kits together. As many kits actually die from cold, the effect will depend on the temperature in the nursing period. The greater the risk of the kits is to get away from the nest, the more important the monitoring and effort of the breeder will be to revive kits that have been cooled down. Future investigations will have to disclose whether the ability of the female to keep the kits together is inheritable.

Literature.

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Original Report

Length, growth and wearing of claws among farmed blue foxes (*Alopex Lagopus*) with and without nest boxes.

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Abstract

It was examined on 97 2-3 years old blue fox vixens how length, growth and wearing of claws was affected by the cage environment. The claw lengths of 50 blue fox vixens kept in wire cages and provisioned with nest boxes and a shelf were compared with the claw lengths of 46 blue foxes kept in an unprovisioned cage environment. The length of the claws was measured before cutting, just after cutting and 8, 14 and 22 weeks after cutting. Mean lengths and growth rates of the claws were compared between the two groups and no significant differences were found. In addition 135 8 months old silver foxes and 113 8 months old blue foxes had their claws measured at pelting to examine differences in claw lengths between the two species and between young and old blue foxes. Blue foxes at the age of 8 months had significantly longer claws than silver foxes of the same age and 2-3 year old blue foxes had significantly longer claws compared to 8 months old blue foxes. The conclusion of the investigation was that very long claws were seen only among old blue foxes and that the provision of a solid floor in form of nest boxes or a shelf did not wear their claws. If long claws constitute a welfare problem to farmed blue foxes the solution seems to be cutting of claws on individuals with very long claws.

Introduction

In Denmark no investigations have been made of the length, growth and wearing of claws on

farmed foxes, as well as no investigations have been made of whether long claws constitute a welfare problem to farmed foxes. It has been the general opinion that a wooden plate or box in the cage would help the animals in wearing down their claws on the forefeet. Long claws are observed mostly among blue foxes whereas silver foxes in general have moderate to short claws. In the project "Improvement of Cage and Nestbox-systems for Farmed Foxes" it was examined whether blue fox vixens provided with whole-year nest boxes and a wooden shelf had shorter claws than blue foxes kept without this enrichment of the cage. At the same time knowledge about the growth and wearing of blue fox claws during autumn and winter was achieved. Young silver and blue foxes were also examined with regard to claw lengths to see if any difference between the species and between young and old animals existed.

Materials and methods

50 blue fox vixens kept in double fox wire cages with three different types of whole-year nest boxes and a wooden shelf were assigned to the experimental group. The control group consisted of 46 blue fox vixens kept in non-enriched double fox wire cages. The age distribution was identical in the control and experimental group, with vixens born in the spring of 1986 and 1987. Both the control and experimental group had been kept in the same environment for two years at the start of this project. All foxes were fed the same amount of feed once a day at the same position in the cage.

After weaning of all cubs in September 1989, each vixen was caught in her home cage and the fourth claw from the left, on the right front paw, was measured from the cuticle to the claw tip with a slide gauge. Then the claws on all 4 paws were cut to the blood vessel (approximately 1.5 cm), and again the fourth claw on the right front paw was measured. The same claw was measured 8, 14, and 22 weeks after the cutting. The last measure was taken just before the start of the breeding period.

To examine difference between the species, the same measure method as above was used on 135 silver foxes and 113 blue foxes born in the spring of 1989. They were kept under normal farm conditions and fed the same food. Their claws were measured once just before pelting in November and no cutting was performed.

Data were analysed with parametric and non-parametric tests on PC with the Statistical Analysis System (SAS) package.

Results

There was no significant difference in mean claw lengths between the control and experimental group in any of the observations made (start, 0, 8, 14, 22 weeks) (figure 1).

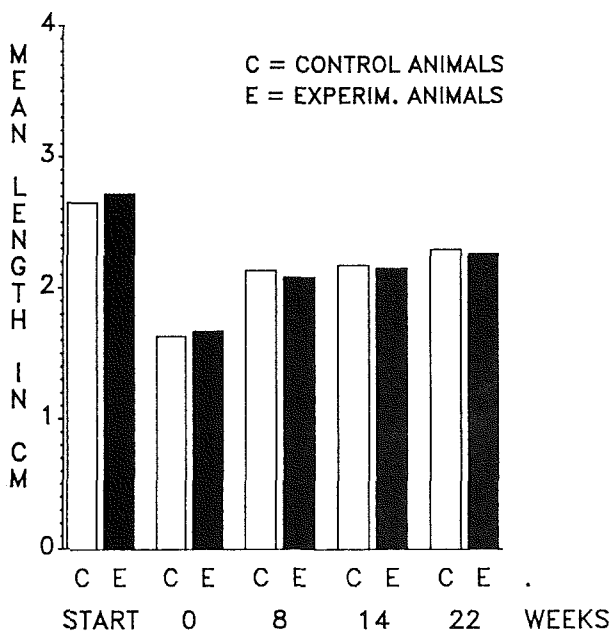


Figure 1. Mean claw lengths in centimeters for 46 control (C) and 50 experimental (E) blue fox vixens before cutting (START) and at various weeks after cutting (0, 8, 14, 22 weeks).

Within the control group there was a significant difference between mean claw length before and after cutting (start, 0) and between mean length at start and length at 8 weeks, 14 weeks and 22 weeks ($0.01 > p > 0.0001$, Wilcoxon signed rank test). The same result was achieved within the experimental group.

No significant difference was found in growth rates from 0 to 8 weeks, from 8 to 14 weeks, from 14 to 22 weeks, from 0 to 14, from 0 to 22 weeks and from 8 to 22 weeks between the control and experimental group.

There was no significant difference in the distribution of animals in the claw length ranges between the control and experimental group at start or at 22 weeks after cutting (tables 1 and 2). Number of animals having claw lengths longer than 2.5 cm before cutting and 22 weeks after cutting did not differ significantly between the control and experimental group.

Table 1. Number of individuals among 46 control blue fox vixens and 50 experimental blue fox vixens having claw lengths in intervals ranging from 1.5 to 4 centimeters at start (see text) before cutting.

	CLAW LENGTH INTERVALS IN CENTIMETERS				
	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0
NO. OF CONTROL ANIMALS	2	13	20	11	1
NO. OF EXPERIMT. ANIMALS	0	10	30	9	1

Table 2. Number of individuals among 46 control blue fox vixens and 50 experimental blue fox vixens having claw lengths in intervals ranging from 1.5 to 4 centimeters 22 weeks after cutting (see text).

	CLAW LENGTH INTERVALS IN CENTIMETERS				
	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0
NO. OF CONTROL ANIMALS	7	23	14	2	0
NO. OF EXPERIMT. ANIMALS	5	32	12	1	0

Old blue foxes had significantly longer claws than young blue foxes kept under same farm conditions. Claw lengths of the 3 years-old blue foxes before cutting in September (start) were compared with the claw lengths of the young 8 months old blue foxes at pelting in November (mean young = 1.96, mean old = 2.65, $p < 0.0001$, Wilcoxon - Mann-Whitney U-test).

Young silver foxes kept under normal farm conditions had significantly shorter claws compared to young blue foxes kept the same way and of the same age (mean silver = 1.59, mean blue = 1.96, $p < 0.0001$, Wilcoxon - Mann-Whitney U-test).

Discussion

On behalf of my experience from the daily work with the foxes, long claws do not seem to cause a welfare problem for blue or silver foxes. They move freely around on the wire-mesh and do not seem to prefer solid surfaces when offered. Long claws may, however, increase the risk of getting stuck in the wire-mesh and for that reason long claws should be avoided. Some visitors on the farm also seem to oppose against long claws for purely ethical or aesthetical reasons. In order to satisfy the aesthetical claim for shorter claws and

to reduce significantly the risk of the fox of getting stuck in the wire-mesh, it is my impression that the claws of farmed foxes should be kept below the length of 3 cm.

The nest box environment provided in this experiment was used by the foxes for resting and hiding, and some animals used it also for scratching and performance of digging movements. The solid floor covered a considerable area of the cage environment and it was used by the foxes, but nevertheless it was ineffective in wearing down their claws. For that reason it seems unlikely that an enrichment of the cage would be a way of reducing the claw lengths of farmed foxes. This argument is supported by the fact that other husbandry animals and pets have their claws cut frequently even if they live on or are kept on solid ground.

On the other hand, this experiment shows that claw lengths are easily controlled by cutting and that the growth rate of claws is so slow and species dependent that cutting of nails is necessary only among adult blue foxes kept for breeding purpose and only once or twice a year.

Quality and colour of melatonin- and bromocriptine-induced winter fur growth in mink (*Mustela vison*) given a supplemented diet.

O.D. Slayden, J. Adair, F. Stormshak.

An experiment was conducted to evaluate the effects of diet on fur colour and quality of bromocriptine- and melatonin-induced winter pelage in mink. At weaning, 90 standard dark female kit mink were assigned randomly to one of two dietary regiments. Diet 1 (no. = 30) was a basal ranch mink diet, and diet 2 (no. = 60) was the basal diet, supplemented with liver and eggs. On 26 June 1986, mink given each diet were assigned to treatment (no. = 15) and control groups (no. = 15). Animals receiving diet 1 were treated with 120 mg melatonin implants (silastic) while those given diet 2 were treated with 120 mg melatonin implants, 60 mg bromocriptine pellets, or 60 mg bromocriptine plus 18.6 mg melatonin implants (silastic). Control groups on each diet received no implants. Subsequently, fur growth was measured at biweekly intervals. Mink treated with 120 mg melatonin, 60 mg bromocriptine, and 60 mg bromocriptine plus 18.6 mg melatonin all moulted 1 month earlier than controls and exhibited significantly greater fur growth during the months of August and September ($P < 0.05$). Mink implanted with 120 mg melatonin, and bromocriptine plus melatonin were considered to be in fully prime pelage by mid October and were pelted by October 23. Mink receiving bromocriptine alone were not considered to be in prime pelage in October and were pelted in December with controls. Neither diet supplementation with liver and eggs, nor treatment to induce early fur growth had an effect on fur colour or quality. It was also concluded that treatment of mink with bromocriptine may not completely mimic the effect of exogenous melatonin on winter fur growth.

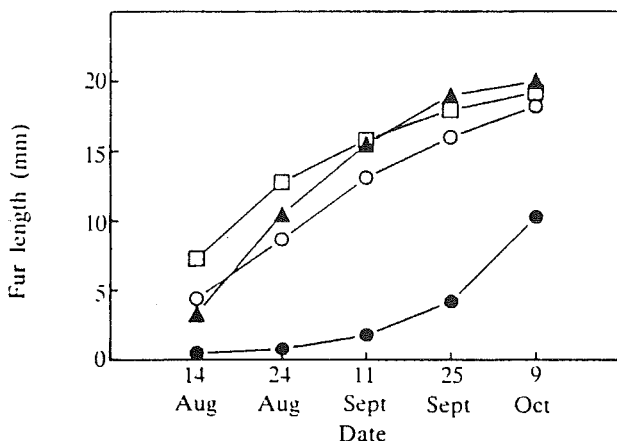


FIG. 1. Fur growth of mink treated with 120 mg melatonin (▲—▲), 60 mg bromocriptine (○—○), 60 mg bromocriptine + 18.6 mg melatonin (□—□) and control (●—●). Common estimate of s.e. = 3.4.

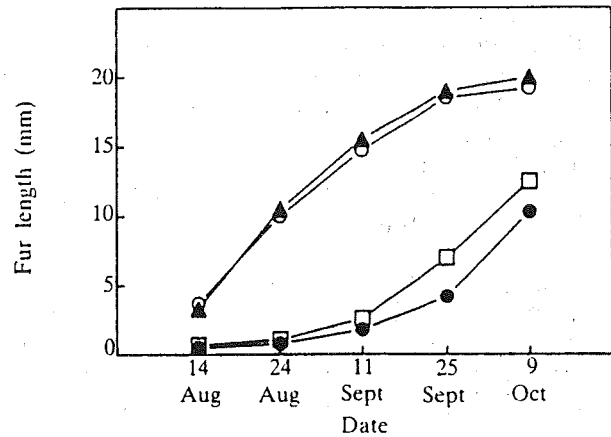


FIG. 2. Effect of supplemented diet on fur growth in mink. Mink fed a basal diet treated with 120 mg melatonin (○—○), basal diet with no implant (□—□), diet supplemented with beef liver and eggs and treated with 120 mg melatonin (▲—▲), supplemented diet with no implant (●—●). Common estimate of s.e. = 3.9.

Anim. Prod. 49, 123-127, 1989. 2 tables, 2 figs., 11 references. Authors' abstract.

A quantitative comparison of the number of alpha-MSH receptors in hair follicles of farm-bred mink (*Mustela vison*) during fur replacement and in the inguinal pelt priming defect.

A.B. Cunningham.

The specific objectives of this study were four-fold: (1) To identify the location of alpha-melanocyte stimulating hormone (α -MSH) receptors in mink hair follicles. (2) To measure the onset of receptor appearance in hair follicles as associated with fur replacement. (3) To ascertain if there are color phase differences (dark, opal, and pastel mink) in receptor numbers that could explain why these animals differ in coat color. (4) To establish if there are increased numbers of receptors in hair follicles in the inguinal pelt priming defect (IPPD). Tissues used in this research were processed using autoradiographic techniques.

Inguinal skin biopsies from dark mink were taken during the autumnal molt. Visual observations using microscopy coupled with photometric readings were used to compare the melanin granules, silver grains (with light magnification), and illuminated silver grains (with darkfield condensor) between the differential anatomical areas of the basal portions of guard hair cross sections. The α -MSH receptors were located in both the medulla and cortex in the basal portions of hair follicles.

Tissue biopsies from inguinal and back (hip) areas were taken from dark mink throughout the autumnal molt. The increases and decreases of α -MSH receptors concomitant with fur replacement indicated that receptor site appearance was associated with fur replacement.

Tissue biopsies (inguinal and back areas) from dark, opal, and pastel mink were obtained during the spring molt. No significant difference in number of α -MSH receptors existed between the different color phases.

Microscopic observations of hair follicles revealed dense amounts of melanin in dark mink, small amounts of melanin in pastels, and very little melanin in opal mink. Thus, coat color differences may have resulted from the amount of enzyme activity after receptor activation rather than from the absolute number of α -MSH receptors present on the cell membrane.

Inguinal skin biopsies taken from mink with the inguinal pelt priming defect were compared with normal inguinal tissue biopsies. The number of receptor sites from diseased tissues were significantly higher than those from normal specimens. This study established that the inguinal pelt priming defect results from α -MSH receptors persisting in the inguinal hair follicles after they should normally disappear. (Abstract shortened with permission of author).

Dissertation Abstracts International, B (Sciences and Engineering), Vol. 49, 11, 4713, 1989. Only abstract received. Author's abstract.

Effect of water trays in conventional mink cages on the well-being and production of farm mink.

Steffen Werner Hansen.

Farm mink which had from the time of weaning until pelting been living in standard cages with water trays, showed a reduced weight gain compared to mink in standard cages without water trays. A deteriorating effect on the clarity of fur colour was also observed. The presence of water trays did not affect survival of the kits, weight loss of nursing females or physiological stress response.

Farm mink like to "bathe" in water trays. The result was that the water trays were empty very soon, and then the mink used the trays as resting place or as an extension of the area where to move about.

Danish Fur Breeders Association, Technical Year Report 1989. 7 tables, 2 references, p 45-51. In DANH. Author's summary.

The structure and development of play in ferrets and dogs.

A. Sen Gupta.

This thesis investigated the structure and development of play in two ways; theoretical and empirical.

The theoretical section covers three areas. First, existing literature on animal play was reviewed to identify the basis for confusion in theories of animal play. Second, a discussion of the acquisition of the concept "play" in humans, and its effect on our understanding of animal play, revealed the appropriateness of the use of models and analogies in the study of play. Finally, the utility of Markov Chains, Hierarchical Cluster Analysis and the Grammatical Model in studying play were assessed.

In Chapter Six an investigation of the development of social play and object "predation" showed no major ontogenetic differences. In both cases, a) there was some evidence for age changes in the composition of play/"predation"; b) the majority of observations could be accounted for by a group of five "dominant" behaviour patterns.

Chapter Seven examined the function of the Open Mouth Play Face (OMPF) as a play signal. Results indicated that the OMPF did not function specifically as a play signal in young ferrets. There was also evidence that the OMPF was related to arousal in a way not exhibited by other behaviour patterns.

Chapter Eight investigated sequential structure in social play, object "predation" and aggression. Results showed great variability in the sequences of behaviour in all three contexts. All three behavioral contexts showed little variability in the identify of about initiations and about terminators. The "grammar" constructed failed to provide a formal description of social play, aggression or object "predation". These results suggest that many assumptions made about the structure of play, especially with regard to other behaviours, are invalid. The study of play should proceed in terms of identifying the structural configuration of sequences of social play.

Index to Theses Accepted for Higher Degrees in the Universities of Great Britain and Ireland, Vol. 37, 4, 1608-1609, 1988. Only abstract received. Author's abstract.

Experiment to control the weight gain of mink kits from August to December.

Carsten Riis Olesen and Tove Nørgaard Clausen.

Poor density of fur in the hip area of standard mink has a considerable negative effect on skin quality. The fattening of mink kits seems to increase the development of the problem and thus has a negative effect on quality.

In order to find the most efficient feeding model for the period around the vertex of the weight curve of kits, several levels of daily gain were tested.

At the same time the effect of feeding strategy on the hematological values of the kits was tested.

The results show that between the two feeding techniques (ad libitum and restricted) there are significant differences in skin quality of the animals. Feeding mink kits ad libitum throughout the entire growth period gives a clearly poorer result than feeding restrictively from September 1st with a maximum average gain of approx. 8 g/animal/day and from October 1st with a very moderate gain of approx. 1-1.5 g/animal/day.

The hematological parameters did not show correlation to body weight or weight/length relation of the kits. The authors therefore conclude that body condition does not affect the hematological picture except probably in cases of extreme over- or undernourishment.

Danish Fur Breeders Association, Technical Year Report 1989. 5 tables, 1 fig., p 200-206. In DANH. Authors' summary.

The effect of an oxytocin stimulating preparation on lactating mink females and weight gain of kits.

Niels Therkildsen.

In this experiment mink females were treated shortly after birth with Decomoton Vet.^R, which includes an oxytocin analogous drug, korbetocin. The aim of the investigation was to see if korbetocin could improve the weight gain of kits. An adequate amount of colostrum milk including immunoglobulins is supposed to be important for the early development of the kits. The moment of treatment, 48 hours after birth, is obviously too late to influence the production of colostrum milk.

The results show that the weight loss of lactating females until 21 days after birth only amounts to approx. 20% of the total weight loss until 45 days after birth. There were no significant differences in the weight loss of females between the two groups.

The weight gain of kits was also similar in the two groups. The main difference between the groups was that the correlation between the weight loss of females and the weight gain of kits after 21 days is negative in the control group but positive in the treated group. The correlations are, however, not significant, and thus it is concluded that there is no reason for korbetocin treatment of lactating females.

Danish Fur Breeders Association, Technical Year Report 1989. 3 tables, p 212-215. In DANH. Author's summary.

Selection for humoral immune response in mink.

Henrik Falkenberg.

The objective of this experiment was to select for a high and a low humoral immune response, respectively. Bovine serum albumin (BSA) was chosen, as it is supposed that mink do not have antibodies against BSA beforehand.

Humoral immune response in mink can be measured by means of a simple Eliza-technique. There is a large deviation in the size of the immune response, although this is not perfectly normal distributed.

Immune response is clearly heritable, thus permitting a divergent selection experiment. The line with high response (41) differs clearly from the lowest responding line (42).

After 12 months' selection there is a significant difference between the relative immune response of the two lines with line 41 (max. immune response) as the highest.

Future selection will show whether it is possible to direct the lines further from each other, and whether this will have any effect on other recordable qualities of the animals, such as for example their ability to survive/combat diseases.

Danish Fur Breeders Association, Technical Year Report 1989. 4 tables, 4 figs., 4 references, p 238-246. In DANH. Author's summary.

The role of age in the ability of mink kits to produce antibodies against bovine serum albumin (BSA).

Henrik Falkenberg.

The objective of the present experiment was to examine at which time after birth mink kits are able to produce antibodies against the antigen BSA which has been used as a model antigen in the experiment "Selection for humoral immune response in mink" (Falkenberg, 1989).

Even though an analysis of variance cannot confirm that there is a difference in immune response between the four experimental groups, the results seem to indicate that as for other animals mink can give a specific immune response early after birth, and that the efficiency of this response seems to grow with age, as both time difference between immunization and the vertex of immune response as well as difference in titre values between first and second blood sample increase with the time of the immunization.

Danish Fur Breeders Association, Technical Year Report 1989. 1 table, 1 fig., 2 references, p 247-250. In DANH. Author's summary.

Humoral immune response in "greasy kits".

Henrik Falkenberg.

The objective of this experiment was to investigate if difference in the ability to produce antibodies (humoral immune response) could be shown between greasy and normal kits and their mothers. As a supplement a number of hematological parameters (number of red and white blood cells etc.) was measured in females with and without greasy kits.

The investigation was performed in June 1989 on wild mink. 10 females with (experimental group) and 10 females without (control group) greasy kits were immunized on Thursday 1/6 with 1.0 mg BSA dissolved in 1 ml injection fluid.

The lower immune response of greasy kits compared to normal kits can be genetically conditioned or caused by the disease.

Danish Fur Breeders Association, Technical Year Report 1989. 2 tables, 2 references, p 251-253. In DANH. Author's summary.

Evaluation of a combination of tiletamine and zolazepam as an anesthetic for ferrets.

Alice Jayne Payton, James R. Pick.

A combination of equal parts by weight of tiletamine hydrochloride and zolazepam hydrochloride was evaluated clinically in 12 adult male ferrets. Two dosage levels of 12 mg/kg and 22 mg/kg were evaluated. Both doses produced excellent immobilization, the length of which was dose dependent. However, only the higher dose consistently produced good muscle relaxation. Excessive pain upon injection was not noted nor was residual lameness evident. Electrocardiographically, notching of the QRS complex was noted at both doses. Anesthesia with poor analgesia occurred at the lower dose, while ferrets receiving the higher dose showed more variability in the degree of analgesia. It was concluded that this combination administered intramuscularly provided excellent immobilization, variable muscle relaxation and a generally smooth induction and recovery. At the higher dose, analgesia was adequate for minor surgical procedures of short duration.

Laboratory Animal Science, Vol. 39, 3, 243-246. 3 tables, 10 references. Authors' abstract.

Damages and diseases of coat and skin in the nutria.

Ulf D. Wenzel, G. Albert.

In farm nutria damages and diseases of coat and skin play a particular role, as the value of a fur-bearing animal depends almost exclusively on the quality of the fur.

In nutrias, the following diseases were observed in the course of activities associated with fur animal health service and have been described by us: innate lack of hair - trichophytosis - hair matting - injuries and wounds - necrobacillosis of the skin - infestation with mites - skin papilloma.

Course of diseases and necessary therapeutic and prophylactic measures are described.

Brühl 30, 2, 32-33, 1989. 2 figs. In GERM. Authors' abstract.



Attempt at defining some factors influence on the quality of Blue Polar fox pelts.

S. Kubacki.

The pelts of Polar foxes slaughtered in a fur animal farm in November of 1983 and of 1984 were evaluated. The mean value of examined pelts in 1984 was lower by 34.51 percent as compared with those of 1983. The main causes of this lower quality were: the beige and yellowish colouring and the colour type. The lower hair density in the female pelts was also stated.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 61-72, 1987. 5 tables, 4 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Interrelationship between the evaluation of Blue Polar fox pelt on the live animal and as the raw skin.

R. Cholewa, J. Gedymin.

The winter coat of 914 Polar foxes were evaluated on the live animals and then their raw skins were classified. Generally the correlations were low and insignificant. Such great incompatibility of estimating method results makes difficult the breeding work and selection in Polar fox population.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 73-79, 1987. 2 tables, 3 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Investigations on the metabolite profile in the blood of black-silver foxes.

L. Saba, Z. Bialkowski.

The blood samples were taken in the summer, autumn and winter from 20 foxes of both sexes. The haematological and biochemical indices of fox blood were analysed. All these parameters were in physiological limits and were characterized by a high stability.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 81-87, 1987. 3 tables, 10 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Relation between age and sex and morphological and biochemical traits of nutria blood.

U. Witaszek, L. Nogowski, S. Swierkiel.

In view of a very scarce data in the hitherto literature on hematological and biochemical blood

indices of nutria - fur animal bred to a wider and wider scale investigations aiming at determination of the level of selected blood parameters taking into account the sex and age of the animals were carried out. The investigations comprises 207 nutria of the Standard breed, males and females, in the age groups: 1-year, 1-2-year and females over 2 years. Blood for analyses was taken during slaughter of the nutria at the state farm Wilczyna. Hematocrit, number of erythrocytes and leucocytes and hemoglobin level in blood as well as the level of total protein, glucose, cholesterol, free fatty acids and triglycerides, were determined. The results obtained prove the statistically significant differences connected with sex - only for free fatty acids and with age - for the remaining parameters, with the exception of total protein.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 247-254, 1987. 2 tables, 9 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Effect of dry complete mixtures on the blood metabolic profile of blue foxes.

S. Wojcik, L. Saba, Z. Bialkowski, J. Slawon.

The influence dry complete mixtures on the blood metabolic profile and the reproduction of blue polar foxes was studied. The evaluation of the metabolic profile was carried out on 30 animals divided into 3 groups. Two experimental groups were fed with dry mineral mixtures differing in the composition of components. Twice repeated blood investigations showed that feeding the mixtures caused slight decrease of a hematocrit and hemoglobin index and a significant decrease of the total protein level from 72-74 g/l as compared to 82-84 g/l in the control group. An increased activity of transaminase in blood serum was also recorded. The AspAT activity increased to 31,8-35,2 U/l in comparison with 21,7-32,1 U/l in the control group. The ALAT activity increased to 17,6-19,8 U/l and 9,2 U/l respectively. Only a slight negative influence of dry mixtures on the reproduction indices was stated.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 231-238, 1987. 3 tables, 6 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Influence of suckling period duration on the development of Polar fox puppies.

R. Cholewa, J. Gedymin.

The puppies were weaned from their dams at age

of 28 to 60 days. Their live weights were recorded at age of 60 and 90 days and their size and pelt quality was evaluated in autumn. The results obtained did not indicate a marked influence of suckling period on the growth rate and conformation traits of young foxes.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 111-118, 1987. 4 tables, 4 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Nutria keeping and diseases related to way of keeping.

U.D. Wenzel, G. Albert.

Hygienic and health problems occurring in nutria breeding and keeping are closely related to the respective way of keeping. Therefore the paper is introduced by a survey of ways to keep nutrias: in ground pens with or without pools and in elevated cages with or without pools. Advantages and disadvantages of the different ways of keeping nutrias are described, and minimum demands the pens have to comply with are pointed out. A short survey of the most frequent diseases in GDR nutria populations as related to the ways of keeping follows (salmonella infection, rodentiosis, coccidiosis, strongyloidosis). It is estimated that, from the angle of the veterinarian, dry enclosures are to be preferred to enclosures with pools.

Brühl 29, 1, 36-38, 1988. In GERM. Authors' summary.

Studies on microvasculature of the large intestine of the chinchilla.

Cleo Chen-pan.

Microcirculation of the large intestine of the chinchilla was examined by transmission and scanning electron microscopy of cast samples, in comparison with that of the guinea pig and rat. In the chinchilla, there were detected precapillary arterioles, fenestrated capillaries and venules in the mucosa of the large intestine. The densities of the fenestrae varied among different intestinal segments. In the caecum and the large colon, the density of capillary fenestrae in the subepithelial area of the luminal epithelium was higher than that in the small colon. Three types of microvasculature were identified based on the capillary distributional pattern in the subepithelial area of the luminal epithelium and in the area surrounding the crypts. In the guinea pig and rat, the caecum and the ascending colon had a similar microvasculature in that each capillary mesh connected with several vessels. The capillary

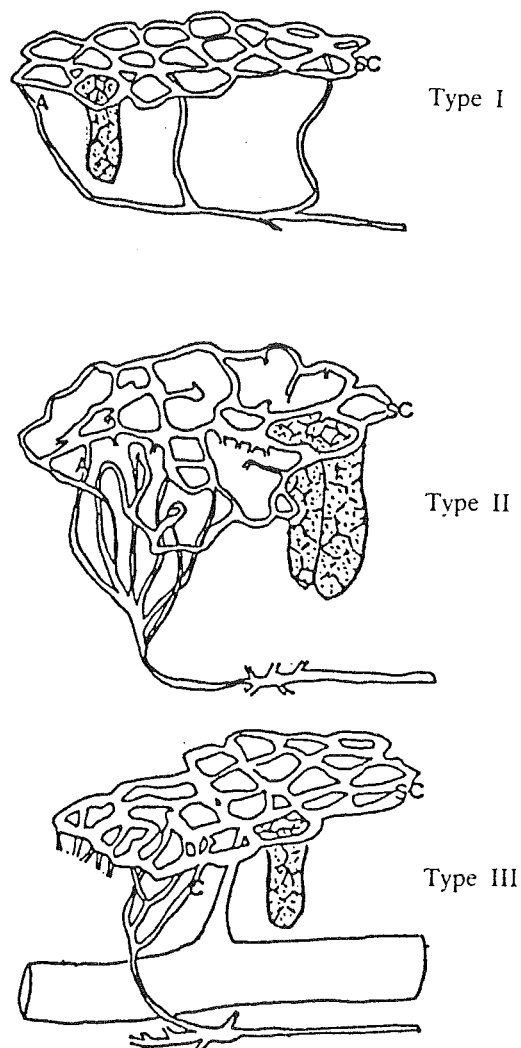


Fig. 3. Three types of the microvasculature in the large intestine of the chinchilla. Type I: a fishing net-like structure of uniform capillary meshes in the subepithelial area. Type II: numerous arterioles ascending along the crypts and irregularly formed capillary meshes in the subepithelial area. Type III: capillaries distributing uniformly in the subepithelial area and also descending to surround crypts. SC: subepithelial capillaries, A: artery, C: capillaries.

density in the large intestine was the highest in the chinchilla among the three species examined.

Jpn. J. Vet. Sci. 50, 6, 1215-1221, 1988. 9 figs., 27 references. In ENGL, Su. JAPN. Author's abstract.

Morphological aspects of male genitalia of the coypu.

M. Bura, C. Radu, C. Ganta.

The coypu has neither cremaster externus muscle nor neck of vaginal process and for that

reason the authors propose the term testicular diversticuli of abdominal wall. The epididymis is mostly detached from epididymal border of testicles. In consequence, the authors propose the term epididymal testicular pol instead of epididymal border, comparable with that from domestic mammal. The free border of testicular mesos includes an storage of fat with considerable dimensions, and the tail ligament of epididymis is indefinite. Different canuuls haven't ampillae and doesn't exist ejaculatory canal. The penis has os penis.

Lucrari stiintifice, I.A.T., Vol. 21, 69-70, 1986. 2 references. In ROMN, Su. ENGL. Authors' summary.

Histology of the male genitalia of the coypu.

M. Bura, M. Sincai, S. Botarel, N. Gluhovschi.

Making histological examinations of genital system components at adult coypus, there were shown some morfological peculiarities. So, seriate sections through penis points out in the third anterior part of the organ the existence of a penian bone with a cartilaginous structure in the initial portion. Also the microscopical examination of the perianal gland shows that it has a similar structure with the sebaceous glands, the secretion mechanism, it sums, it is the holocrin type. Interesting aspects were observed in the structure of vesicular glands too, which are cavitar, but with a very pleated wall, with numerous ramifications, as well as in the structure of bulbouretral gland rohich has a rich wall in smooth and striated muscular fibres, that intervene in excretory mechanism.

Lucrari stiintifice, I.A.T., Vol. 21, 71-73, 1986. 1 reference. In ROMN, Su. ENGL. Authors' summary.

Liver angioarchitectonics at coypus.

C. Radu, C. Ganta, R. Palicica, L. Simion.

The coypus liver has six lobes: lateral left, medial left, quadrate, medial right, lateral right and caudate. The processes of the caudate lobe are not

pediculate. The quadrate lobe is annexed in its greatest part to the left medial lobe. All liver ligaments are present. The hepatic artery and the portal vein divide into two terminal branches, left and right, whose distribution does not exactly coincide. The portal vein passes through the hepatic parenchyma in the proximity of the

dorsal border of the organ. The caudate and the lateral right lobes are irrigated from a common trunk provided from the right terminal of the hepatic artery or caudate lobe has an own arterial branch detached from left terminal branch of the hepatic artery and the lateral right lobe from another branch which provide from the right arterial branch of the hepatic artery. The right branch of the portal vein is distributed to caudate and lateral right lobes, and the left branch to right medial, quadrate, left medial and left lateral lobes. There are 3-4 hepatic veins. In one from two cases the common hepatic duct was absent. The configuration of the confluence of biliary extra-hepatic ducts is variable. Bile duct flows into neighbourhood of the mesenterial border of the duodenum at approx. 5 cm away of pylorus.

Lucrari stiintifice, I.A.T., Vol. 21, 151-153, 1986. 2 references. In ROMN, Su. ENGL. Authors' abstract.

Danish Statistics in 1989.

Anonymous.

The 1989, in Denmark, there were 3,018,470 mink, 10,719 blue foxes, 24,612 silver foxes, 2,083 shadow foxes, 2,863 other types of fox, 1,147 polecats, 233 raccoon dogs and 15,000 chinchillas vs. 2,827,417, 21,973, 26,700, 4,243, 4,599, 779, 465 and 10,000 resp. in 1988. The number of mink, fox, polecat, raccoon dog and chinchilla breeders was 5,132, 619, 72, 18 and 382 resp. in 1989, and the av. mink farm comprised 588 breeding females. Of mink breeding females 42.66, 34.25 and 12.70% resp. were Scan Black, Scan Brown and Pastel. Data are presented in 5 tables.

Våra Palsdjur, 60, 7, 210, 1989. 5 tables. CAB-abstract.

Singe, dark leather, hair clipping, infertility and related diseases: Their common origin.

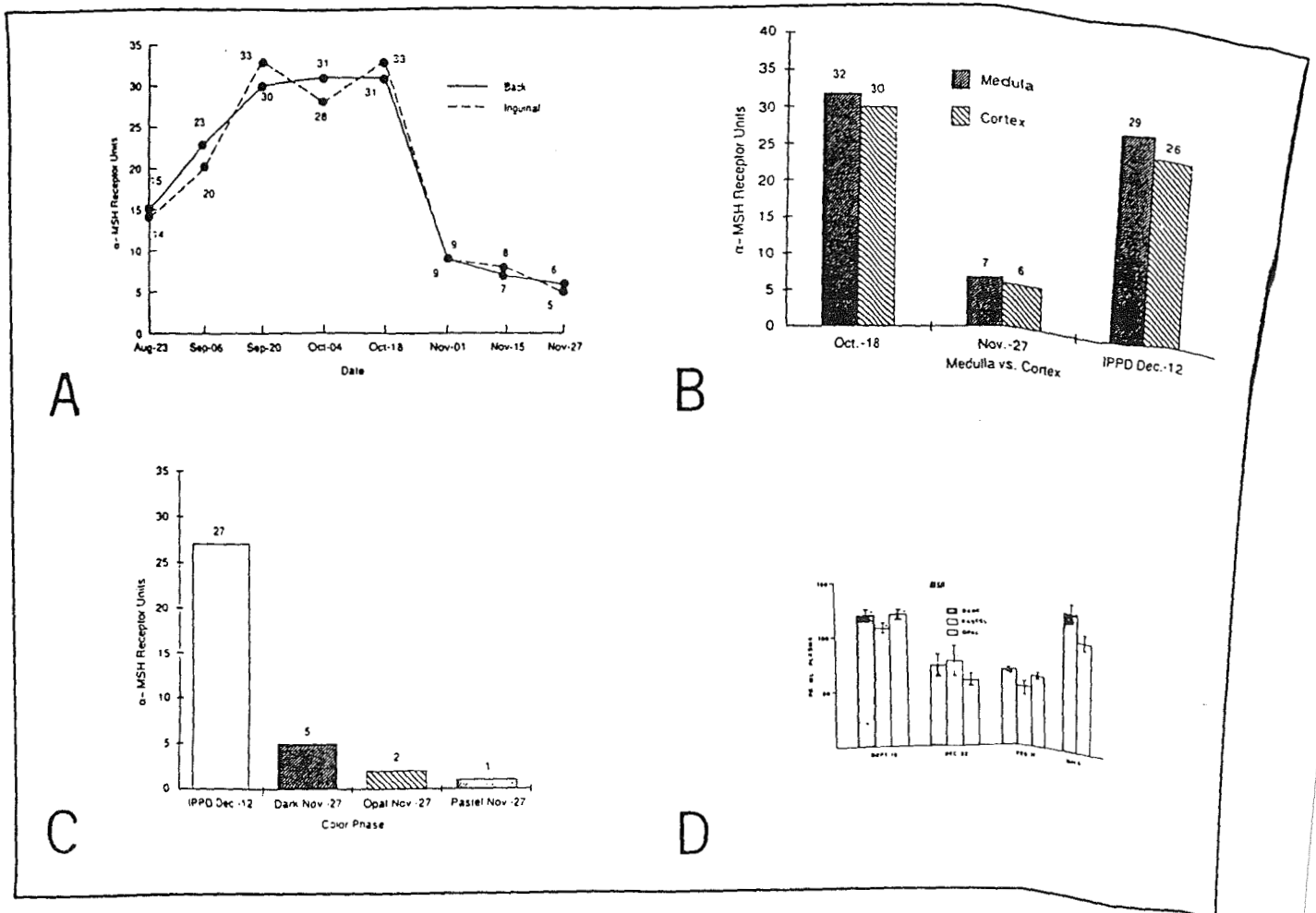
LeGrande C. Ellis, Baha M. Alak, David Patten.

In the genetic selection of mink with dark guard hairs with a sheen and the dense, dark underfur, there has been a selection for animals that have overstimulation mechanisms within the melanocytes that results in the production of large



amounts of highly-oxidized melanin that is found not only in the medulla and cortex of the hairs as is the case for the mutant color phases, but in the cuticle as well. Twelve years of research on single, dark leather, hair clipping, infertility, nursing sickness, aseptic gastroenteritis, and hindleg paralysis now indicates that they all have similar etiologies. There is edema resulting from the localized production of vasoconstrictive compounds, some localized hemorrhagic foci, cellular death from overstimulation, connective tissue necrosis, and some localized itching or mild pain in the skin causing hair clipping. Connective tissue necrosis is then followed by the development of granular tissue. This damage appears to affect all of the major organs and is more prevalent in males than females (excepting neonatal kit loss and nursing anemia). Separate genes appear to orient the damage to specific organs (e.g., brain, gonads, skin, etc.) causing the specific production problems noted above.

Figure 2: α -MSH receptor levels in the hair follicles and α -MSH levels of dark, opaline, and pastel mink during various stages of the yearly cycle. Figure 2A shows the follicular receptors of dark mink in the hip and inguinal regions during the fall molt. Figure 2B shows the α -MSH receptor levels on cells of the medulla and cortex of developing lancets of dark mink on Oct. 18 and Nov. 27 just before pelting and in skin samples from this strain with dark leather (inguinal pelt priming defect). Figure 2C shows the elevated α -MSH receptor levels in the skin of normal darks, compared to receptors of opalines, and pastels. Figure 2D shows the high levels of plasma α -MSH during the fall (Sept. 15) and spring (May 8) molts and lower basal levels during the inactive phase (December and February) for dark, pastel, and opaline mink.



Investigations on uniaxial straining of fur in skin state. Part I. Effects of straining on skin length, contraction and fur characteristics.

K. Rouvinen, P. Niemelä, M. Marjoniemi, E. Kemppinen, E. Mäntysalo.

This study attempts to clarify the effect of straining in the conservation of mink and blue fox skins on their length, contraction in dressing, and their general fur characteristics. 80 blue fox and 88 scanblack mink skins were divided into four groups each and submitted to following experimental treatments before fixing them onto stretching boards and drying: no straining, straining with muscle power, a load of 200 N and a load of 400 N. The skins were measured for their initial fresh length, for dried length, and also for dressed length. The fur characteristics were evaluated in the dried raw skin state after 3 months' storage before dressing.

The length of the raw skins increased with increased straining load both in minks and blue foxes. Contraction of the skins in the dressing process was also the more prominent the stronger the strain had been, but all the skins returned to their initial fresh length. In blue foxes, the fur characteristics were significantly affected by straining. Color purity, mass and quality class deteriorated when the straining load was raised. In minks, straining did not affect fur quality in the dried raw skin state, but nearly half of the skins strained with the strongest load appeared to be shapeless and pouch-like after dressing.

The fact that pricing at auctions is determined by skin size has brought a temptation to "create" more length to the skins in conservation. This leads, however, to an undesirable deterioration of skin quality, especially in blue foxes. Straining of a certain degree before drying is needed to improve skin elasticity in dressing, but it should be even and kept within reasonable limits, or the fiber structure of the skins will be permanently damaged.

Tampere University of Technology Department of Electrical Engineering Physics. Report 5, 1990. 2 tables, 8 references, 9 pp. In ENGL. ISBN 951-721-480-4. ISSN 0359-811X. Authors' abstract.

Investigations on uniaxial straining of fur in skin state. Part II. Effects of straining on physical characteristics in leather state.

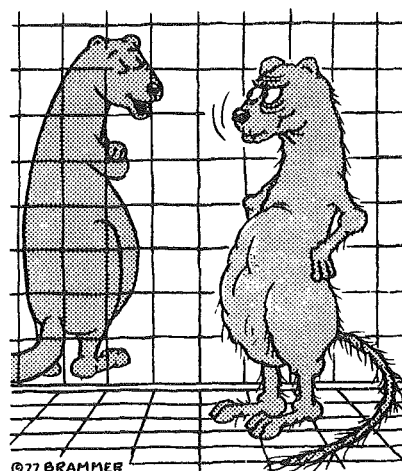
M. Marjoniemi, E. Kemppinen, E. Mäntysalo, K. Rouvinen, P. Niemelä.

Uniaxial strain of varying magnitude as applied to skins of male and female blue fox (*Alopex*

lagopus) and male scanblack mink (*Mustela vison*) in the conservation process. Effects of the strain along the line of the backbone on physical characteristics, i.e. elongation at break, breaking load, breaking energy and tensile strength were investigated for a number of selected leather samples by using a previously reported special sampling set system. According to the results obtained in this work the mechanical strain has a considerable effect on the physical characteristics of fox leather. The effect is not so clear in the case of strained mink leather.

On the basis of the results obtained in this work it is concluded that fox and mink leather can be strained with a load of 400 N. Even in this case the breaking load remains a high enough value to meet the lower acceptable value for breaking load. Straining with a load of 400 N along the line of the backbone only to some extent homogenizes the tensile and elongation behavior of the leather with respect of the transversal direction.

Tampere University of Technology Department of Electrical Engineering Physics. Report 6, 1990. 3 tables, 12 figs., 5 references, 25 pp. ISBN 951-721-481-2. ISSN 0359-811X. Authors' abstract.



I would have thought "elastic skin" fitted a bit better.

Three new plasma protein polymorphisms in domestic foxes, detected by a simple method of 2D horizontal electrophoresis.

R.K. Juneja, T. Niini, H.E.B. Larsson, B. Gahne.

Plasma samples of 270 foxes from 45 complete families (14 of arctic foxes, 28 of silver foxes and 3 with arctic x silver fox hybrid offspring) were analysed by a method of two-dimensional agarose gel (pH 5.4) - horizontal polyacrylamide

gel (pH 9.0) electrophoresis followed by general-protein staining of gels. Genetic polymorphism of three plasma proteins, tentatively designated prealbumin (Pr), postalbumin 1 (Pa1), and pretransferin 1 (Prt1), was observed. In silver foxes, Pa1 and Prt1 showed a high degree of polymorphism, each with 3 common alleles, while Pr showed a scarce polymorphism. The arctic foxes were monomorphic for Pr and Prt1 and showed a scarce Pa1 polymorphism. The Prt1 phenotype of arctic foxes showed identical mobility with one of the Prt1 variants of silver foxes.

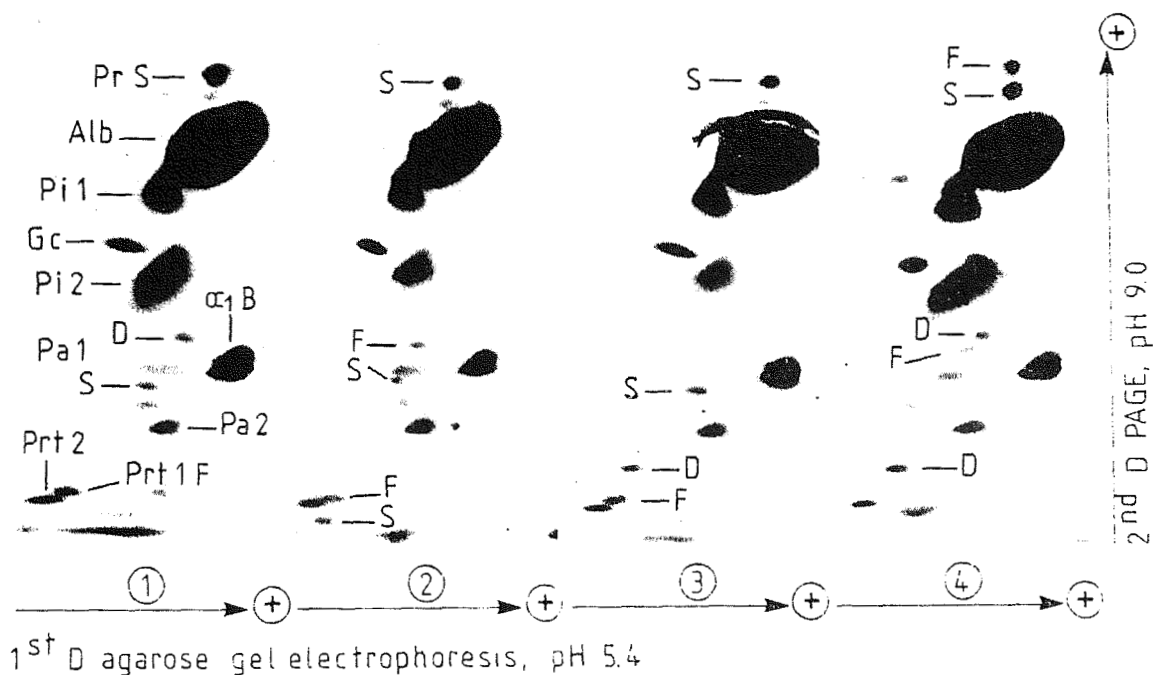


Fig. 1. Two-dimensional electrophoresis, followed by general-protein staining, of four plasma samples of silver foxes. The symbols used for different proteins are: Pr, prealbumin; Alb, albumin; Pi1, protease inhibitor 1; Gc, Gc protein; Pi2, protease inhibitor 2; Pa1, postalbumin 1; α_1 B, α_1 B-glycoprotein; Pa2, postalbumin 2; Prt1, pretransferin 1; Prt2, pretransferin 2. The phenotypes of samples 1-4 (also written in the Figure) are: Pr-S, S, S, FS; Pa1-DS, FS, S, DF; Prt1-F, FS, DF, D. Note that the bottom 3 cm part of the separation gels is not included in this Figure and the only distinct fractions in that region were those of transferrin (Tf).

Hereditas 110, 159-164, 1989. 2 figs., 3 tables, 14 references. Authors' abstract.

Polymorphism of esterases in plasma of foxes.

Arne E. Andersen, Mikael Braend.

Plasma samples from 114 arctic foxes and 40 silver foxes have been investigated by use of isoelectric focusing in polyacrylamide gels. At pH ranges 4-6.5 and 4.2-4.9 and after specific staining, arylesterase (AAR_E) appeared as poly-

morphic band patterns. These could be explained by three codominant alleles in arctic foxes and two codominant alleles in silver foxes. Segregation figures in families agreed with the genetic theory.

Hereditas 110, 109-111, 1989. 2 figs., 1 table, 11 references. Authors' abstract.

The comparison of basic breeding traits of Polish and Norwegian blue polar foxes against the background of existing purchase and export of fox coats in Poland.

S. Kubacki.

The research was performed on polar foxes (*Alopex lagopus* L.) of POLISH and NORWEGIAN types coming from Fur animals Farm of Wiartel State Farm. The experiments covered 4272 females (1234 females of the Norwegian type) bred from 1976 to 1985. The obtained data allowed to characterize the examined females group as far as their breeding usability (fertility) was concerned. They also allowed to establish relations between breeding features and other usage traits of the foxes. The research dealt also with the coats quality and the level of polar foxes coats production. The study of the coats quality concerned laboratory measures of hair coats and skin tissue histology. The investigation proved that: - the Norwegian type of a polar fox examined in Polish conditions as far as discussed fertility indices were concerned, did not differ from mean indices obtained for the females of the Polish type, it often showed even higher measures; - the earlier date of females cubbing which is to high extend genetically conditioned ($r^9 = 0,4-0,8$), had good influence on females fertility. However, the factor that clearly influenced the breeding results was the females age. Young females delivered and bred much fewer cubs than the older ones; - hair coat of the Norwegian fox differed favourably in comparison to the Polish type as far as the hair length and thickness, medulla thickness and the ratio of the number of underhair to one overhair were concerned. There was no proof of better hair forming at the Norwegian fox ($\frac{S}{P} = \frac{36}{1}$).

It should be assumed that better hair coat appearing at the Norwegian fox is the result of bigger histological thickness (S+P); - the presented tendency of polar foxes coats production and export as far as the quality and the quantity of coats produced in Poland are concerned, proves that this production not only does not keep up with the world production but also shows recession from the quality level obtained earlier; - the low level of Polish fox coats quality was caused mainly by faults and damages (over 50% of examined coats showed faults). It proves bad breeding conditions, wrong slaughter date and wrong preservation; - there is a low level of relation between breeding animals evaluation (licence) and the coat evaluation at purchase and the evaluation of fur coats prepared for auction sale. Little correlation appeared also between the evaluation according to the Polish Norm used at purchase and the evaluation performed according to the lot instruction for breeding foxes coats.

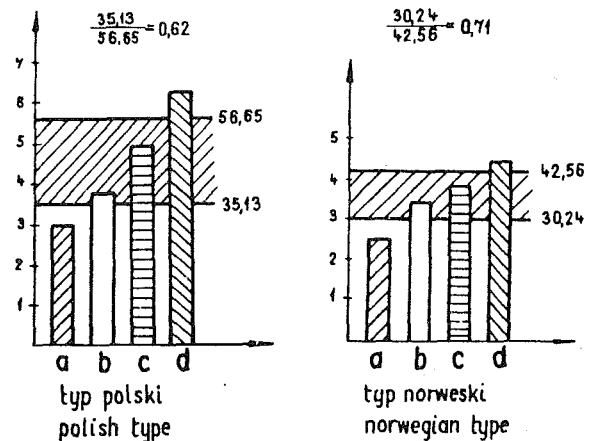
Rising the level of the coats production needs the knowledge of many factors which influence the final effect. It is important to analyse country data connected with the coats production and trade, to get acquainted with the world fur market, to improve feeding and breeding conditions and the methods of animals improvement.

Legenda:

a - włosy puchowe
b - włosy przejściowe
c - włosy ościste
d - włosy przewodnie

Legend:

down hair
awned down hair
awn hair
guard hair



Rys. 1. Stosunek wysokości warstwy podszycia do warstwy pokrywowej u lisów polarnych

Fig. 1. The ratio of the high of undercoat to overcoat in the polar foxes

Rozprawy, no. 36, 102 pp, 1989. 27 tables, 13 figs., 171 references. In POLH, Su. ENGL, RUSS. Author's summary.

Repeatability of Polar fox female fecundity (*Alopex lagopus* L.).

S. Kubacki.

Repeatability of number of born and weaned puppies in litter was relatively low and next to similiar parameters calculated for other females of the related genera. The highest repeatabilities were obtained for females between the first and third year of their reproductive life.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 139-145, 1987. 1 table, 10 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Culling causes of the Blue Polar foxes.

O. Szeleszczuk, S. Jarosz, W. Koczera.

The visual score and anatomo-pathological examination of culled foxes (26 females and 27 males) from 2 breeding farms as well as bacteriological and pathological analyses were carried out. A lack of testicles in the scrotal bag was found in 2 males. The inflammatory state in uterine horn of 11 females, occlusion of oviducts or of uterine cervix and hydronephrosis in 3 females there were stated. The pathogenic strains of *Escherichia coli* and *Streptococcus aureus* in uterine horns were found too.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 37-50, 1987. 3 tables, 16 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Pelt value of nutria of the amber-golden variety.

S. Niedzwiadek, G. Palimaka-Rapacz.

Investigations comprised 24 skins of nutria of the amber-golden variety, including 12 skins of males and 12 ones of females. The skins were obtained from animals reared by the cage-bathless system, slaughtered at the age of 7.5-8.0 months. The area of raw skins amounted to 15.5 dm². The weight of skins of males amounting to 202.9 g was significantly higher as compared with those of females - 186.4 g. The furs of the

amber-golden nutria were characterized by a considerable thickness; the joint SGM value amounted to 39.08 mm. The thickness of downy hairs in particular topographic points varied within 11.0-13.1 microns and of fur hairs - within 94.9-128.7 microns. The density of downy hairs in the abdomen part varied within 14 425-18 975 hairs per 1 cm² of skin. In the back part the density varied within 7 895- 9 189 hairs per 1 cm² of skin.

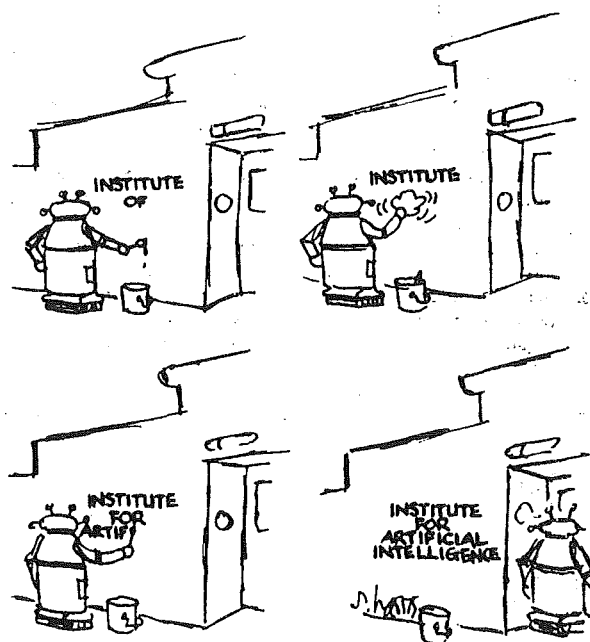
Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 255-265. 4 tables, 10 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Breeding of fur bearers in the year 2000 in the light of recent breeding techniques.

Einar J. Einarsson.

An account is given of the importance of artificial insemination (using fresh and frozen semen), sex control, embryo transfer, cloning, gene mapping, DNA finger printing, gene regulation, gene micromanipulation, tissue typing, monoclonal antibodies, melatonin implants and light regimes for the reproductive performance and pelt production in mink, blue foxes and silver foxes.

Norsk Pelsdyrblad 63, 3, 6-9, 23, 1989. 1 table, 4 figs. In NORG. CAB-abstract.



Erratum:

When presenting the abstracts from NJF-Seminar No. 170 in SCIENTIFUR, Vol. 13, No. 4, unfortunately we left out one of the authors. Therefore we bring the full abstract of the poster in this issue and ask the authors to accept our apology. This reference will appear in our database. The sorry editor.

Electrolyte and acid/base changes in lactating female mink (*Mustela vison*) subject to nursing sickness.

Tove Nørgaard Clausen, Otto Hansen, Søren Wamberg.

Nursing sickness is a widespread disease of ill-defined etiology observed in inadequately nourished female mink in the latter part of lactation. The incidence rate is high among female mink raising large litters, with heavy mortality losses among those females affected. In Denmark total losses due to nursing sickness in mink during the 1989 breeding season have been estimated to be about 150,000 dams, representing a value of approx. 4 mill. \$.

Clinically, the ailment is characterized by an extreme loss of body mass, diminishing appetite, progressive weakness and staggering gait. In the advanced stage, severe dehydration, lethargy and non-ketotic stupor or coma precedes death.

In a pilot study in 1988, *Clausen & Hansen* observed heavy losses of intra- and extracellular water and electrolytes in a few dams with clinical signs of nursing sickness.

The present investigation was planned and started in spring 1989 in order to evaluate the factors involved in the development, pathogenesis and maintenance of nursing sickness in mink. Preliminary results obtained from our study in nursing mink with large litters in the 1989 breeding season clearly demonstrate that nursing sickness is associated with distinct changes in water, electrolyte and acid-base metabolism. Whole blood

glucose and serum potassium concentrations increased by 200-400% and 200%, respectively, whereas that of sodium in serum decreased by 20%. The concentration in urine of potassium was low, and that of sodium was extremely low, suggesting a high extracellular aldosterone activity. Furthermore, low values of whole blood base excess and plasma bicarbonate were found, with or without increased concentrations of plasma lactate, indicating variable degrees of metabolic acidosis. The absence of ketonemia and ketonuria clearly demonstrated that classical met-ketosis can be excluded as causal factors in the development of nursing sickness.

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NJF Seminar 170, 1989. 3 references. Poster. Authors' abstract.

Effects of PMSG and GnRH for ovulation induction and stimulation on reproductive performance of once-mated mink.

H. Hattenhauer, P. Tschauschev, R. Krieg, A. Pot-schulat, R. Stein.

In the frame of four experimental series involving experimental and control groups of 20 to 25 female minks each, studies were made on the possibility of improving the generally low reproductive performances of female minks mated once by means of biotechnical treatment to draw level with the results of twice-mated females. For this purpose the following methods were tested: ovulation induction (OI) with 10 µg GnRH applied to each mink eight days before planned mating date; OI with 10 µg GnRH per animal pretreated (three to four days before OI) with 50 IU PMSG; OI with 10 µg GnRH per

animal receiving additionally 50 IU PMSG five days after OI; ovulation stimulation (OS) with 10 μg GnRH per animal within one hour after mating, and OS with 10 μg GnRH per animal pretreated (three to four days before OS) with 50 IU PMSG. In comparison with all other methods, OI produced higher reproductive results in terms of conception rates and litter size. The method contributed to raise the reproductive performances of once-mated female minks so that they were better than the results of untreated animals mated twice. The results were similarly good after OS with PMSG pretreatment, especially when the animals were mated in the last two weeks of March. The other methods tested were found to be to some extent disadvantageous and not satisfactory.

Archiv für Tierzucht, 30, 6, 529-538, 1987. 10 tables, 9 references. In *GERM*, Su. ENGL, RUSS. Authors' summary.

Preliminary study on the suitability of Suacrone (beta-adrenergic blocker) during the mating period of Polar fox males.

K. Sciesinski, A. Frindt.

The 55 Polar fox males were injected with various doses of Suacrone. The animals well tolerated the drug and the profitable effect of Suacrone on their sexual activity was also stated.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 129-138, 1987. 3 tables, 12 references. In *POLH*, Su. ENGL, RUSS. CAB-abstract.

Size distribution of ferret luteal cells during pregnancy.

M.M. Joseph, R.A. Mead.

Steroidogenic cells in the corpus luteum of the ferret (*Mustela putorius*) during early (Days 6 and 13) to midpregnancy (Day 24) were characterized using electron microscopy, immunocytochemical localization of neurophysin, and smears of dispersed cells obtained by dissociating luteal cells with collagenase. The latter were stained for 3β -hydroxysteroid dehydrogenase (3β -HSD) activity, and the diameters of the cells were determined with an ocular micrometer. Very small cells ($<12\ \mu\text{m}$) stained negative for 3β -HSD, occurred in clumps of 5-50 cells, and were presumed to be primarily endothelial cells. 3β -HSD-positive cells covered a wide spectrum of sizes ranging from 14 to 56 μm and did not exist as two discrete populations. The ratio of small ($<25\ \mu\text{m}$) to large ($>25\ \mu\text{m}$) cells was 1.86:1.0 on Day 6, with the

17- to 20- μm cell size class predominating. On the day of implantation (Day 13), about 75% of the cells ranged from 26 to 50 μm , with the 29- μm size predominating. By Day 24, the ratio of small-to-large cells had declined to 0.15. Nearly 90% of the cells were in the 26- to 56- μm range, the predominant size being 35 μm . All size classes of luteal cells stained negative for neurophysin on all 3 days of pregnancy studied. Luteal cells obtained on Days 6, 13, and 24 of pregnancy failed to reveal any evidence of mitosis after *in vivo* or *in vitro* colchicine treatment. We interpret these results as indicating that the 3β -HSD-positive luteal cells of ferrets progressively increase in size as small luteal cells complete their differentiation from granulosa cells and ultimately from larger luteal cells with somewhat different ultrastructural characteristics.

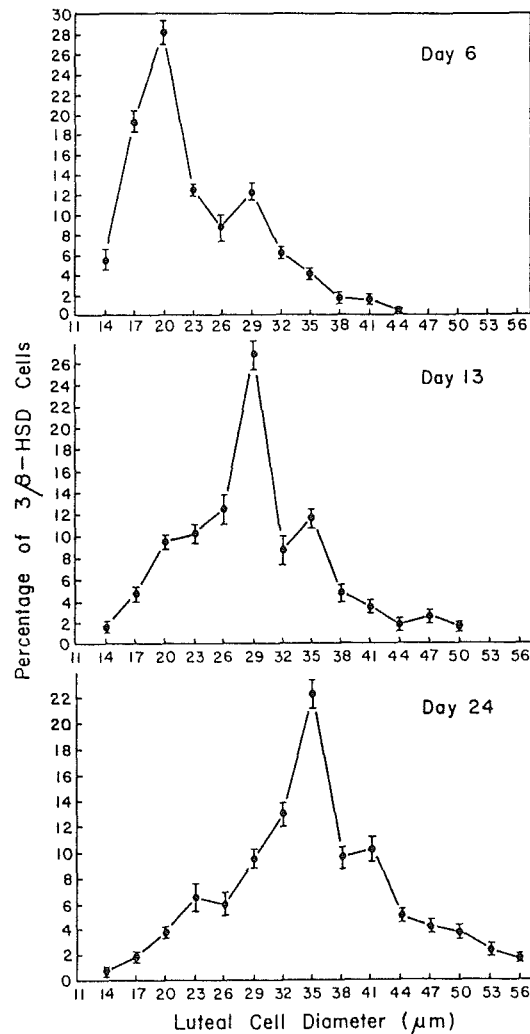


FIG. 1. Mean percentage \pm SEM of 3β -hydroxysteroid dehydrogenase (3β -HSD)-positive dispersed luteal cells for each size range on Days 6, 13, and 24 of pregnancy.

Biology of Reproduction 39, 1159-1169, 1988. 1 table, 10 figs., 32 references. Authors' abstract.

Control of body condition and flushing of mink - effect on litter size and progress of lactation period.

Carsten Riis Olesen.

The objective of the investigation was to study whether females, which are pressed far down in body condition in order to be "flushed" towards the time of mating, will get more kits and perhaps at the same time have problems in the lactation period.

The controlling of body condition of females in the winter period and flushing just before mating are correlated in the way that the control of body condition will decide to which extent flushing is possible.

The results show that it is recommended to keep the females in a body condition of around 900 g in winter. This body condition will permit a moderate flushing at the beginning of March.

Danish Fur Breeders Association, Technical Year Report 1989. 2 tables, p 150-153. In DANH. Author's summary.

Testing of MEDATA pregnancy controller for mink.

Tove Nørgaard Clausen.

Examinations for pregnancy in mink females were performed by means of a Medata K9 pregnancy controller.

It is not possible with this technique to point out barren females at the middle of April with a view to pelting.

Danish Fur Breeders Association, Technical Year Report 1989. 1 table, 1 fig., p 178-181. In DANH. Author's summary.

Examination of ovulation and fertilization time of mink females.

Tove Nørgaard Clausen and Carsten Riis Olesen.

Examination of mink females in the month of March in order to demonstrate time of ovulation and fertilization in relation to time of mating has been carried out in 1988 and 1989 on a total of 22 females.

Time of ovulation was indicated as 40-46 hours after mating.

Time of fertilization was indicated as 42-50 hours after mating.

Using 1+1 mating of females at the end of March instead of 1+2 mating will give the result that "fresh" semen are present in the Fallopian tube when the ovulation takes place after 1st mating.

Danish Fur Breeders Association, Technical Year Report 1989. 1 table, 2 references, p 182-186. In DANH. Authors' summary.

Development of testicles in mink.

Niels Therkildsen.

The aim of this investigation was to describe the development of testicles in young males from the beginning of January until immediately after mating at the end of March. Furthermore, at the end of March the weight of testicles and epididymis as well as body weight were recorded. The testicle recordings obtained were then correlated with the reproduction results of the males. The investigations were made on males from a strongly inbred line and from a line without any inbred worth mentioning.

Evaluation of the size of testicles was done by palpation 5 times during the investigation period: on 6/1, 20/1, 1/2, 3/3 and 20/3. The results show an evenly increasing size from 6/1 until 3/3 and then a slight decrease in the mating period until 20/3.

Generally there is a good positive correlation between testicle sizes obtained on the dates mentioned, especially at the end of the period. Therefore, at the evaluation of testicles on 6/1 it is possible with some certainty to predict the size of the testicles around the normal mating time of mink in March. There is a significant positive correlation between evaluations of testicles in March and weight of testicles and epididymis on 20/3.

The correlation between body weight and weight of testicles and epididymis on 20/3 is not significant.

In one of the lines examined, there was a high and significantly positive correlation between weight of testicles and epididymis in the left and right side. In the other line this correlation was not found.

In one of the lines a positive and significant correlation was found between weight of testicles and epididymis and the breeding result of the male in the form of kits alive per litter and per mated female for the males on average. In both lines no significant correlation was found between evaluation of testicles and breeding result expressed as kits/mated female and kits/litter for males on average.

Provided testicles are present in scrotum, their size evaluated by palpation has no influence on the breeding result of the males.

Danish Fur Breeders Association, Technical Year Report 1989. 3 tables, 5 references, p 216-223. In DANH. Author's summary.

An examination of the importance of ovaries/placenta to the maintenance of pregnancy in mink.

Henrik Falkenberg.

In the beginning, pregnancy is maintained by means of an increased production of progesteron by corpus luteum in the ovary. The objective of this experiment was to suspend the production of progesteron in the ovary, by chemical or surgical treatment, at certain intervals from mating and examine the importance of this operation to the progress of the pregnancy as well as to the production of progesteron from corpus luteum.

To reduce the production of progesteron in the ovary Estrumat R vet. was used. This preparation contains cloprostenolum and is a prostaglandin analogus preparation with significant luteolytic effect (Christiansen, 1981).

Removal of the ovaries on 13/4 makes the females become barren and causes a severe reduction of progesteron concentration. This seems to indicate that pregnancy is maintained by the progesteron production in corpus luteum at least until the middle of April. Whether later on control of pregnancy is taken over by placenta, cannot be evaluated on basis of this experiment.

Danish Fur Breeders Association, Technical Year Report 1989. 4 tables, 3 references, p 228-232. In DANH. Author's summary.

Testing of Antex and Physex on mink females before and simultaneously with mating.

Henrik Falkenberg.

On Research Farm South a hormone product, Gonadoplex leo vet, was tested in 1988 with the objective of increasing litter size and decreasing percentage of barren females (Falkenberg, 1988).

Gonadoplex is a mixture of two other hormone preparations, Antex and Physex, in a 2:1 ratio.

Gonadoplex was injected 7 and 3 days before 1st mating and 5 days after 1st mating.

The experiment showed no significant differences in whelping result between the groups examined.

The objective of this experiment was to separate Antex and Physex which were then injected before and simultaneously with 1st mating.

The number of fertile follicles was counted on some females from the control group as well as from the experiment, and the content of progesteron in blood was measured for both groups.

Antex is analogus to the follicle stimulating hormone FSH, and Physex is analogus to the luteinizing and egg-releasing hormone LH.

Injection of the hormones Antex and Physex gave a significantly lower breeding result compared to the control group.

The experimental group had a higher plasma progesteron concentration in March and April compared to the control group, and there was a significant, negative correlation between plasma progesteron and number of kits at birth on 28/3.

No difference in number of follicles was found between the two groups.

Similar number of follicles in the two groups, seems to indicate that injection of Antex was not able to develop more follicles. The higher amount of progesteron in the research group can indicate that as a result of LH hormone more follicles were released and thus more corpus luteum had been formed than in the control group.

The low whelping result and the high percentage of barren females in the experimental group is explained by a loss of eggs before implantation or foetuses during the period of gestation.

Danish Fur Breeders Association, Technical Year Report 1989. 3 tables, 1 fig., 1 reference, p 233-237. In DANH. Author's summary.

Progesteron as heat diagnosis in blue foxes.

Henrik Falkenberg.

In 1988 the following heat-diagnostic methods were compared on Research Farm South: visual control of labia, microscopic examination of vaginal cells, temperature measurement, measurement of resistance and measurement of progesteron in blood plasma (Falkenberg, Therkildsen, Møller, 1988).

All the foxes in the above mentioned experiment were inseminated on basis of a series of measurements of resistance, and the conclusion of this experiment was that a measurement of plasma progesteron was a possible alternative heat-diagnostic tool to measurement of resistance.

The objective of this experiment was to inseminate a group of females by means of measurement of resistance and measurements of progesteron in blood plasma, respectively.

The percentage of barren females was slightly higher, but the whelping result was slightly better when using progesteron instead of measurements of resistance.

In practice, the daily blood tests and analysis of blood samples will probably be too time-consuming and too expensive for the method to be used on ordinary fox farms. However, it is possible that progesteron analyses could be performed on male stations and be a tool for heat-diagnostication of problem females that are not showing clear signs of heat.

Danish Fur Breeders Association, Technical Year Report 1989. 1 table, 3 references, p 224-227. In DANH. Author's summary.

Greasy kits. Results from Research Farm West 1989.

Carsten Riis Olesen and Tove Nørgaard Clausen.

On Research Farm West most of the experiments in the lactation period of 1989 were mainly started to provoke greasy kits or avoid them, respectively.

When examining the results across the groups, but each colour type individually, the following general characteristics were found:

- 1) The frequency of greasy kits was higher among young females.
- 2) Females with greasy kits had approx. 1.1 kit more at birth than females without greasy kits.

Average weight of the kits was lower in litters with greasy kits.

Females with greasy kits lost significantly less weight in the latter part of the lactation period than females with normal kits.

- 3) On average females with greasy kits gave birth later than females without greasy kits.

Danish Fur Breeders Association, Technical Year Report 1989. 9 tables, 3 figs., p 154-164. In DANH. Authors' summary.

Influence of mating frequency and pregnancy duration on reproductivity of Blue Polar foxes.

H. Bernacka.

The observations were carried out on 2070 vixens from a fox farm in the period of 1974-80. The vixens were mated once, twice or three times. The pregnancy lasted 50 to over 56 days. The age of females, number of born and weaned kits in the litter were analysed. The highest reproductive parameters were obtained in the vixens by three times mating and by pregnancy lasting 51-53 days.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 119-128, 1987. 2 tables, 11 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Relation between mating time and pregnancy duration, litter size and fertility in minks.

B. Barabasz, S. Jarosz, J. Kasperczyk.

Many investigations prove the existence of relationships between the covering date and the pregnancy duration on the one hand and the number of litters and fertility in minks on the other. The aim of the work was to investigate this relationship. The respective observations were carried out in 1980-1982 at the farm situated in the north-eastern region of the country; in total 2927 kittened females of the Standard variety minks were analyzed.

It has been proved that the pregnancy duration is closely connected with the covering date. The fertility of the minks under observation revealed in the period 1-5 May a growing tendency, which later gradually decreased. The best reproduction results showed the 2-year old females.

The litters from the pregnancy shorter than 40 days were characterized by a small size, while the most abundant ones originated from the 40-60-day pregnancy. As optimum covering date the second ten days of March are regarded.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 383-393, 1987. 4 tables, 9 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Reproductive disorders in foxes in the light of bacteriological examinations of vaginal and preputial swabs in the period 1985-1987.

A. Kopczewski, T. Zdunkiewicz, M. Wroblewska.

Bacteriological study of vaginal and preputial

swabs from a large arctic fox population showing low fertility rates was carried out during 3 successive years. Statistical analysis of the isolation incidence of seven bacterial species over the 3 years indicated a significant increase in *Pseudomonas aeruginosa* isolations from clinically abnormal preputial mucosa. The isolation rates of staphylococci, streptococci and diplococci had no statistical significance. Following the elimination of infected animals and immunization with *Pseudomonas* autovaccine the normal fertility rate was restored.

Medycyna Weterynaryjna, 44, 11, 680-683, 1988. 2 tables, 5 figs., 16 references. In POLH, Su. ENGL, RUSS. CAB-abstract.

Effect of some factors on the fecundity of Polar fox females.

B. Bil, S. Jarosz, O. Szeleszczuk.

The investigations on relationship between age of polar foxes and the occurrence of oestrous, parturition and number of litters comprised in the period 1979-1982 2131 females from the state farm of fur animals. In primipara females entering their first utilization year, the oestrus occurred by 12, 18 days later than in other, older females. Among multiparous females at the age of 2-6 years no statistically significant differences were found in this respect. The delay of parturition in primipara females in relation to 2-3 year old females amounted to 15 days and was statistically significant. Also statistically significant difference in the number of litters between 2-year and 6-year females on the one hand and 2-5 old females on the other, was observed.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 147-155, 1987. 3 tables, 12 references. Authors' summary.

Reproduction and rearing results of white foxes at some farms in Poland.

G. Jezewska, J. Maciejowski, S. Socha.

The farms specializing themselves in breeding white foxes were supplemented dozen or so years ago with the import of shadow foxes from Norway. However, it has not been taken into consideration the fact that genetic pattern of both types of animals is not identical. Imported animals distinguished themselves with better fur structure, which led to their distinct preference in the reproduction as compared with the initial material. Therefore, in every next generation the frequency of recessive genes of white colour was restricted in favour of genes of shadow colour.

These genes are of the lethal character in the homozygotic system and for that reason the mutually mated animals create a great possibility of limitation of the size of litters.

The investigations on reproduction and rearing of white foxes including shadow ones were carried out at 4 farms in 1983. The observations comprised 260 females. The reproduction results have proved their inferiority as compared with litters of blue foxes. The expected litter sizes were estimated taking into consideration the probability of occurrence of homozygotic patterns. Lowered reproduction indices prove the necessity of breeding measures aiming at determination of an appropriate mating methods of white foxes.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 165-178, 1987. 5 tables, 5 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Results of fox artificial insemination in 1985 (in Poland).

W. Zalewski, J. Stryjecki, Z. Sochacka.

In herd of 421 females of blue foxes there were inseminated 62 vixens and 57 of which with silver fox male semen. The results of artificial insemination (a.i.) and mating were compared as regards the following criteria: - Conception rate for a.i. 57.8% and 70.5% for mating. - Service efficiency for a.i. 4.6 and 4.2 for mating. - Services per conception for a.i. 2.0 and 2.6 for mating. The litter size of a.i. at birth averaged 7.7 of crossbred puppies.

Panstwowe Wydawnictwo Naukowe, Warszawa (Poland), no. 341, 179-186, 1987. 1 table, 1 fig., 6 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Reasons for small litters in farmed mink.

Pia Holmqvist.

Minkproduction is dependent on females producing big litters and on pups producing big furs of good quality. The pup is vulnerable during the period of delayed implantation, late in the gestationperiod, and during the first couple of days after birth. There is a big intrauterine loss of embryos - about 50-60%. The loss of pups from whelping to weaning is approximately 10%.

After a review of the literature, I have catalogued some of the causes to reduction in litter size in the farmed mink. I have found many possible causes related to genetics, infections, management and nutrition. Most of them play a minor or

hypothetical role, which endanger the pup only in cases of bad conditions.

To maximize productivity of breeding animals, three important factors can be pointed out, related to management: 1) Females as well as males, should be selected for their genetic capacity to produce big litters. 2) Females should be bred according to different mating systems, in relation to age (see matingsystems). 3) The period of delayed implantation should be kept as short as possible without conflicting with the mating systems.

It is also important to keep a balanced diet (see fish-induced anemia), a high hygienical quality of the feedstuffs and not to starve or overfeed the

animals, especially before and during the reproduction period. As mink food mainly is composed of fish- and slaughterhouse offal the hygienical quality can sometimes be doubtful (see endotoxininduced abortion). It may also contain pathogenic bacteria as for example Salmonella, which can cause abortion in the mink. As fish is a major part of the diet, mink is indirectly exposed human pollution in the ocean (see PCB, HCB). Fertility tests for detection of infertile males, is the most important factor in the management of male mink. This is best and most safely done by spermtest and palpation of the testes.

Swedish University of Agricultural Sciences. Dept. of Clinical Chemistry, 1989. 58 references. In SWED, Su. ENGL. Author's summary.

New Vet. Med. Dr. Mats Forsberg.

Mats Forsberg defended his thesis: The male silver fox. Effects on reproduction of sperm numbers, photoperiod and melatonin, March 9th 1990. As official opponent our good friend and member of the board of IFASA Dr. Bruce D. Murphy, Canada, was active.

We congratulate with the result and the new title.

In the following we are giving abstracts of thesis and following papers. All of it can be obtained at: Vet. Med. Dr. Mats Forsberg, Swedish University of Agricultural Sciences, Dept. of Clinical Chemistry, Faculty of Veterinary Medicine, S-75007, Uppsala, Sweden.

The male silver fox. Effects on reproduction of sperm numbers, photoperiod and melatonin.

Vet. Med. Dr. Mats Forsberg.

Reproductive activity in the silver fox (*Vulpes vulpes*), a colour mutant of the red fox, is highly influenced by the annual light-dark cycle. For both wild and captive foxes, in the northern

hemisphere, the breeding season extends from January to late March. Thus both sexes are seasonal to the extent that fertility is restricted to a limited time of the year, leading to a birth season in spring/early summer.

Artificial insemination (AI) of farmed foxes is today utilized as a commercial breeding tool. The technique facilitates cross breeding between silver- and blue foxes and has increased the breeding capacity of male foxes. This study was designed to increase the understanding of the mechanisms governing reproductive seasonality in the male silver fox and lay the groundwork for further increasing breeding program efficiency.



The effect of different sperm numbers on fertility after artificial insemination was studied. The number of spermatozoa per insemination dose varied from 20×10^6 to 100×10^6 . The results demonstrate that with the present technique for semen preservation and oestrous detection, 20 million sperm per insemination dose can give acceptable fertility when crossbreeding foxes.

Silver fox males were exposed to short days or melatonin implants to investigate the effects on reproductive seasonality. When treatments commenced in June, when the testes were fully regressed, short days and melatonin implants had a stimulatory effect on testicular development. Semen frozen during the artificially induced breeding cycles possessed normal fertilizing ability when inseminated in a subsequent natural breeding season. Plasma prolactin levels were significantly reduced immediately following melatonin treatment in June but increased to greater levels than control values and "peaked" after 7 months. This "peak" was associated with a rapid decrease in testosterone secretion. The normal seasonal spring rise in prolactin secretion was prevented by melatonin administration. Thyroxine levels decreased and were significantly lower after 2 months of melatonin treatment.

When treatments were initiated during the active phase of the reproductive cycle in February and extended beyond the natural breeding season, testicular regression was inhibited. Semen frozen after the natural breeding season possessed inferior fertilizing capacity. One possible explanation is that semen quality was influenced by high environmental temperature during spring/early summer, when the days were often very warm.

When males were exposed to short days or if active melatonin implants were left *in situ* for a long period, the animals became refractory to the treatments; testicular activity decreased and sexual activity could not be maintained.

In conclusion, the results illustrate that exposure to high doses of melatonin induces the same changes in reproductive activity as exposure to short days. This strengthens the hypothesis that melatonin is the hormonal signal transducing photoperiodic information in the silver fox. Artificial illumination or melatonin treatment can be used to induce an advanced breeding cycle in late autumn/early winter and to inhibit testicular regression and extend the reproductive season in the spring.

Swedish University of Agricultural Sciences, Report 8, 56 pp., 10 figs., 171 references. Uppsala 1990. In ENGL. Author's abstract. ISSN 0348-8659; ISBN 91-576-3979-5. Code 5-3-10-F.

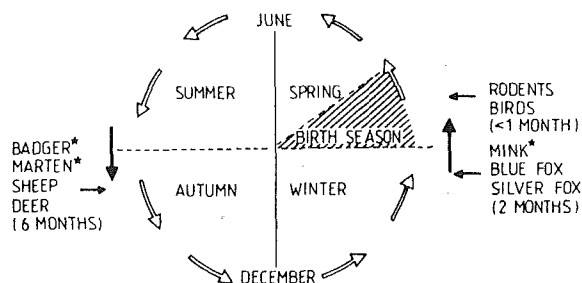


Fig. 3. Timing of the annual reproductive cycle in some seasonal breeders. Horizontal arrows (\rightleftharpoons) indicate approximate onset of breeding period. Vertical arrows: (\downarrow) decreasing day length; (\uparrow) increasing day length: Months are approximate intervals from conception to parturition. (*) indicates that the species has delayed implantation. (Modified after Karsch et al., 1984 and Gilbert, 1987).

This thesis is based on the following papers which is referred to in the text by their Roman numerals.

- I. Fougner, J.A. and Forsberg, M. 1987. Effect of different sperm numbers after artificial insemination of foxes. *Acta vet. scand.* 28, 403-407. *SCIENTIFUR*, Vol. 13, no. 2.
- II. Photoperiodic regulation of reproduction in the male silver fox (*Vulpes vulpes*).

M. Forsberg, J.A. Fougner, P.O. Hofmo, M. Madej, E.J. Einarsson.

Six silver fox males were exposed to short days (6L:18D) from February, when the testes were fully developed, until June 1986 (Group 6L). Eight males maintained in natural daylight served as controls (Group N). Histological sections from the testes of 2 males in Group 6L killed in June indicated full spermatogenic activity. Three blue fox vixens inseminated the following year with semen collected and frozen in June from 3 males in Group 6L failed to produce litters. One possible explanation for the reproductive failures could have been that the high environmental temperatures in June influenced semen quality. There was no significant difference ($P > 0.05$) in LH release in response to GnRH stimulation in June, but testosterone response to LH release was significantly higher ($P < 0.01$) in animals subjected to a restricted photoperiod, demonstrating that testicular testosterone production was maintained longer than in control animals. Two males in Group 6L were retained in 6L:18D from June until December 1986 and then exposed to natural daylight until the end of the study in May 1987 (Group 6L:6L.N). These males started to shed their winter coat and showed clinical signs of testicular regression in December, i.e. after ~ 11

months exposure to 6L:18D. The 2 remaining males in Group 6L were moved to cages with natural daylight in June 1986, where they were kept until the end of the experiment (Group 6L:N:N). These males displayed testicular regression soon after the change in photoperiod but maintained their capacity for testicular redevelopment during the following breeding season.

Five males from Group N were moved from natural daylight to 6L:18D in June 1986, when the testes were fully regressed. The animals were kept in 6L:18D until December 1986 and then exposed to natural daylight until the end of the study (Group N:6L:N). The 3 remaining males in Group N continued to serve as controls (Group N:N:N). Six blue fox vixens inseminated in the natural breeding season with semen collected and frozen in December 1986 from 4 males in Group N:6L:N conceived with an average litter size of 8.8 ± 1.7 . Plasma concentrations of LH in response to GnRH stimulation in October and November 1986 indicated no variation of the pituitary to respond by LH release. In contrast, total testosterone release was twice as high in animals subjected to a restricted photoperiod compared with control animals, indicating that short days had a stimulatory effect on testicular redevelopment.

The results demonstrate that artificial illumination can be used to increase the reproductive capacity of silver fox males.

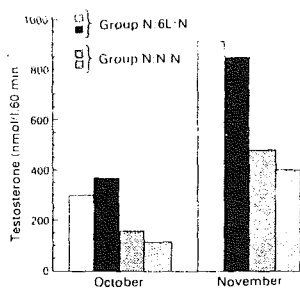


Fig. 3. Testosterone response after GnRH challenge in October and November 1986 in 2 males in Group N:N:N subjected to natural daylight since February 1986 and 2 males in Group N:6L:N subjected to natural daylight from February until June 1986 and then moved to short days (6L:18D).

J. Reprod. Fert., 87, 115-123, 1989. 1 table, 4 figs., 28 references. Authors' summary.

III. Forsberg, M. and Madej, A. 1987. Validation of a direct radioimmunoassay of melatonin in the blue fox. *Acta vet. scand.* 28, 73-79. *SCIENTIFUR*, Vol. 12, No. 4.

IV. Effect of melatonin implants on reproduction in the male silver fox (*Vulpes vulpes*).

M. Forsberg, J.A. Fougner, P.O. Hofmo, E.J. Einarsson.

In June 1987, when the testes were fully regressed, 5 males were given s.c. implants of 40 mg melatonin. The same treatment was repeated in August and October 1987. Five males served as controls. Plasma concentrations of melatonin increased significantly in treated males and were still elevated at the end of the study in April 1988. The changes in testicular volume and blood plasma concentrations of testosterone in response to GnRH indicated that melatonin administration promoted testicular development. However, testicular regression was observed earlier in treated than control animals, perhaps because of refractoriness to melatonin or to a down-regulation of melatonin receptors. Semen was collected and frozen in November 1987, 2 months ahead of the natural breeding season, from the melatonin-treated males, and 10 blue fox vixens were inseminated the following breeding season: 9 vixens conceived, and the average litter size was 7.6 ± 0.5 .

The results demonstrate that melatonin treatment initiated during exposure to naturally long days (a) promotes testicular development in a way similar to an artificial short photoperiod and (b) may induce a refractory condition after an extended period of treatment.

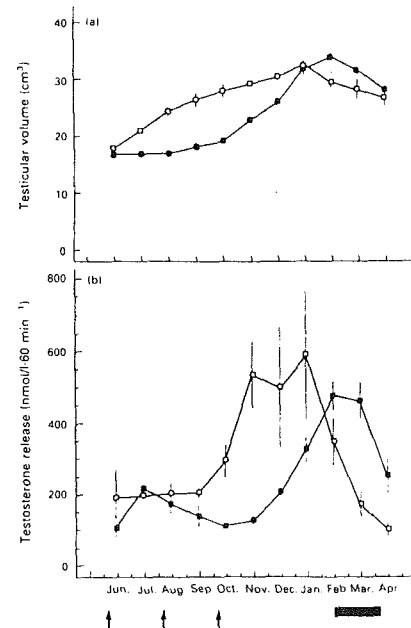


Fig. 1. Seasonal changes in (a) testicular volume and (b) testosterone release after GnRH challenge of control (■) and melatonin-treated (□) animals (N = 5). The arrows depict the dates of melatonin administration and the horizontal bar the natural breeding season. Values are mean \pm s.e.m.

J. Reprod. Fert., 88, 383-388, 1990. 1 fig., 27 references. Authors' summary.

Artificial insemination in 1987 and 1988.

Jan Fougner.

For 3672 and 36.970 blue fox females inseminated with fresh blue and silver fox semen resp. in Norway in 1987, and for 18.896 silver fox females, inseminated with silver fox semen, the CR was 73.1, 77.5 and 74.4% resp., litter size at birth averaged 8.64, 8.11 and 4.31 cubs, and the number of cubs weaned per inseminated female

averaged 4.61, 4.15 and 2.44. The corresponding figures for 6995, 12.984 and 23.575 inseminations in 1988 were 73.8, 75.8 and 74.0% for CR, 8.95, 7.70 and 4.27 for litter size at birth and 4.63, 3.97 and 2.47 for number of cubs weaned per inseminated female. For 207 blue fox females inseminated with frozen silver fox semen, the CR was 87.0% and litter size at birth averaged 7.73.

Norsk Pelsdyrblad, 63, 3, 12-13, 23, 1989. 1 table, 2 figs. In NORG.



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With kind regards,


Dr. Einar J. Einarsson
President of IFASA


Gunnar Jørgensen
Editor
Board member of IFASA

Original Report

Growth promoting and antibacterial effects of zinc bacitracin in mink diets.

Anders Skrede and Reidar Sandvik

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N-0212 Oslo 2, Norway

Summary

Zinc bacitracin, a polypeptide antibiotic mainly active against gram-positive bacteria, is used world-wide as a growth- and performance promoting agent in animal husbandry, mainly in the production of pig and poultry. In the European Community and in Norway, zinc bacitracin is also approved as a growth- and performance promoter for fur animals. In 1989, a trial with zinc bacitracin for mink was performed at the Agricultural University of Norway in collaboration with Apothekernes Laboratorium A.S. The trial covered bacteriological/feed-hygiene examinations and growth- and performance promoting effects in mink kits.

Bacteriological/feed-hygiene examinations

Wet feeds for mink (composed mainly of fish- and slaughter offals, blood, fish meal, carbohydrate- and fat supplements, and water) were supplemented with 0 ppm (negative control), 20, 100 and 200 ppm zinc bacitracin as granulated Albac^R (registered trade mark of zinc bacitracin feed supplement produced by Apothekernes Laboratorium A.S). Samples of the feeds were examined for pH-development, total count of bacteria, lactic acid bacteria, coliforms, yeast and fungi, acetic and lactic acid, and for zinc bacitracin activity immediately after production and after storage of the feed samples at 4°C, 10°C and 20-25°C for several days.

It was registered that zinc bacitracin, depending on the concentration, delayed the souring process and the growth of bacteria (total count) in the feeds during storage. Selection for lactic acid bacteria and gram-negatives was observed in the feeds supplemented with 100 and 200 ppm zinc bacitracin. No effects of zinc bacitracin on growth of yeast and fungi were detected. The production of acetic and lactic acid was reduced in the zinc bacitracin supplemented feeds. Determination of zinc bacitracin activity in the feeds at the start showed satisfactory recoveries and homogeneous distribution. Investigations have demonstrated that granulated zinc bacitracin, when compared with a powder product, is of preference in this type of feed because of its better recovery- and stability properties.

Growth- and performance promoting effects

Four groups, each of 24 mink females of type standard dark received either 0 ppm (negative control), 20, 100 or 200 ppm zinc bacitracin in their diet from January 23 until weaning of the kits at 7 weeks of age. Feeds were produced once a week, increasing to twice a week from May 13, and stored cool until feeding. The animals were fed once a day.

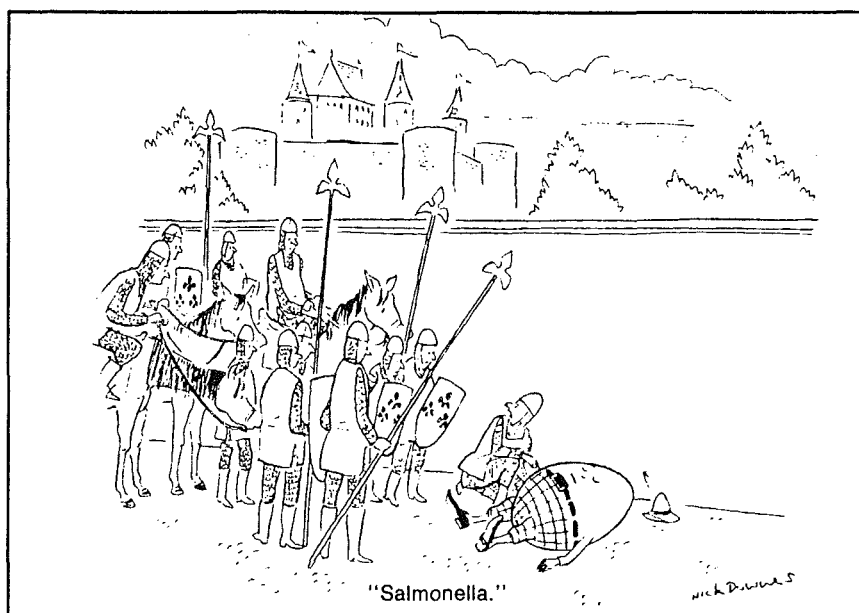
The results indicate that the supplementation of zinc bacitracin did not influence litter size or kit mortality. Kit body weights at birth and at 21 days of age were in the usual range with only

minor differences between the groups. At weaning (49 days of age), a positive effect of zinc bacitracin was found. At the 20, 100 and 200 ppm zinc bacitracin levels, the body weights of the male kits were 9.6, 8.9 and 12.0% increased compared to control, respectively. These weight differences were all statistically significant ($P < 0.05$). The corresponding figures for the female kits were 4.7, 2.4 and 10.1% (the increase for the group fed 200 ppm zinc bacitracin being statisti-

cally significant). It was observed that the groups given the two highest concentrations of zinc bacitracin had firmer stools than the control- and the 20 ppm groups.

References

Skrede, A. & Sandvik, R. 1990. Forsøk med sink bacitracin i våtfôr til pelsdyr. Norsk Pelsdyrblad 64, 3.



Original Report

Mink feeding with diets based solely on hake offal as protein source during late growth.

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Abstract

The effect of feeding diets based on fish offal (*Merluccius hubbsi*) as only source of protein in minks was studied. Thirty wild males and 30 females minks were assigned to 3 diets, 10 males and 10 females per diet, and fed for the last two months of the growing period in conventional cages. The diets were formulated with 87% and 77% of hake offal and compared to a control diet of 55% of fish offal. Live weight was recorded, digestibility and feed intake estimated and diet quality measured throughout the feeding period. Finally at pelting, the weight of the carcass, fur, undercoat fat, viscera and liver weight were taken; samples of blood were obtained for analysis of enzyme activity, and the skins were tagged for further quality evaluation. Acceptability and dry matter digestibility were higher in the control diet, however the digestibility of the organic matter, protein and lipid were not different among diets. Live weight, carcass, liver, fat and pelt weight and length, and enzyme activity were not affected by diet. It was concluded that hake offal as only source of protein for minks performed well in the last two months of growth, with minor and inconclusive effects on pelt quality.

Introduction

The mink (*Mustela vison*) as a carnivorous animal is raised on byproducts of animal origin such as cattle, poultry and fish offal. Being these byproducts the main animal protein sources for mink feeding in Argentina.

In general terms, a typical ranch mink diet may comprise between 40 to 70% of fish offal complemented with beef and/or poultry offals.

In Argentina cattle and poultry byproducts are more expensive than fish offal, therefore the cost of the feed for minks could be reduced if more fish offal could be used in mink diets.

In the south east of Argentina hake offal is widely used as a source of protein for mink diet, however there is not local experimental evaluation of the effect of diets formulated with hake byproducts as only source of protein, on mink performance and pelt quality.

It is known that certain fish-based feeds, may cause anemia during early growth, which leads further to the "cotton fur" symptom at the late growth period. On the other hand, Skrede (1978) had reported that diets based solely on fish byproducts promoted slightly lower rates of body gains, with minor or not significant effects on fur quality, compared to conventional diets containing a mixture of protein sources. In addition, this author also had pointed out that the frequency of death increased with decreasing level of protein in animals fed extensively fish byproducts. Thus, it appeared necessary to study the performance of minks fed diets based on hake offal as the main protein source.

The aim of this exploratory experiment was to evaluate mink performance and fur quality, in animals fed diets based solely on hake byproducts (*Merluccius hubbsi*) during the last two months of the growing period before pelting.

Materials and methods

A feeding trial was carried out between April and June of 1989 in a mink farm located in the southern hemisphere at 38.00° of latitude and 57.31° of longitude west. Sixty wild minks, 30 males and 30 females, housed in conventional cages of one male and one female were assigned to 3 diets with different content of hake offal. Diet 1 (D1) comprised (fish : cereals : oil) 87:12:1, D2 77:22:1, and the control diet (T) 55:18:1 plus 24% of cattle offal and 1.5% of bovine fat. The meals were prepared daily with fresh ingredients and supplemented with vitamins and minerals, and the animals fed once a day for 69 days at approximately 500 g/d per cage.

Animals were weighed every three weeks, and samples of the feed taken periodically for laboratory analysis. Voluntary feed intake and digestibility were evaluated at the middle of the experimental period, by measuring during 5 days the feed offered and refused and feces production. Right before killing blood samples were drawn by cardiac puncture and deep frozen in carbonic ice. The samples were analyzed for Glutamic Oxaloacetic Transaminase (GOT), Glutamic Pyruvic Transaminase (GPT) and Gamma Glutamyl Transferase (GGT). After pelting the weight of the pelts, carcass, undercoat fat, liver and viscera were taken, and pelts tagged for further quality evaluation. Pelts were visually graded according to a local standard based on density, luster, silkness, depth of underfur and coverage of guard hairs. The pelts receiving the maximum grade, which were free of any abnormality, were tabulated as percentages in each treatment under "Top quality pelts", and the data were not statistically analyzed because of the few animals per treatment.

All parameters under study, except pelt quality, were compared by analysis of variance (Ostle, 1965). Finally, all the animals were used, pooled by sex, to establish relationships between live weight, body components and pelt weight and length by regression analysis.

Results and discussion

As shown in table 1, the dry matter content of the experimental diets (26 and 27%) was slightly below the control diet (29%). The content of protein and fat of the diet with the highest content of fish offal (D1), 43% and 18% was higher than in the other two diets. The diet with 77% of fish offal (D2) was quite similar than the control diet in protein (37 and 34%), fat (15 and 16%), ash (11 and 9%) and carbohydrate (37 and 40%). On the other hand, the replacement of beef offal for hake byproducts reduced the cost of the diet from 110 U\$A/Tn to 80 U\$A/Tn.

Table 1.
Composition of experimental and control diets used to feed minks during late growth.

Parameter	Diet 1 (D1)	Diet 2 (D2)	Control (T)
	%		
Cattle offal	-	-	24.0
Hake offal	87.0	77.0	55.5
Cereals	10.0	20.0	15.0
Gluten	2.0	2.0	3.0
Sunflower Oil	1.0	1.0	1.0

Bovine Fat	-	-	1.5
Dry matter	26.0	27.0	29.0
Ash	12.6	10.8	8.9
Protein	43.0	37.1	34.3
Lipid	17.8	14.8	16.4
Carbohydrate	26.6	37.3	40.4
U\$A/Tn	79	80	110

Animals showed higher preference for the control diet and secondly for the experimental diet with the smallest content of cereals (D1). When animals were fed ad libitum per one week, placing the meal in a tray inside the cage, the dry matter intake (g/d/kg) was 50 in the experimental diets, and 77 in the control diet (table 2).

Table 2.
Feed intake of a female and a male mink when fed ad libitum (expressed as dry matter per day).

Parameters	D1	D2	T
Body weight Kg (1)	3.2	3.1	3.4
g/cage (1)	155.7	153.4	255.4
g/kg Body 0.75	49.6	49.7	76.6
g/kg (2)	66.0	65.8	103.7

1: Male and female in the same cage

2: Metabolic body weight

The lower acceptability of the experimental diets did not bring about any adverse effect on the live weight of the animals, because they were fed 500 g/d/cage, during the whole experimental period of 69 days in all treatments, which close to the level of feed accepted by the animals (50 g of dry matter per kg of body weight) when fed the experimental diets ad libitum.

The digestibility of dry matter (DMD) was higher in the control than the experimental diets, 81, 76 and 72% for T, D1 and D2, respectively (table 3). The dry matter content of the feces was higher in the experimental diets, 26% versus 22% in the control diet, and the content of ash was higher in D1, 27%, than in D2 and T, 23%. The content of lipid and protein in feces was not affected by diet, being 4% and 20% respectively.

Although DMD was lower in the experimental diets, the digestibility of the organic matter, proteins and lipids were not different among diets.

The digestibility of the organic matter was between 80 to 84%, and was not affected by the increase of level of cereal from 10 to 20% in diets D1 and D2 respectively (table 1). The digestibility of protein 88%, and lipids 95% were in range with those reported by Tauson (1988).

Table 3.
Digestibility of the experimental (D1 and D2) and control (T) diets.

Digestibility % of	Diet 1 (D1)	Diet 2 (D2)	Control (T)
Dry matter	75.7a	71.8a	81.2b
Organic matter	79.6	80.4	84.2
Protein	90.0	86.5	88.8
Lipid	94.3	92.7	95.9

a, b: averages with the same letter are not statistically different. The averages without letters are not different.

Live weight remained unchanged throughout the feeding period in all treatments (fig. 1). The average live weight was not affected by diet. Females reached an adult average weight of 1.3 kg, with a range between 1.02 to 1.56 kg, and males 2.45 kg, ranging from 2.0 to 2.9 kg. The live body weight has not changed during the experiment because the animals had reached adult live weight at the beginning of the trial, and the level of feeding was enough for maintenance.

The weights of the carcass, pelt, undercoat fat and liver were not statistically affected by diet, but gut weight was lower in animal fed the control diet (table 4 and 5). The weight of the pelts, after removing the fat, was between 100 to 120 g in females and 230 to 240 g in males, its length was approximately 60 and 75 cm in females and

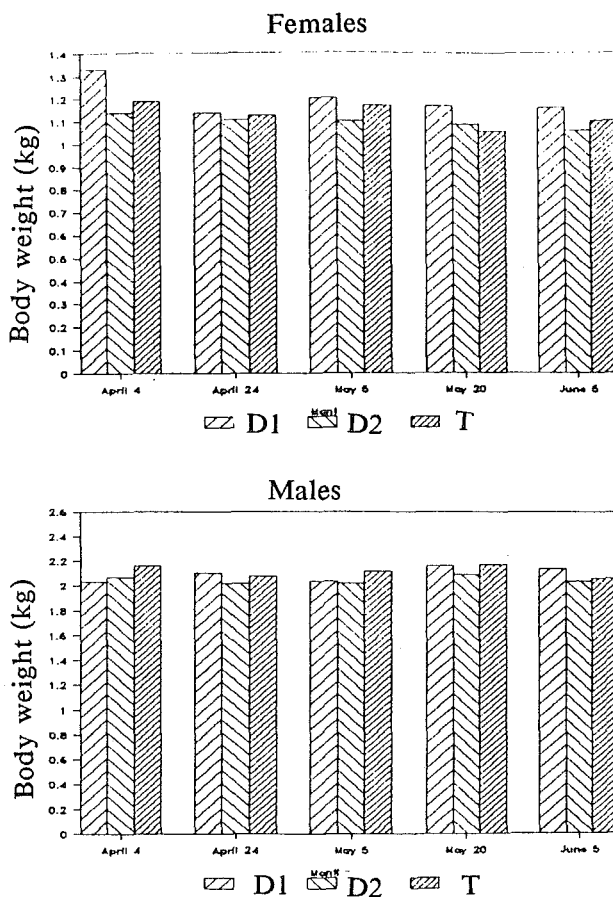


Figure 1.
Body weight of females and males minks fed diets with different content of hake offal in late growth. D1: 87:12, D2: 77:22, fish: cereals, T: 55% fish 24% beef offal and 18% cereals.

males respectively. In average the weight of the skin was between 8 to 10% of the animal weight.

Table 4.
Body weight and body composition in minks fed diets rich in hake offal (D1 and D2) and in the control diet.

Parameter	FEMALES			MALES		
	D1	D2	T	D1	D2	T
Carcass	796	715	738	1466	1385	1390
Viscera	223a	206ab	175b	358c	367cd	311d
Fat	194	169	204	350	370	396
Fur	122	104	118	241	232	238
Liver	67	54	47	101	96	91
Total weight	1402	1248	1465	2516	2450	2426

a, b, c, d: averages with the same letter are not statistically different. The averages without letters are similar within sex.

Table 5.
Pelt weight and length in females (F) and males (M) minks fed the experimental diets (D1 and D2) and in the control diet (T).

Parameter	Sex	Diet		
		D1	D2	T
Weight (g)	F	122.0	104.2	118.1
	M	241.0	232.3	238.1
Length (cm)	F	59.8	58.9	61.0
	M	74.0	74.3	76.5

When all the animals were pooled, within sex, to study the relationship between body weight and body components, the analysis showed that the higher the body weight the higher the weight of the carcass, gut, undercoat fat, liver and pelt. However, the increase of the weight of viscera and fat, with the increasing of body weight, was higher than the increase of the pelt and liver weight (fig 2a). In other words, the components of the body, such as the pelt and the liver increased at lower rate than the other components.

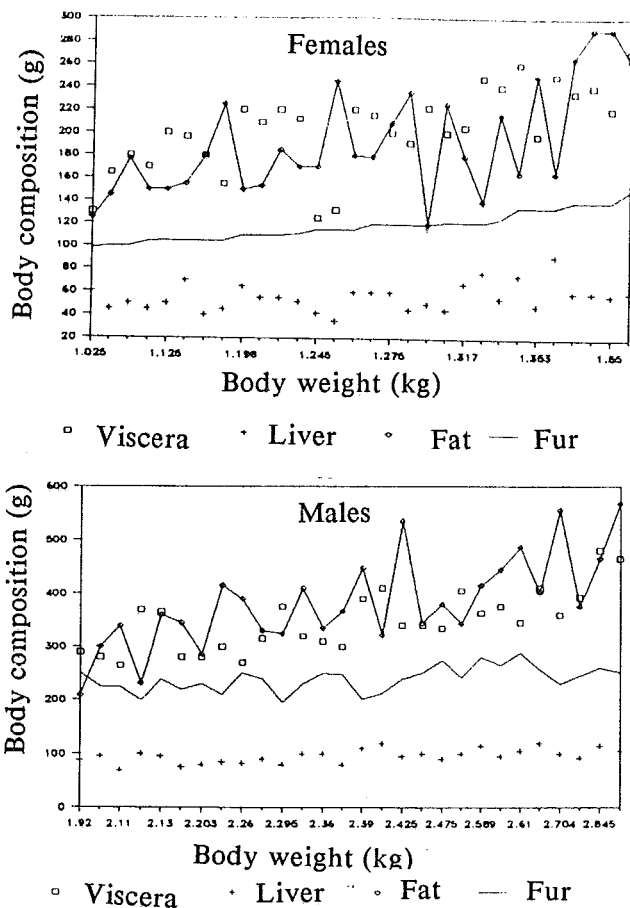


Figure 2.
Body weight and body components in females (a) and males (b).

The length of the pelt also increased in a fashion similar than its weight in females, but not in males. The length of the pelts in males increased only until a set point of 2.4 kg of body weight (fig. 4), and thereafter remained constant even that the weight of the pelt and the body increased.

The results point out the fact that in females the heavier the animal the heavier and longer pelt, but in males the same relationship only held under 2.4 kg of body weight. Which indicates that males over 2.4 kg have heavier pelts and bodies but not longer pelts. Thus, if the skins of males over 2.4 kg are heavier but not longer they may be either thicker or wider.

It may be appropriate to comment that data presented elsewhere (Skrede, 1978) may indicate that increased fat deposits, which occur in heavier animals, may be negatively related to some parameters of fur quality, which could be the case of the mink males over 2.4 kg of body weight.

The relationship between fur length (y) and body weight below 2.4 kg (x) was: $y = 12.95x + 43.9$, which points out that the length of the fur increased approximately 13 cm per kg of body weight. According to this equation a mink of 2 kg should yield a pelt of 70 cm ($13 \times 2 + 44$).

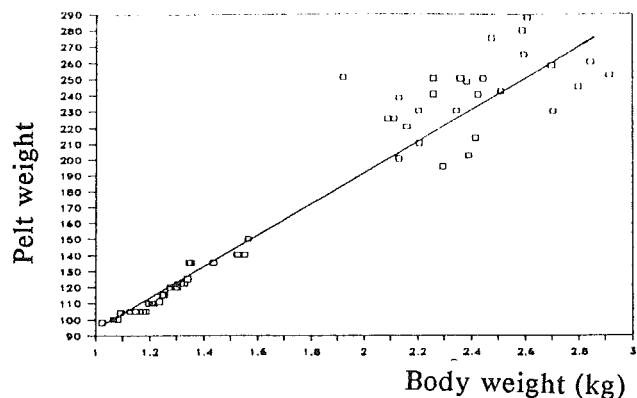


Figure 3.
Relationship between body weight and pelt weight in females and males minks. $y = 102x - 8.7$ (x : body weight in Kg, x : pelt weight in grams).

The results of the blood analyses are presented in table 6. In general, there were not differences in enzyme activities among treatments, although the tendency showed a higher activity in animal fed the control diet. Increased values in serum are signs of cell damage, being GOT specific for heart muscle, GPT for liver and GGT for pancreas and kidney (Juoksalahti et al., 1980). The results, in range with those reported by Jouni et al. (1980), shows a high coefficient of variation

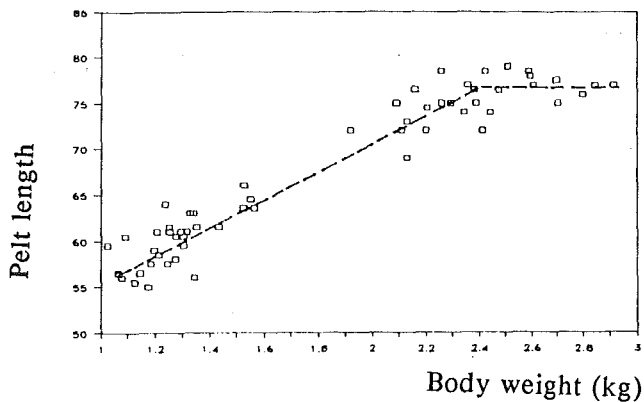


Figure 4.
Relationship between pelt weight and length in females and males minks.
 $y = 12.95 x + 43.9$ (x : fur weight in grams,
 y : fur length in cm).

(% CV), which was higher for GGT in all treatments and smallest in animal fed diet D2 for the three enzymes.

Table 6.
Serum enzyme activity (U/l) in mink fed two diets rich in hake offal (D1 and D2) and in the control diet (T).

Enzymes (1)	D1	Diet D2	T
GOT	127.3 (33.8)	155.0 (26.8)	204.5 (32.1)
GPT	39.2 (37.8)	35.6 (16.4)	47.6 (40.9)
GGT	15.1 (65.9)	15.7 (47.7)	20.2 (1.2)

(1) mean and % CV. Means are not statistically different.

The effect of diet on pelt quality was difficult to evaluate and conclusions from these results should be taken with some cautions. First, the animals were not rigorously selected at the beginning of the experiment, and the treatment were compared based on the percentages of top quality pelts, which were free of any kind of abnormalities. Then a treatment could have being penalized incorrectly if it had abnormalities caused by other factors than diet, such as management or an aggressive behavior exerted between animals placed in the same cage. For example, there is not an explanation why D2 performed worse than D1 and T in males, and better in females (table 7). In fact, only 67% of the males fed D2, brought about top quality pelts, versus 81% and 89% in the control and D1, respectively. However, females fed D2 produced higher percentages of pelts of the highest quality (67% versus 44%).

Table 7.
Percentages of pelts graded as top quality pelts.

Diet	males %	females %
Control (T)	81	63
77% fish 22% Cereals (D2)	67	67
87% Fish 12% Cereals (D1)	89	44

Obviously, the abnormalities found in the pelts could have been caused by other factors than diet. Secondly, because few animals were used per treatment (10 males and 10 females), only one or two pelts with abnormalities could have affected the results in 10 to 20% within sex.

Having in mind the limitation of the analysis due to the drawbacks stated above, only the following facts could be remarked. First, it was observed more pelts graded as top quality in males than in females. Secondly, the animals fed the experimental diets (D1 and D2) brought about pelts at least as good as the ones fed the control diet. Finally, the effect of the sex on pelt quality may due to the competence and behavior of the male and the female housed in the same cage.

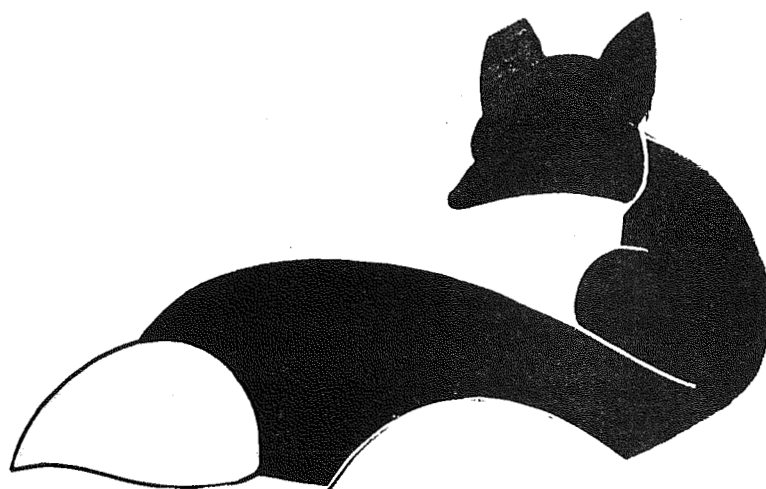
Acknowledgements

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Zinc balances in young and adult mink (*Mustela vison*) in relation to dietary zinc intake.*H. Mejborn.*

The effect of zinc content in the diet on the zinc metabolism was investigated. In balance studies with growing and adult male mink it was shown that the zinc balance (mg) increased with increasing zinc intake, and that most zinc was excreted in the feces. Zinc excretion in feces seemed mainly to be important for the zinc homeostasis at higher zinc intake, while excretion in urine apparently also contributed to the homeostasis at lower intake. In percent of intake the zinc excretion in feces was low, 28-40%, when the zinc intake was low (4.1 mg Zn/kg wet feed) and high, 60-80%, when the intake was normal and high (37 and 83 mg Zn/kg wet feed). On the contrary the urinary zinc excretion was high, 12-24% of the intake, when the zinc intake was low, but only about 5% at feed zinc levels of 37 and 83 mg/kg wet feed. It can, however, not be excluded that the determination of fecal zinc excretion was too low because of difficulties with total fecal collection. On the other hand urinary zinc excretion seemed to be very high, perhaps as a consequence of fecal zinc contamination. Thus the zinc retention might have been overestimated.

J. Anim. Physiol. a. Anim. Nutr. 61, 187-192, 1989. 3 tables, 11 references. Author's summary.

Effects of arginine-free diet on urea cycle enzymes in young and adult ferrets.*Devendra R. Deshmukh, Cynthia D. Rusk.*

Young ferrets develop hyperammonemia soon after eating an arginine-free diet, whereas adult ferrets do not develop hyperammonemia after an identical treatment. Earlier reports indicate that young or adult rats do not develop hyperammonemia and encephalopathy after a single meal of an arginine-free diet. The effects of a single feeding of an arginine-free diet on the urea cycle enzyme activities in the liver of young and adult ferrets is reported. Ornithine carbamyl transferase, carbamyl phosphate synthetase and ornithine aminotransferase activities in the livers of adult ferrets were significantly higher than those in the livers of young ferrets. A single meal of an arginine-free diet did not alter the urea cycle enzyme activities in the liver of young or adult ferrets. The levels of urea cycle enzymes in the liver and kidney of young ferrets were comparable to those in rat liver and kidney. The results suggest that the hyperammonemia observed in young ferrets following a single meal of an arginine-free diet may not be due to the deficiency of enzyme activities.

Enzyme, Vol. 41, 3, 168-174, 1989. 3 tables, 24 references. Authors' abstract.

Vitamin E deficiency in silver-foxes.*G. Albert, U.D. Wenzel.*

Occurrence of vitamin E deficiency in young silver-foxes is reported. The animals exhibited disturbance of food uptake, apathy and inactivity. Some animals died. Males were particularly affected. After treatment with vitamin E and selenium preparations and change of feed composition the health of the population improved. Late sequelae were not found.

Pathomorphological examination of perished foxes exhibited pronounced degenerative changes in the myocardium and in the smooth muscles of the gastrointestinal tract. Another regular sign was tubulonephrosis and fat-liver.

Brühl 29, 4, 37, 1988. In *GERM*. Authors' summary.

Influence of the beta-carotene diet supplementation on the reproductivity of foxes.*S. Jarosz, O. Szeleszczuk, B. Barabaszk.*

The respective experiment was carried out in the period of 2 years. In the first year 1-2-year old foxes divided into the experimental 30 animals and the control group 30 animals were used. The foxes of the group I were fed in the reproduction preparation period and in the reproduction period the farm diet with added 60 mg of 10% Rovimex. In the second year of the experiment seventy 1-year old and older foxes were divided also into the experimental 30 females + 4 males and the control group 30 animals were used. Animals of the experimental group were fed farm diet with added 125 mg of 10% Rovimix. In animals of both groups before the experiment start and in its duration period the vitamin A and beta-carotene level in the blood serum and in the reproduction period - reproduction utilization indices of females and males were determined.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 239-246, 1987. 2 tables, 8 references. In *POLH, Su. ENGL, RUSS*. Authors' summary.

Mineral balance in raccoon dogs.*Z. Bialkowski, L. Saba.*

The investigations of the level of mineral ele

ments in blood serum and in hair of raccoon dogs as the indices of mineral balance of those animals were carried out. The studies included 20 raccoon dogs of both sexes equal in number. Blood and hair were taken 3 times i.e. at the end of summer, in autumn and in winter. The level of mineral elements in blood serum was as follows: Ca 2.32-2.52 mmol/l, P 1.84-2.03 mmol/l, Mg 0.82-1.11 mmol/l, Na 96.0-126.0 mmol/l, K 4.12-4.58 mmol/l, Zn 26.0-27.5 μ mol/l, Cu 15.1-17.1 μ mol/l, Fe 39.0-42.4 μ mol/l. The level of mineral elements in hair was as follows: Ca 1324.7-1609.3 mg/kg d.m., P 382.4-417.3 mg/kg d.m., Mg 197.2-209.6 mg/kg d.m., Na 1639.7-2097.0 mg/kg d.m., K 470.8-497.2 mg/kg d.m., Zn 133.3-146.1 mg/kg d.m., Cu 19.3-22.4 mg/kg d.m., Fe 33.2-38.2 mg/kg d.m., Mn 1.1-1.3 mg/kg d.m., Co 0.35-0.40 mg/kg d.m.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 409-415, 1987. 2 tables, 7 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Using of brown livex in feeding foxes.

S. Jarosz, B. Barabasz, O. Szeleszczuk.

The aim of the respective investigations was to determine the usefulness of brown livex (gelatinized blood clot) in feeding polar foxes in the period of their growth and winter hair cover formation. They were divided into 3 groups; 2 experimental and 1 control fed rations with the following share of livex: I - 60%, II - 30%, III - 10%. The following results were obtained: The digestibility coefficients of organic substances in the growth period of animals amounted in the groups I, II, III to 86.6, 81.6 and 79.2% and in the period of the winter cover formation to 86.7, 82.2 and 79.2%, respectively. The final body weight of males and females in particular groups amounted to 6.22, 5.61 and 6.78 kg as well as to 6.18, 6.38 and 6.20 kg, respectively. With regard to the habitat traits by the best ones animals in the group II on the average 25.34 scores and by the worst ones - those of the group I 23.32 scores were characterized. Also the number of the best-quality skins was the highest in the group II. The 60%-tual addition of livex to the diet affected negatively the purity of fur colour. Hematologic and enzymatic indices of the experimental and control animals maintained within the limits of the assumed physiologic standards.

Panstwowe Wydawnictwo Naukowe, Warszawa (Poland), no. 341, 211-220, 1987. 4 tables, 6 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Application of different doses of waste curd in feeding of young minks and foxes.

S. Jarosz, B. Barabasz, O. Szeleszczuk.

The aim of the respective investigations was to estimate the palatability of applied diets containing different additions of curd in relation to the body weight gains and performance of foxes and minks.

The observations were carried out in 1983 (300 minks of the Standard variety) and 1984 (200 blue polar foxes). The arrangement of groups was as follows: I - fed the diet with 60%-tual addition, II - with 40%-tual addition, III - with 20%-tual addition of curd, IV - control, fed farm diet without addition of curd.

It has been found that higher share of waste curd in the diet (60%) led to a decrease of the acidity of the whole diet and to a reduction of the value of digestibility coefficients and the palatability of the diet. Such a high addition of curd affected also some traits of hair cover, in particular: colour purity and density of hair. The most favourable production results estimation of habitat, body weight gains, post-slaughter estimation of skins were observed in animals fed the diet with 20%- and 40%-tual addition of curd.

Panstwowe Wydawnictwo Naukowe; Warszawa (Poland), no. 341, 187-200, 1987. 4 tables, 1 fig., 8 references. In POLH, Su. ENGL, RUSS. Authors' summary.

Optimization of diet for fur animals.

A. Eldegaard, A. Skrede.

Production of better and cheaper mixtures to cover the nutrient requirements of fur animals at different stages is discussed, with emphasis on knowledge of raw materials, conventional or otherwise, and suitable feed consistency. Trials on foxes or mink given optimized diets with different energy concentrations, a high level of herring waste or of fish silages or various carbohydrate sources are described. Results illustrate flexibility of fur animals in relation to dietary components.

Norsk Pelsdyrblad, 62, 12, 14-15, 29, 1988. 3 tables. In NORG. CAB-abstract.

Ensiled feedstuffs in the diet of fur animals.

Morten Ruud.

From July till pelting, 3 groups of 48 blue foxes

and 80 mink, male and female, were given diets containing 24% mixed chicken waste or chicken offal, both preserved with formic acid, or conventional carcass waste mainly bovine rumina. For all groups protein supplied 32, fat 45 and carbohydrate 22% of energy. Final body weight and body length, and length, dried weight and quality characteristics of pelts did not differ significantly among groups.

Norsk Pelsdyrblad, 62, 4, 15-16, 1988. 3 tables, 2 figs., 1 reference. In *NORG. CAB-abstract*.

Chemical composition of mink's milk with different diets.

Carsten Riis Olesen.

During lactation 2 series of Standard mink, in 3 groups of 10 or 15, were given diets with high, medium or low protein content or with fat source, at 5.5%, lard, soyabean oil or fish oil. Diets contained about 150 kcal/100 g. Milk protein differed little among groups. Milk fat was highest with lard from day 22 to 40 and least with fish oil, but differed little among protein groups. There was a decrease in lactose and increases in DM and energy contents in all groups. At 40 days, milk energy was highest with lard, 340 kcal/100 g, and lowest with fish oil, at about 240 kcal. Body weight of young from 2 to 42 days is given.

Norsk Pelsdyrblad, 62, 4, 27-28, 1988. 1 table. In *NORG. CAB-abstract*.

Varied energy distributions for mink in the breeding period and the occurrence of greasy kits.

Georg Hillemann.

On Research Farm North experiments have been carried out in the breeding period of 1989 with various distributions of energy especially in order to investigate a possible correlation with the occurrence of greasy kits. Other parameters have also been included, for example age and weight of the animals. These investigations included all animals on the farm with the exception of the animals in the experiments with pellets.

The results gave reason to the following conclusions:

- the distribution of energy in the winter period as well as in the lactation period must be fairly normal, i.e. neither as little as 5% nor as much as 15% of the energy from carbohydrates, if the occurrence of greasy kits should be minimized,

- the losses in pastel mink were higher with the lowest amount of energy from carbohydrates,
- the group with the lowest content of protein together with the highest content of carbohydrates has needed more treatments. The problem has therefore been more difficult to control with this distribution of energy,
- above all young females, especially pastel, caused trouble,
- large litters caused most problems,
- females which are too thin in February ran the highest risk of having greasy litters,
- feeding with mackerel offal up to 20% the preceding summer did not increase the probability of more greasy kits,
- the content of marine fat did not directly result in greasy kits.

FIG. 1
1989 - SCANBLACK - % FEDTEDE KULD
PR. HOLD.

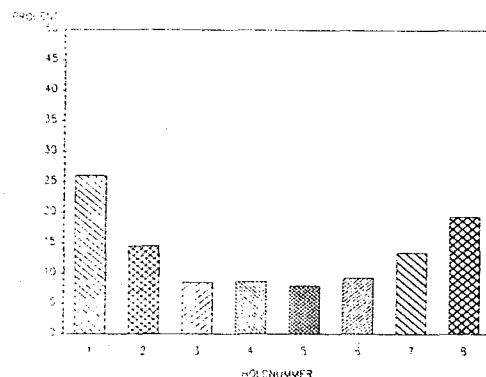
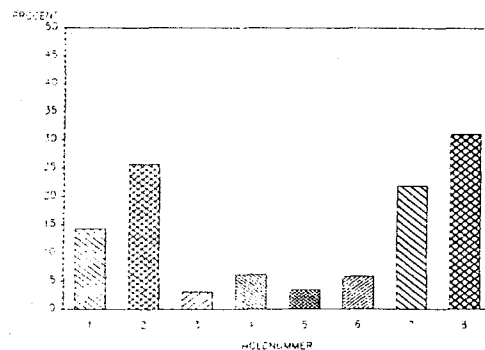


FIG. 2
1989 - PASTEL - % FEDTEDE KULD
PR. HOLD.



Danish Fur Breeders Association, Technical Year Report 1989. 4 tables, 20 figs., p 70-87. In DANH. Author's summary.

Further experiments with scrap fish.

Georg Hillemann.

In the summer of 1988 an experiment was carried out on Research Farm North with 25% and 35% of scrap fish, respectively. The experiment was a continuation of the groups with similar diet from the winter period.

The results were satisfactory both in the winter period and the following summer period. There were no problems with the animals. The size of standard was influenced negatively and with regard to quality the effect was significantly positive. Pastel showed no effects worth mentioning in comparison to the control group.

It can be concluded that scrap fish can be used all through the year in the quantities tested and, according to the experiment, with an absolutely satisfactory result.

Danish Fur Breeders Association, Technical Year Report 1989. 4 tables, p 88-95. In DANH. Author's summary.

Mackerel offal, scrap fish or fish meal in fox diet in the breeding period of 1989.

Bente Lyngs and Georg Hillemann.

The experiments on foxes in the spring of 1989 must be regarded as a continuation of the spring experiments of 1988. In 1988, experiments were carried out on Research Farm North with, for example, 25% scrap fish for silver foxes in the breeding period. Measured as number of kits weaned per mated female the experiment showed that 25% scrap fish did not affect the whelping result.

In 1989 the experiment has therefore been extended to comprise a group with another fat fish and a group with 30% scrap fish. Mackerel was given in the form of mackerel offal from frozen mackerel. Furthermore, more knowledge was desired about the effect of fish meal in the breeding period.

Based on the above mentioned experiments on Research Farm North in the spring of 1989 the following conclusions have been reached:

- Mackerel offal and fish meal in the quantities tested here had on silver foxes a negative effect on the number of kits weaned per mated female.
- Mackerel offal and scrap fish reduced feed cost by approximately 17 DKK per silver

fox female, but this advantage was lost due to a poorer whelping result in these groups.

- In blue foxes there was a tendency towards higher kit mortality in the group with scrap fish compared to the group with mackerel offal.
- As the general whelping result of blue foxes was considerably above the results of the year before, it can be concluded that mackerel offal and scrap fish did not have a considerable negative effect on the whelping result.

Danish Fur Breeders Association, Technical Year Report 1989. 4 tables, p 96-100. In DANH. Authors' summary.

Cheaper feed and changed feeding techniques for foxes in the growth period.

Bente Lyngs and Georg Hillemann.

The objective of the experiment was to obtain a reduction of the price of fox feed and at the same time to maintain or improve the achieved quality in fur production.

The idea behind the experiment was that the fox breeder could use mink feed from his feed kitchen as basic ingredient and add a few other raw materials. This means that the breeder must be able to purchase and store these raw materials without heavy economic costs or expenses for increased labour.

It was possible to reduce the price of fox feed in the growth period when the feed price only comprised the price of raw materials. However, certain labour costs were involved in mixing various ingredients into the mink feed. There could also be problems in relation to purchasing and storing raw materials etc.

Greaves is an expensive feed, but the foxes did not respond with better fur qualities. Meat and bone meal of mink quality was apparently a very good feed for silver foxes and blue foxes as well as blue frost foxes. Silage seemed to be a very good feed for blue foxes, and "restrictive" feeding didn't harm them under any circumstances. The experiment was at the same time a control of the results of last year with regard to energy distribution and energy content for foxes. Both in 1987 and 1988 it turned out that in the growth period foxes managed very well with an energy distribution in the feed of 30, 50 and 20% of the energy from protein, fat, and carbohydrates respectively, and an energy content of approx. 200 kcal per 100 g of feed. At the same time it was

seen that a higher energy content in the feed reduced feed consumption measured in weight units.

Danish Fur Breeders Association, Technical Year Report 1989. 11 tables, p 101-112. In DANH. Authors' summary.

Mackerel offal and choline chloride for mink in the growth period.

Georg Hillemann and Bente Lyngs.

The aim of the experiment was partly a repetition of preceding experiments and partly to get a picture of the necessary level of choline chloride at a given amount of mackerel offal.

Based on experiments with mackerel offal with and without addition of choline chloride the following conclusions have been reached:

Standard mink:

- mackerel offal had a slightly depressive effect on feed intake,
- mackerell offal tended to affect skin size negatively,
- mackerel offal did not affect quality or colour of pelts. There was a tendency towards an inferior quality with an increasing amount of choline chloride,
- neither mackerel offal nor choline chloride had any effect on body weight of the animals at pelting,
- body length of the animals at pelting was affected negatively by mackerel offal at all levels. Choline chloride did not affect body length of the animals.

Pastel:

- 30% mackerel offal reduced quality compared to 10 and 20%,
- quality was not affected by the amount of choline chloride,
- mackerel offal had a slightly depressive effect on feed intake,
- skin size was affected negatively by mackerel offal at all levels,
- 80 and 120 mg choline chloride had a negative effect on skin size,

- the clarity of the colour was affected neither by mackerel offal nor by choline chloride,
- weight of animals at pelting showed no significant correlation with mackerel offal, but similar negative correlation to the amount of choline chloride as described in regard to skin size could be seen here,
- length of the animals at pelting was affected neither by mackerel offal nor by choline chloride,
- 20 and 30% mackerel offal increased the frequency of animals with fatty liver. At 20% mackerel offal this could be remedied by means of 40 mg choline chloride per 100 g of feed. At 30% mackerel offal 80 mg choline chloride per 100 g of feed were necessary.

Danish Fur Breeders Association, Technical Year Report 1989. 12 tables, p 113-125. In DANH. Authors' summary.

Mackerel offal, scrap fish and poultry offal in the growth period and unchanged feeding in the suckling and growth periods for foxes.

Bente Lyngs and Georg Hillemann.

At certain times herring offal contains quite a lot of mackerel offal. It is therefore important to know how foxes react to this raw material. The experiments with scrap fish and with extra addition of poultry offal was a continuation of the experiments in the breeding period of 1988, when scrap fish and poultry offal were fed to breeding animals. Experiments were planned especially in order to get answers to the following questions:

What does a change of feed at weaning and separation of kits mean to their total growth and pelt quality.

Will the feed which the mother has been eating throughout the gestation and nursing periods and which the kits are eating in the first part of their growth period have any effect on the fur quality of the pups.

The results seem to indicate that:

Mackerel offal in the quantities used here reduces feed consumption of silver foxes.

Mackerel offal and scrap fish have no negative influence on fur development in silver foxes. Neither quality, nor size or clarity have been affected by these ingredients.

Drastic changes of feeds at separation of the pups apparently have no effect on the development of their fur later in the year. At any rate, unchanged feeding in the suckling and growth periods did not show any beneficial effects.

On the other hand it seems that blue foxes react negatively to fat fish and too much poultry offal. Experiment 6 (15% extra poultry offal and 25% scrap fish) produced inferior quality, size and clarity. 20% mackerel offal resulted in poorer clarity and there was a strong tendency towards smaller skins.

In blue frost foxes 15% extra poultry offal + 25% scrap fish caused smaller size just as for blue foxes. However, there was apparently no effect on skin quality and clarity (the same picture as for the silver foxes).

Danish Fur Breeders Association, Technical Year Report 1989. 10 tables, p 126-137. In DANH. Authors' summary.

Experiments with decreasing level of energy from protein for mink in the suckling period.

Carsten Riis Olesen.

Earlier experiments on Research Farm West have proved that females do very well and that kit gain is satisfactory on a feed composition with an energy distribution of 40:50:10 (protein, fat, carbohydrates). In 1988 different protein levels were tried on groups of pastel females in connection with our investigation of mink milk. The reproduction results and weight development of kits were used to analyse the validity of the previous results.

The variation in protein was in this experiment compensated with fat. In the control group, the ratio of energy was 52:35:12. In the research groups protein levels 38, 43, and 49 were tried.

In this experiment the best results in the standard type were achieved with energy distribution 49:39:12. In the pastel group the highest weight gain was recorded in group 43:45:12. Kits in the low protein group (35:50:12) gained less, but the difference compared to the control group was not significant. Therefore, even the low protein level is considered satisfactory for lactating females.

Danish Fur Breeders Association, Technical Year Report 1989. 3 tables, p 187-190. In DANH. Author's summary.

Development of FFA and Peroxides in heat treated cereals when stored as whole grain or ground products.

Carsten Riis Olesen and Anton Aarup.

The objective of the investigation was to demonstrate the effect of grinding on the development of free fatty acids and peroxides at storage. In other words, what is the safe length of storage time for ground products compared to whole grain.

Normal storage of heat treated as well as ground cereals cannot be recommended for more than one week. If the heat treated product has not been ground, it can be stored for up to two weeks.

The results seem to indicate that the fat in heat treated wheat is peroxidized to a higher degree than in heat treated barley.

For untreated and heat treated whole grains no immediate problems should arise when stored up to a month. As the amount of FFA is increasing, the basis for an unfortunate development of quality will, however, exist and can be expected.

Danish Fur Breeders Association, Technical Year Report 1989. 2 figs., p 191-196. In DANH. Authors' summary.

German poultry offal for mink females in the winter and nursing periods.

Carsten Riis Olesen.

After a relatively poor breeding season in 1988 with a low average litter size, feed composition in various feed kitchens was checked. The only factor that seemed to be common for feed centrals that had a particularly low breeding result was the use of German poultry offal. It was therefore suspected that hormonal residues could be found in poultry offal from Germany. In order to test this suspicion, breeding groups of standard and pastel mink were fed a high amount of poultry offal.

The experiments could not reveal any negative effect on litter size of mink females when German poultry offal was fed.

On the contrary, it seems possible to use German poultry offal with advantage, if the price is competitive.

Whelping result and kit gain are satisfactory in comparison with the control group.

Danish Fur Breeders Association, Technical Year Report 1989. 3 tables, p 197-199. In DANH. Author's summary.

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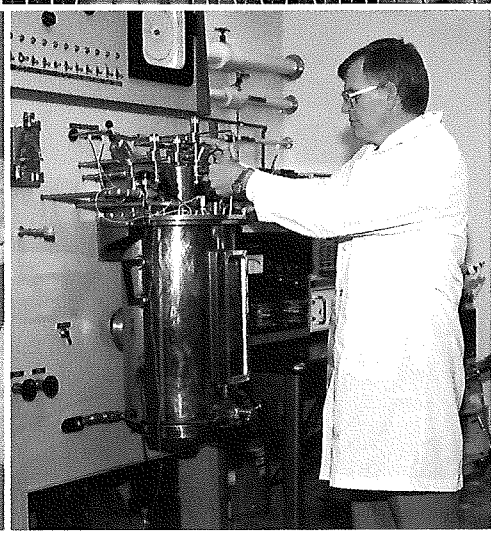
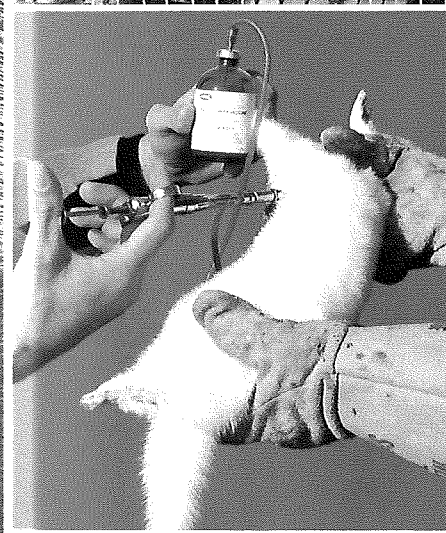
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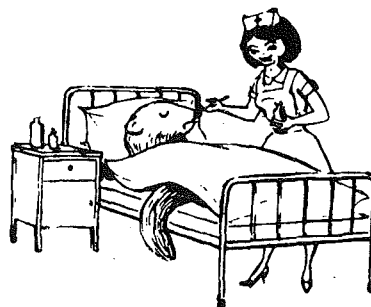
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Standard list of feedstuffs for both foxes and mink, 1989.

H. Sterten.

As a general guide a standard diet for both foxes and mink is shown, consisting of cod scraps, coalfish scraps, oily fish scraps, fish silage, fish meal, slaughterhouse waste, blood, livestock fat, soyabean oil, carbohydrate concentrate, vitamin supplement and water. Proportions are varied over the 4 periods of the year. Metabolizable energy per 100 g in the 4 periods and proportions of protein, fat and carbohydrate are tabulated, also average chemical composition and nutrient digestibility of raw materials. Other components could be substituted, or amounts adjusted depending on price, availability, quality and feeding value. Supplementary iron is recommended throughout and salt seasonally.

Norsk Pelsdyrblad, 63, 4, 14-15, 24, 1989. 2 tables. In NORG. CAB-abstract



Veterinary Sciences

Pasteurellosis in the mink.

G. Albert, U.D. Wenzel.

Pasteurellosis infections may occur enzootically in mink populations. We observed an outbreak of Pasteurellosis which took a chronic form and resulted in a high amount of deaths. The examined animals always exhibited pronounced pleuritis and peritonitis. Simultaneously, metabolic disorder occurred as predisposing factor for Pasteurellosis infection. Course of disease and necessary therapeutic and prophylactic measures are described.

Brühl 30, 6, 34-35, 1989. 10 references. In GERM. Authors' abstract.

Monoclonal antibodies applied in an immunoperoxidase method for detection of parvovirus in specimens of small intestine from dog and mink.

L. Jonsson, C. Magnusson, M. Book, N. Juntti.

A pool of three monoclonal antibodies, against three epitopes on the parvoviral haemagglutinin, detected parvovirus in formalin-fixed, paraffin-embedded tissues from dogs and mink. Background staining was minimized.

Acta Veterinaria Scandinavica, 29, 2, 263-264, 1988. 9 references. CAB-abstract.

An outbreak of post-vaccinal suspected distemper-like encephalitis in farmed ferrets (*Mustela putorius furo*).

J.M. Gill, W.J. Hartley, N.L. Hodgkinson.

Two outbreaks of an encephalitis apparently induced by an attenuated live distemper vaccine occurred in a large ferret breeding establishment in New Zealand. Approximately 350 of 6,000 young ferrets 16-22 weeks old died. Many were found dead with no premonitory signs, others showed severe neurological signs. Some with central nervous system (C.N.S.) signs recovered.

Pathological examination showed no gross abnormalities except for a few with mild conjunctivitis, rhinitis and lung emphysema. Microscopically there was a moderate to massive non-inflammatory necrosis of hippocampal nerve cell bodies. In those animals which survived for several days with CNS signs there was also a mild to moderately severe non-supportive encephalitis, and in some of these distinct neuronal intranuclear and intracytoplasmic eosinophilic inclusion bodies in bronchiolar epithelium. All these lesions suggest that a distemper like condition was involved. About half of the ferrets also had a mild to severe inflammatory myocardial necrosis.

N.Z. vet. J. 36, 173-176, 1988. 3 figs., 15 references. Authors' abstract.

An outbreak of septic endometritis in the Arctic Blue fox (*Alopex Lagopus*) caused by *Clostridium carnis*.

H. Sørum, K. Nordstoga, G. Loftsgaard, D.J. Brenner, D.G. Hollis, K. Fossum.

An outbreak of endometritis and septicaemia in farms that raise Arctic blue foxes is described. Eleven animals from eight different farms were examined, most of them pregnant or with newly delivered litters. Pathological examination indicated inflammation of the uterus, and focal necrotic changes in the liver. In some animals evidence of hemorrhaging was found in the anterior part of the small intestine. Bacteriological examination revealed abundant growth from different organs of the animals of a pure culture of a small, slender, Gram-variable, sporeforming rod, which was identified phenotypically as aerotolerant *Clostridium carnis*. This identification was confirmed by DNA hybridization. The organism caused death in mice 1-2 days after intraperitoneal inoculation, and killed an Arctic blue fox which was inoculated intracervically. Two foxes, pretreated with diethylstilboestrol, became seriously ill after intrauterine inoculation, but survived. The spontaneous outbreak of the disease was characterized by sudden onset of septicaemia with few or no clinical symptoms before the animals succumbed.

Acta Vet. Scand. Vol. 29, 2, 181-191, 1988. 4 tables, 2 figs., 21 references. Authors' summary.

Salmonella arizona in a chinchilla.

A. Mountain.

We recently isolated a *Salmonella arizona* (serotype 0-21 r,z) from a chinchilla with septicaemia. Records appear very sparse on this serotype and I would be interested in hearing of any other cases involving this serotype.

Veterinary Record, 125, 1, 25, 1989.

Humoral immune response in kits with plasmacytosis.

Henrik Falkenberg.

The objective of this experiment was to examine whether mink infected with plasmacytosis produced less antibodies against bovine serum albumin (BSA) than mink free of plasmacytosis.

60 standard kits born in 1989 participated in the experiment, and of these 36 had mothers who were plasmacytosis positive, whereas the remaining 24 mothers were plasmacytosis negative.

Plasmacytosis affects the ability to produce antigens against another specific antigen.

Danish Fur Breeders Association, Technical Year Report 1989. 2 tables, 2 references, p 254-256. In DANH. Author's summary.

Suspected Aleutian disease in a wild otter (*Lutra lutra*).

G.A.H. Wells, I.F. Keymer, K.C. Barnett.

Clinical and pathological observations of a naturally occurring disease in a British wild otter (*Lutra lutra*) are reported. Systemic lymphoreticular proliferative changes with plasmacytosis, glomerulonephritis, arteritis and biliary hyperplasia closely resembled the pathological changes in Aleutian disease of mink (*Mustela vison*). Feral mink provided a possible source of infection.

Veterinary Record, 125, 9, 232-235, 1989. 4 figs., 23 references. Authors' abstract.

Infection studies in mink with seal-derived morbillivirus.

M. Blixenkronne-Møller, V. Svansson, P. Have, A. Bøtner, J. Nielsen.

Morbillivirus derived from diseased harbour seals (*Phoca vitulina*) has characteristics of acute virulent canine distemper virus infection in mink. The infection induced a disease resembling the acute systemic and nervous form of canine distemper.

Arch Virol, 106, 165-170, 1989. 1 table, 1 fig., 11 references. Authors' summary.

Preliminary investigations on sideraemia and TIBC in nutria.

I. Chisu, P. Pop, L. Stana, C. Falca.

The researches were made on 13 male mature nutria and on 62 male young nutria of 7-9 months from two different technological and feeding condition units. It was determined proteinemia, proteic fraction, sideremia and TIBC in blood obtained by sacrifice.

Proteinemia and Beta-globulins have higher values in adults than in youth. Sideremia has values between 111.1 ± 3.54 and 143.8 ± 3.56 $\mu\text{g Fe}\%$ and TIBC has values between 196.7 ± 5.89 and 294.9 ± 8 $\mu\text{g Fe}\%$. The saturation coefficient of transferrin in these species in comparison with others have values between 48.2% and 60.1%.

Sideremia and TIBC values may represent referring values for pathologic cases.

Lucrari Stiintifice, Institutul Agronomic Timisoara, Medicina Veterinara, 22, 119-122, 1987. 2 tables, 4 references. In ROMN, Su. ENGL. Authors' summary.

Aujeszky's disease in furbearing animals

P.N.G.M. van Beek.

In North Brabant (Netherlands) Aujeszky's disease has occurred sporadically among mink (and also some foxes and raccoons) on 15 premises since 1985. Infection from the feed was ruled out, and airborne infection from piggeries seemed probable. Attempts to immunize foxes with two inactivated vaccines failed.

Tijdschrift voor Diergeneeskunde, 113, 21, 1201-1202, 1988. In DUTH. CAB-abstract.

Thesis. Epizootology of influenza in Sweden - in horses, pigs and mink.

I.A. Abusugra.

The aim of this study was to characterize viruses which have been isolated from outbreaks of influenza in horses, swine, and mink. The characterization was based on results of serology, on migration patterns of viral polypeptides and RNA segments, and on viral oligonucleotide fingerprints - these always in comparison with relevant standard reference strains. The data thus obtained should enable the epizootologist to draw conclusions about the provenance or even the origin of incriminated strains.

Two Swedish equine H3N8 isolates from outbreaks among race-horses in 1979 were to a high degree congruent with four continental European isolates from 1979 including the Fontainebleau/79 as references. All these six strains were incongruous with the Miami/63 strain. Three Swedish isolates from outbreaks in the 80s were similar to each other but already somewhat different from the Swedish reference strain Solvala/79. Thus, both the isolates of 1979 and from the 80s show that there has been a slowly progressing drift of the Equi-2 virus from the original Miami/63 strain.

Three closely interrelated H1N1 strains of swine influenza virus have been isolated during heavy outbreaks of influenza on three different pig-farms in the south of Sweden in 1983. One of these strains, Sweden/83, has been compared with two Danish strains, Sjaelland/82 and Als/82, isolated during an epizootic of swine influenza in

Denmark. The strains Sweden/83 and Sjaelland/82 were closely related to each other and to the New Jersey/76 strain as reference to the "US group of variants". Contrarily, the Als/82 strain was found to belong to the "European group". A direct transmission of the avian influenza virus H10N4 from a bird to a mammalian species was anticipated after that heavy outbreaks of influenza had occurred on several mink farms along the south-east coast of Sweden in 1984. Six strains have been isolated from the mink on different farms, and all of them were H10N4 strains; one strain was used for comparison. This strain was very closely related to the British isolates Mallard and Fowl from 1985, and more distantly related to the prototype H10 chicken strain "virus N" from 1949. In bioassays on mink, the mink, fowl and mallard strains, but not the virus N, became spontaneously transmitted from experimentally infected to contact mink causing disease.

The conclusions that can be drawn are as follows: (1) the Equi-2 virus has been imported to Sweden as a variant from the continent, by international traffic with race-horses; (2) the swine influenza in Sweden had its source in a Danish epizootic; and (3) the mink influenza was caused by direct virus transmission from an unknown bird of the Swedish coastal avifauna.

This thesis is based on the following reports, which are referred to in the text by their roman numerals:

- I Abusugra, I.A., T. Linné, B. Klingeborn, and Z. Dinter. 1985. Influenza equi 2: patterns of RNA and protein in variant strains. *Zentralblatt Vet. Med. B*, 32, 567-574.
- II Berg, M., U. Desselberger, I.A. Abusugra, B. Klingeborn, and T. Linné. 1989. Genetic drift of equine 2 influenza A virus (H3N8), 1963-1988: analysis by oligonucleotide mapping. In manuscript.
- III Abusugra, I.A., T. Linné, and B. Klingeborn. 1987. The provenance of the Swedish swine influenza H1N1 virus of 1983. *J. Vet. Med. B*, 34, 566-572.
- IV Abusugra, I.A., T. Linné, and B. Klingeborn. 1989. Analysis of some swine influenza H1N1 viruses by oligonucleotide fingerprinting. *J. Vet. Med. B*, 36, 63-68.
- V Berg, M., T. Linné, L. Englund, I.A. Abusugra, and B. Klingeborn. 1989. Relationship between recent avian and mink H10N4 influenza viruses. In manuscript.
- VI Johansson, G., I. Abusugra, K. Lövgren, and B. Morein. 1988. Separation of hemagglutinin and neuraminidase from influenza virus membrane by column displacement electrophoresis (isotachophoresis) with preservation of their activities. *Preparative Biochemistry* 18, 405-412.

Sveriges Lantbruksuniv. Uppsala (Sweden). 1989. 2 tables, 57 references, 43 p. ISBN 91-576-3755-5. Authors' summary.

Salmonella dublin infection in fur animals in Finland.

Taina Loikala, Erik Smeds.

Salmonella dublin bacterium was first isolated in Finland in the 1930's from farmed foxes and cattle.

After the 1950's there were no cases of S. dublin infection in Finland until 1976 when the bacterium was isolated from farmed foxes.

To determine the incidence of S. dublin infection in farmed foxes samples from 500 fox farms were collected in 1981. The farms examined were situated in different parts of the country. The result of the investigation was that 5% of these farms were infected with S. dublin. All positive farms were situated in the same region, Vaasa county.

After 1981 the number of S. dublin cases has varied yearly both in cattle and in fur animals. Almost all cases have been found in Vaasa county. In a few fur farms S. dublin has been isolated in two successive years.

Feed from a central feed kitchen has been the source of S. dublin infection several times. This has resulted in infection in many farms simultaneously. In these cases the feed contained slaughter offal from cattle that had neither been acidificated nor cooked. Slaughter offal originated from slaughterhouses that received slaughter animals raised in the region where S. dublin infection is now and then diagnosed in cattle.

Outbreaks of S. dublin infection in fur animals have typically occurred between the beginning of April and the end of September. Especially whelps and pregnant mink females have been affected. In some farms the mortality has been as high as 30% in those groups of animals that had suffered most.

Chloramphenicol either parenterally or in feed or trimetoprim-sulfa combination in feed have been used to treat clinically ill animals. In most cases the treatment has been effective.

NJF-Seminar no. 170, Stockholm, 1989. Authors' abstract.



"On the other hand I've heard of doctors playing God."

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SMALL ANIMAL PRACTICE

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PRURITUS

Stephen D. White, DVM, Guest Editor

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Pruritus

Edited by Stephen D. White

The first four papers in this collection of reviews give an overview of pruritus, for clinical approach to discover its underlying causes, and symptomatic therapy used. The remaining eight articles deal with the specific diseases that cause pruritus (flea allergy, food hypersensitivity atopic and contact dermatitis, cheyletiellosis and pruritus scabies), and their diagnosis and therapy.

Veterinary Clinics of North America; Small Animal Practice, 18, 5, 971-1114, 1988. Many refs., 12 contributions. CAB-abstract.

Contents

Preface
Stephen D. White

Pathophysiology of Pruritus
Kevin J. Shanley

Pruritus is the result of complex interactions between a stimulus, various mediators, the peripheral and central nervous systems, the subject's immediate mental state, previous experiences and competing external stimuli. This article discusses what is known of these interactions and how they may apply to pruritus in small animals.

The Clinical Approach to the Pruritic Dog
Susan J. Reinke

Diagnosis of pruritic canine skin disease can be a time-consuming process. Careful attention must be paid to history, clinical examination, laboratory and clinical testing, methodical elimination of the differential diagnoses, and client communication in order to achieve success.

The Clinical Approach to the Pruritic Cat
Carol Foil

A problem-oriented approach to the presentations of pruritic skin diseases of the cat is developed. A differential diagnosis for each presentation of pruritus is given. A diagnostic plan for each category of pruritic diseases is proposed.

The Role of Pyoderma in Pruritus
Laurie J. Stewart

In the approach to the pruritic patient, it is important to first determine if a pyoderma is present. This article addresses the classifications of pyoderma, therapy, and the role of pyoderma in the pruritic animal.

Flea Allergy Dermatitis
Vicki Jo Scheidt

Flea allergy dermatitis is one of the most common causes of pruritus in dogs and cats. The degree of pruritus observed in the allergic animal varies widely and is dependent on numerous factors. Management of the flea allergic patient is extremely frustrating for the owner and the veterinarian. Establishing an organized flea control program for use on the patient and in the environment will help to avoid frustration when dealing with this common ectoparasite of cats and dogs.

Food Hypersensitivity
Stephen D. White

Hypersensitivities to foods afflict both dogs and cats. Clinical signs are highly variable, although pruritus is almost always present. Diagnosis and therapy are discussed.

Atopic Dermatitis
Candace A. Sousa

The article considers the pathogenesis, clinical signs, diagnosis, and treatment of atopic dermatitis.

Contact Dermatitis
Gail A. Kunkle

Contact dermatitis may be allergic or irritant in etiology. Contact allergic dermatitis is more difficult to diagnose and usually requires a long sensitization period of several months to years. Pruritus is a major feature along with papules, erythema, and occasional vesiculation. Contact irritant dermatitis is generally more easily defined and is often more painful than pruritic.

Cheyletiellosis and Scabies
Lynn P. Schmeitzel

Cheyletiellosis and scabies can cause pruritus in dogs and cats. Cheyletiellosis is variably pruritic, whereas scabies is usually intensely pruritic. Hypersensitivity reactions are described in both of these parasitic dermatoses and probably contribute to the development of lesions and pruritus. Both parasites are readily eradicated with insecticides.

CONTENTS
Pruritus in Pet Rabbits, Rodents, and Ferrets
Karen J. Timm

This article covers specific causes of pruritus in rabbits, guinea pigs, hamsters, gerbils, rats, mice, and ferrets. It also discusses some behavioral traits that may be confused with pruritus. Diagnosis, treatment, and control of the causes of pruritus are emphasized.

Antipruritic Drugs
Edmund J. Rosser

Symptomatic treatment of pruritus is an important adjunct to the systematic approach of attempting to define the etiology of a pruritic skin disease. This article includes a description of the various systemic and topical antipruritic preparations available to veterinary dermatologists as well as their recommended dosages.

Endocrine, Neoplastic, and Metabolic Causes of Pruritus
Rod A.W. Rosychuk

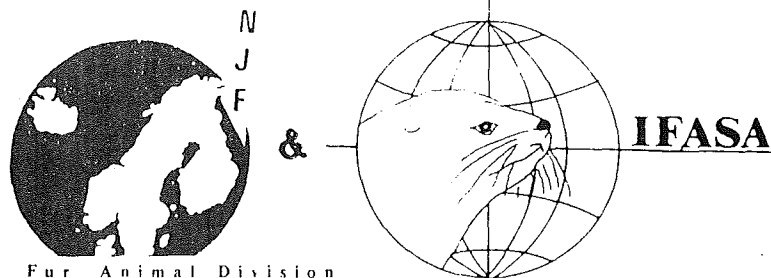
Although they are not common causes of pruritic skin disease in the dog and cat, certain endocrine, metabolic, internal, and neoplastic diseases are on occasion capable of eliciting significant pruritus. Explanations for the pruritus seen with hypothyroidism, hyperadrenocorticism, sex hormone imbalances, and growth hormone-related dermatoses are explored. The incidence and pathomechanism of pruritus associated with diabetes mellitus, hyperthyroidism, uric acid metabolism defects, hepatic and renal disease are discussed. Those cutaneous neoplasms that may be pruritic and mimic other pruritic dermatoses such as cutaneous lymphoma, mast cell tumors, and inflammatory mammary gland tumors are also discussed.

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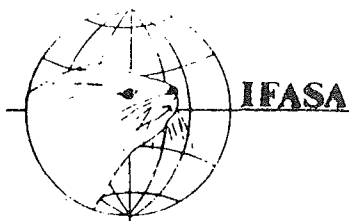
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