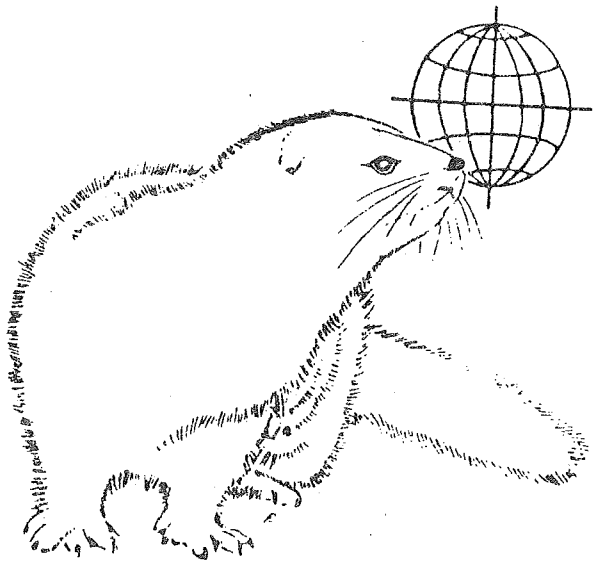

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Vol. 15, No. 1
February 1991

Titles of other publications - not abstracted

Effects of extrusion of barlev on carbohydrate digestibility in mink. *K. Østergaard, K.E. Bach Knudsen, B.O. Eggum, I. Bjoerck, N.G. Asp. Cereal Science and Technology in Sweden, Ystad (Sweden), 13-16 June 1988, STU-Information (Sweden), Styrelsen foer Teknisk Utveckling, 1989, STU, Stockholm (Sweden), no. 710, p. 355-358, ISSN 0347-8465, ISBN 91-87818-00-0. Code 7-6-M.*

7. Veterinary

Titles of other publications - not abstracted

Immunobiological control of mated couples in mink breeding. *A. I Dmitrenko, N. A. Khodzher. Krolikovodstvo i zverovodstvo (USSR)., No. 3, p.9, 1989. ISSN 0023-4885, In RUSS. Code 3-9-M.*

The ferret as a model for vasomotor biocompatibility testing of medical devices. *J. Hoglind, E. Bauer, C. Berlin, K. Nicholas, A. Parisi, W. Kirkpatrick. Laboratory animal science (USA)., Vol. 39 (5), p. 450-452, 1989. Available at: US (DNAL 410.9 p94). ISSN 0023- 6764. Code 3-14-O.*

Skin diseases of ferrets. *J. E. Cooper, Veterinary Annual, Vol. 30, p. 325-334, 1990. 19 references. Code 9-2-O.*

What science knows today about the ECG ailment in mink herds. *John R. Gorham. U. S. Fur Rancher. Nov., 5-7, 1990. Code 9-M.*

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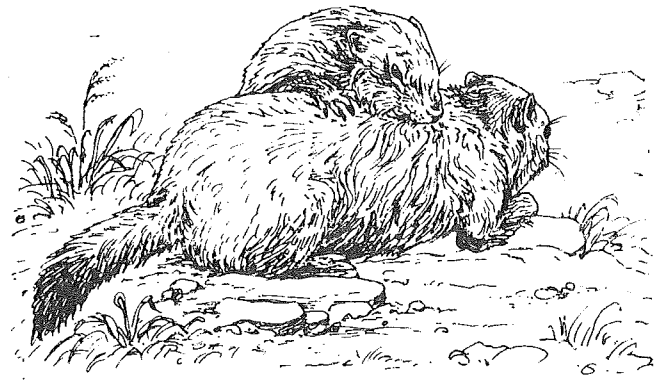
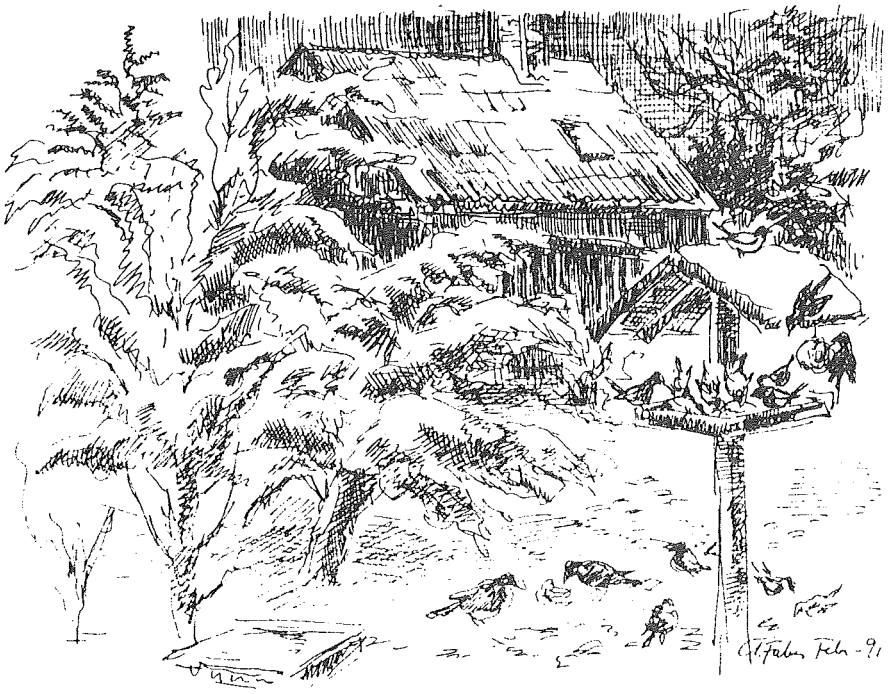
Pathological observations on distemper in racoon dog. *Luan Chenggui. Journal of Liaoning Animal Husbandry and Veternary Medicine (China). No. 2, p. 25-27, 1989. 3 figs. In CHIN. Code 9-O.*



8. Scientific meetings, symposiums and congresses

Fur bearers production and breeding. Research papers. Proceedings



Notes

SCIENTIFUR

Vol. 15, No. 1

February 1991

When you read this issue of SCIENTIFUR, everybody in the Northern Hemisphere is thinking of springtime, sowing the seeds for the 1991 harvest. Hopefully, spring in the fur business will be more pronounced than the very weak signs of today.

In the latest issue of SCIENTIFUR we announced our December meeting in Scandinavia with scientist and breeder associations where the issue was Fur Animal Research in the future.

All parties agreed that it is essential - also during periods of economic crises - to maintain research at a certain level and if at all possible to keep researchers in their positions in order to ensure as much as possible of the fine expertise and competence built up during the good periods.

Another positive signal from the meeting was that the Scandinavian organizations were all willing to support SCIENTIFUR to ensure the future of this very important information and communication link in the fur industry. The Scandinavian organizations sincerely hope, however,that the other fur breeder organizations - outside Scandinavia - will also take their share of the responsibility for the future. This message is herewith conveyed to fur breeder organizations in all fur producing countries.

The responsibility for SCIENTIFUR was taken over by IFASA from January 1990, and IFASA therefore hopes that organizations and institutions will help increase the number of subscribers.

The Scandinavian meeting also recommended that SCIENTIFUR does not publish original scientific reports approved by referees but should instead try to bring good review articles. The reason for this recommendation is that there are so many well established and highly estimated international journals for the very scientific reports, and that it is of greater value for the main circle of actual and potential subscribers to receive good reviews of the various subjects.

We hereby invite colleagues to send such material to us marked: Review articles.

In this issue of SCIENTIFUR we bring abstracts from 2 scientific meetings on Fur Animals in Poland and Germany, respectively. At the same time we bring an invitation to an International Symposium regarding Physiological Basis for Increasing the Productivity of Predatory Fur Animals. This symposium takes place in Petrozavodsk, USSR in September this year.

In fur animal production the "world map" is changing. Especially with regard to raising money for fur animal research and support to IFASA and SCIENTIFUR, it is interesting to see that the European Community (EEC) gradually outdistances the Scandinavian countries as the largest fur producing area.

Per cent of total world production of mink skins	Scandinavia	Others	EEC	Others
1988/89	46.5	53.5	41.0	59.0
1990/91	51.5	48.5	51.8	48.2

This raises the question that the fur research area is worth some attention from the EEC research funds. It is only possible to receive money from EEC funds if 3 or more countries are cooperating on a project, so it is very important that steps are taken towards such cooperation. The problem has been discussed on several occasions, and we hereby want to invite institutions interested in fur animal research to contact us. The correspondence can be sent to SCIENTIFUR, P.O.Box 13, DK-8830 Tjele, Denmark. At the same time we urge fur breeder associations in the EEC to urge their research partners to contact us.

All members of IFASA and subscribers to SCIENTIFUR have now received their 1991 invoices. It is our sincere hope that everybody will pay as soon as possible.

In this issue we bring a copy of the application card for membership of IFASA. We hope that readers who have not yet applied for membership will use this opportunity to do so, and we hope that our readers and members will also try to convince their colleagues etc. involved in fur animal production to become members.

We again thank Janne Hansen for editing and correcting the language of the present issue.

Best wishes for a good spring in all respects.

Your editor

Gunnar Jørgensen

IFASA

INFORMATION ABOUT IFASA

We hope that all Scientifurs readers are members of IFASA. It is only through individual memberships that we are able to make IFASA a strong organization. During 1990 we have reached 80 members, representing 16 countries. In addition we have 13 institutional members, all national fur breeders associations.

Within IFASA, one representative will be appointed for each country, as a link between the individual member and the board. At the next board meeting, a commitee will be appointed for each of the 5 working groups. We hope that they will organize themselves before the next international congress in Oslo in 1992.

Scientifur is now published in the name of IFASA. However, there are problems concerned the economy of such a journal. It looks as if the nordic fur breeders associations will give a financial support that allows further publication, together with individual subscriptions and advertisements.

There are many companies involved in the fur industry, and they should take the possibility to advertise in Scientifur. It could be a good investment, as well as a good support.

If you, dear reader, are not yet a member of IFASA, do apply for membership to day. If you are, good, but make your friend a member too.

Prof. Einar J. Einarsson
President

Send your application for membership to:

STAMP

IFASA
P.O. BOX 13
DK-8830 TJELE
DENMARK

INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

OBJECTIVES

IFASA has the objective to promote knowledge of all aspects of fur animal science and the fur industry, on a worldwide basis. IFASA will encourage the exchange of knowledge among people with an interest in the industry.
IFSA will publish the journal Scientifur, which will include scientific publications, news from the fur industry and advertisements.
IFASA will be the organizing body for international cooperation in fur animal science, and will be the formal link between breeder organizations, government agencies and scientists, on an international level.
IFASA will coordinate and arrange international scientific meetings and congresses.

MEMBERSHIP

The membership of IFASA is based on an individual membership by persons who are, or have been engaged in any activity connected with fur animals- or the fur industry, and who are interested in the objectives of IFASA. Institutions, companies and organizations are welcome to be associate members of IFASA. The annual fee will be decided by the Board of each year, and should be paid to the secretary before February 1. of each year.
Application for membership should be sent to the secretary, to be approved by the Board.

ORGANISATION OF IFASA

The individual members of IFASA are represented in a Council with the following representation from each country:

Number of individual membership	Number of representatives in the Council
1- 5	1
6-20	2
> 20	3

The member of the Council should be elected by members within each country. The Council will meet every fourth year, at the time of the international congress.
The Council will elect a Board of five members who will serve with the past President. Two members will be elected from Scandinavia, one from the western countries, one from the eastern countries and one by free election.

IFASA CONGRESSES

World Scientific Congresses will be organized by IFASA every fourth year. A national committee is responsible for the local arrangements, with a sub-committe of scientists responsible for the scientific programme. The international congresses have been in Finland (1976), Denmark (1980), France (1984), Canada (1988) and will be arranged in Oslo in 1992.
Workshop and other relevant meetings in the name of IFASA may be held at intervals between the congresses.

SPONSORS

IFASA will have official sponsors, which support the organization by means of annual contributions.

WORKING GROUP WITHIN IFASA

Working group 1 - breeding, reproduction and genetics
working group 2 - nutrition
working group 3 - pathology and diseases
working group 4 - behaviour and welfare
working group 5 - fur properties

Your membership in IFASA is welcome,
the International Fur Animal
Scientific Association

Dr. Einar J. Einarsson
President of IFASA

I hereby apply for membership in IFASA

☐ Individual membership of IFASA, DKK 150,-

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☐ Individual membership of IFASA and subscription of Scientifur, DKK 600,-

☐ Subscription of Scientifur, DKK 550,-

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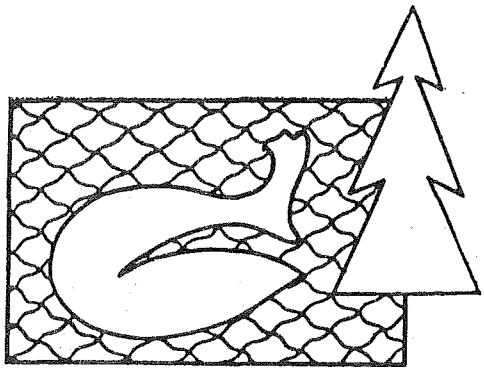
Please send more information how to be an official sponsor of IFASA ☐

Please use typewriter or block letters.



PETROZAVODSK 91

FIRST
ANNOUNCEMENT

Dear colleague Dr. G.Jorgensen

We are glad to inform you that the International Symposium *"Physiological bases for increasing the productivity of predatory fur animals"* will be held *in Petrozavodsk, USSR, on September 17-19, 1991.*

The main theme of the Symposium will be dealt under the following headings:

1. Pathways for promoting reproductive functions and development.
2. Control and regulation of physiological state.
3. Digestive status and optimization of feeding.

The working languages at the Symposium will be English and Russian.

Registration fee (as expected) - 150 $

The Symposium regestration fee includes hotel reservation, volume abstracts, lunch and excursions. Registration fees shoud be paid at registration.

The Organizing Committee will decide, because of the limited number of participants, on the acceptability of the papers. Further detailed information will be mailed in a later announcement.

The registration form (Form No 2) and the abstracts (Form No 1) should be sent to the Organizing Committee not later than Marth 1, 1991 to:

Dr. Viktor M. Olejnik
Secretariat,
185610, Petrozavodsk,
Pushkinskaya, 11, USSR,
Institute of Biology,
Karelian Research Centre,
USSR Academy of Sciences.
Telephone 7 - 61 - 75

The Organizing Committee

Form No 2

International Symposium

"Physiological bases for increasing the productivity of predatory fur animals"

REGISTRATION FORM

(Please type or use block letters)

Family name _____

Given name(s) _____

Institution _____

Title _____

Address _____

Country _____ Telefone _____ Telex _____

The title of the paper _____

_____

Please indicate the number of the session at which you will present your paper (according to the list) _____

Form No 1 *Example*

Abstracts of the report on problem No

STIMULATION OF THE REPRODUCTIVE FUNCTION OF MINKS BY BIOLOGICALLY ACTIVE SUBSTANCES

I. R. Ivanov, A. B. Petrov, K. P. Sidorov - Institute of Biology, Karelian Research Centre, USSR Academy of Sciences, Petrozavodsk, Pushkinskaya, 11.

The influence of sex hormones introduction on the reproductive function of minks was studied.
The sexual activity ...

- -

Instructions for preparing abstracts.

Please provide three copies of single-spaced text (in English) within a 120x170 mm frame.

Each paragraph should start with a new line. Avoid any corrections.

For the title, the name of the autor, affiliation follow the enclosed example (Form No 1).

Original Scientific Report

Measuring hair length in Mink (Mustela vison) using a new method

Keiji Kondo, Shigeharu Fukunaga, Fumio Nakamura, Kazuaki Takenouchi

Faculty of Agriculture, Hokkaido University, 060 Sapporo, Japan

Abstract

A new method for measuring hair length in mink was developed. Five dressed dark male mink were used in this experiment. The hairs, plucked from 6 positions on the skins were mounted in Canadian balsam, and were transferred to the printing paper. Subsequently, the length of hair image on the printing paper was measured using a digitizer connected with a computer.

On all the mink skins the hair length of both the straight guard hair and underfur increased from head to rump. It was demonstrated that the mink skins called "short napped skins" by many furriers showed smaller differences in length between straight guard hair and underfur, and these small differences were caused by shorter straight guard hair and longer underfur. Furthermore the straight guard hair of the short napped skins showed a smaller variation than that of the long napped skins, but there were no significant differences statistically in the variation of underfur between them. The uniformity of hair length in short napped skins was dependent on the straight guard hair.

Introduction

Fur quality in mink skins is estimated by many factors, including the size of skin, hair color, skin thickness and hair quality. Hair quality is separated into the following elements; hair density, hair length, hair thickness, etc. As a rule hair quality is estimated subjectively by professionally trained graders. However, it is important to have a more reliable way to express hair quality objectively, and this can be by using digital values in order to improve and estimate it.

Studies on objective means of determining hair density have been done by many researchers; on sheep by Burns & Miller (1931), by Bosman (1934) and by Carter (1939); on sheep and rabbits by Nawara & Kaszowski (1955), and on mink by Kaszowski et al. (1970), by Blomstedt & Lohi (1981) in special connection to "metallic hair " in mink, and by Kondo et al. in relation to the development of new methods of determining hair density (1989).

Recently hair length has been considered to be an important element of hair quality of mink skins. However, few studies on hair length have been done. In early studies, indirect measurements were made on wool length, that is, wool length was calculated from number of fibers and the weight of the wool (*Henderson, A.E., 1965*). Subsequently, direct measurements were done on the skin of red deer (*Ryder, M.L., 1977*) and mink (*Connor, M.L., 1988*) using a ruler with an accuracy of mm. Previous to Connor's report, Blomstedt, L. & Lohi, O. (1981) reported that direct measurements were made on the length of mink hair with an accuracy of 0.25 mm, but their report did not describe the methods for measuring hair length.

In this paper, the measurements of hair lengthin mink using a digitizer connected with a computer will be discussed.

Materials and methods

Five dressed dark male mink skins, all of the same size produced in Japan, were used in this experiment.

The hair specimens for measuring hair length were plucked from 6 positions as illustrated in fig. 1.

The plucked hairs were classified into straight guard hair (the longest guard hair) and underfur, and then each was mounted in Canadian balsam. The mounted hair samples were magnified approximately five times and the hair image was transferred to printing paper using an enlarger for the photograph. The length of each enlarged hair was measured by a digitizer with an accuracy of 0.1 mm (NEC Co. Ltd., Graphtec KD-3200), that was connected with a computer (NEC Co. Ltd., PC-9801 VX). The measurements of hair length were done on 20 hairs from each position.

Results and discussion

The lengths of straight guard hair taken from 6 positions are given in table 1. The values shown are the average length of 20 hairs from each position.

It is clear from the mean value in the last column of table 1 and fig. 2 that straight guard hair grows longer from head to rump, and grows shorter from dorsum to abdomen in all mink skins. When the straight guard hair of all 5 skins was examined it was noted that skin D straight guard hair grew much longer than on other skins at the mid-dorsum, rump and flank, but there were no statistically significant differences in other positions.

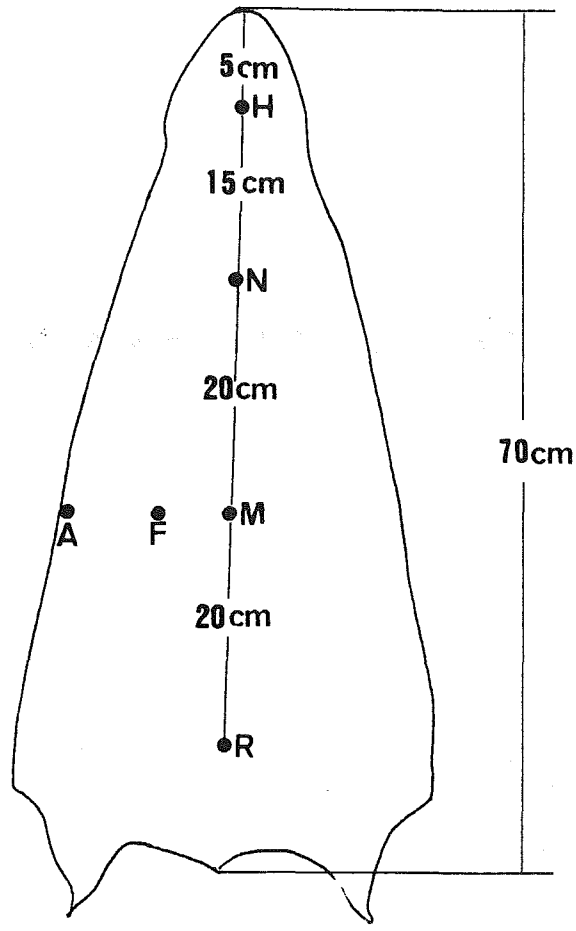


Fig. 1. Hair sampling positions on dressed mink skin. H: Head, N: Neck, M: Mid-dorsum, R: Rump, F: Flank, A: Abdomen.

The length of underfur at the 6 positions is given in table 2.

Table 1. Length of straight guard hair (mm).

	Sampling positions					
	Head X ±SE	Neck X±SE	Mid-dorsum X±SE	Rump X±SE	Flank X±SE	Abdomen X±SE
Skin A	14.48±0.25	18.44±0.25	21.79±0.20	22.38±0.31	19.82±0.17	18.09±0.24
Skin B	15.96±0.23	18.58±0.36	21.27±0.27	21.71±0.39	22.07±0.41	18.08±0.33
Skin C	16.32±0.16	20.14±0.22	21.50±0.13	22.50±0.33	22.74±0.24	17.42±0.28
Skin D	16.32±0.21	19.67±0.34	25.20±0.26	27.67±0.61	24.00±0.30	18.01±0.72
Skin E	13.83±0.16	17.88±0.23	21.10±0.18	21.67±0.22	20.96±0.29	19.88±0.28
Mean	15.38	18.94	22.17	23.19	21.97	18.30

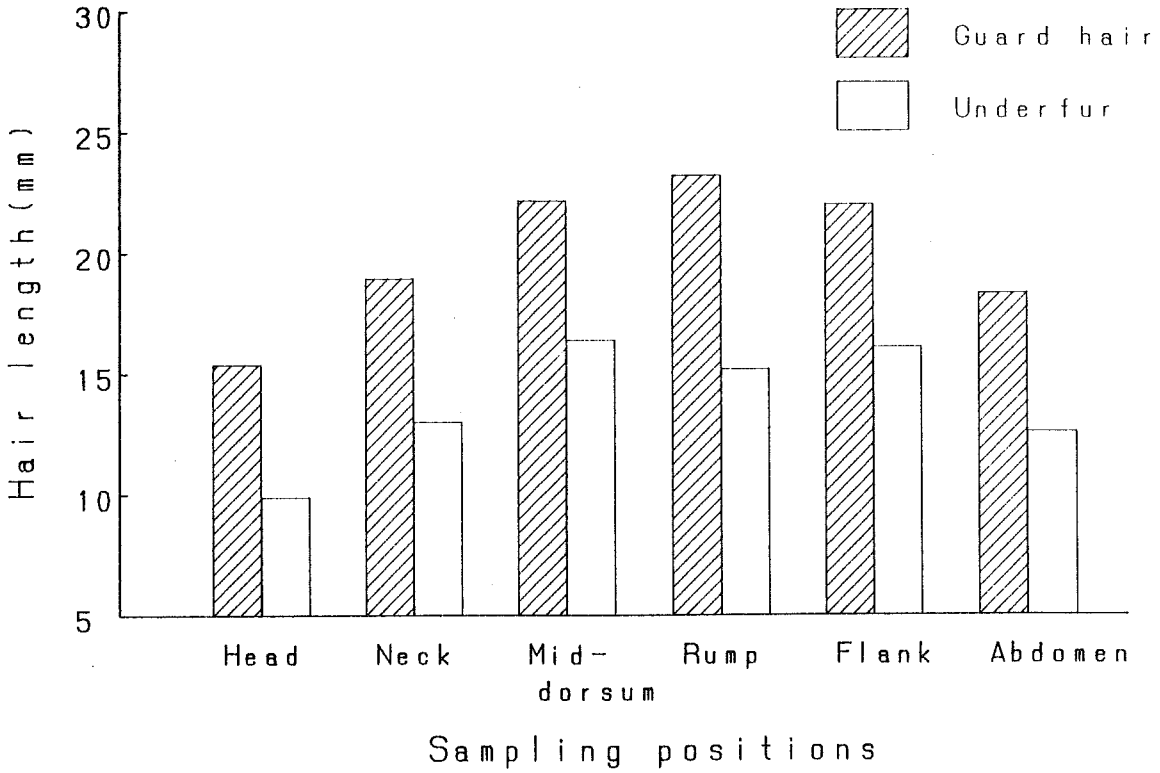


Fig. 2. Mean length of straight guard hair and underfur at each position.

Table 2. Length of underfur (mm).

	Sampling positions					
	Head	Neck	Mid-dorsum	Rump	Flank	Abdomen
	X ±SE	X±SE	X±SE	X±SE	X±SE	X±SE
Skin A	8.19±0.34	12.59±0.19	16.81±0.33	14.47±0.51	16.27±0.29	12.26±0.12
Skin B	8.88±0.31	12.11±0.29	14.99±0.22	14.16±0.29	15.42±0.14	12.16±0.22
Skin C	11.32±0.16	14.88±0.14	16.41±0.32	16.55±0.26	17.42±0.28	12.83±0.12
Skin D	10.28±0.23	12.66±0.30	17.20±0.23	15.09±0.15	15.19±0.27	10.64±0.27
Skin E	10.28±0.19	12.68±0.14	16.53±0.27	15.55±0.14	16.14±0.22	14.90±0.18
Mean	9.89	12.98	16.39	15.16	16.09	12.56

The length of underfur varied in the same way as that of straight guard hair, that is, the mean value of underfur grows longer from head to rump, and grows shorter from dorsum to abdomen (fig. 2).

The differences in underfur length between skins were not so marked as those of the straight guard hair.

The differences in length between straight guard hair and underfur were calculated, and the results obtained are shown in table 3.

Table 3. Differences in length between straight guard hair and underfur (mm).

	Sampling positions					
	Head X ±SE	Neck X±SE	Mid-dorsum X±SE	Rump X±SE	Flank X±SE	Abdomen X±SE
Skin A	6.29±0.25	5.85±0.25	4.97±0.19	7.91±0.56	3.55±0.17	5.83±0.24
Skin B	7.09±0.23	6.47±0.36	6.28±0.27	7.54±0.39	6.65±0.41	5.92±0.33
Skin C	4.52±0.16	5.26±0.22	5.08±0.13	5.95±0.33	5.31±0.24	4.59±0.28
Skin D	6.04±0.21	7.01±0.34	7.94±0.28	12.58±0.61	8.81±0.31	7.37±0.72
Skin E	3.60±0.16	5.20±0.23	4.57±0.18	6.12±0.22	4.82±0.29	4.98±0.28
Mean	5.51	5.96	5.77	8.02	5.83	5.74

The mean values of samples taken from 6 positions of the 5 skins are as follows; 5.51 mm at the head, 5.96 mm at the neck, 5.77 mm at the mid-dorsum, 8.02 mm at the rump, 5.83 mm at the flank, 5.74 mm at the abdomen. The greatest difference in length between straight guard hair and underfur was found at the rump where straight guard hair was the longest (table 1).

In table 3, values that were below the mean values of each positions are underlined. The differences in length between straight guard hair and underfur were examined in each skin. Skin C and E showed lower than mean values at all positions; skin Ashowed lower than mean values with the exception of the head and abdomen. While skin D had higher than mean values at all positions, and skin B had also higher than mean values except at the rump.

The professionally trained graders who examined these five skins suggested that skins A, C and E were better fur quality than the other two and belonged in the "short napped skin" groups as termed by furriers. These five skins were classified into two groups; Groups I (skins A, C, E) and Group II (skins B, D). The difference of hair length between the groups is given in table 4.

Tabel 4. Differences in hair length between Group I and Group II (mm).

	Sampling positions					
	Head X ±SE	Neck X±SE	Mid-dorsum X±SE	Rump X±SE	Flank X±SE	Abdomen X±SE
	Length of straight guard hair					
Group I	14.88±0.19*	18.82±0.23*	21.46±0.17*	22.18±0.37*	21.17±0.23*	18.46±0.27
Group II	16.14±0.22	19.13±0.29	23.24±0.27	24.69±0.50	23.04±0.36	18.45±0.53
	Length of underfur					
Group I	10.09±0.23	13.38±0.16*	16.58±0.31	15.52±0.30	16.61±0.26*	13.33±0.14*
Group II	9.58±0.26	12.39±0.30	16.10±0.23	14.63±0.22	15.31±0.21	11.40±0.25
	Differences in length between straight guard hair and underfur					
Group I	4.80±0.19**	5.44±0.23**	4.87±0.17**	6.66±0.37**	4.56±0.23**	5.13±0.27
Group II	6.57±0.22	6.74±0.35	7.11±0.28	10.06±0.50	7.73±0.36	6.65±0.53

*: $P<0.05$ **: $P<0.01$

There are statistically significant differences between the 2 groups in the length of straight guard hair with the exception of straight guard hair on the abdomen ($p<0.05$); that is, the length of straight guard hair in Group I is shorter than that of Group II.

It was recognized that the length of underfur in Group I was longer than that of Group II. Especially, there were statistically significant differences at all positions except at mid-dorsum and the head ($p<0.01$). It was demonstrated that the skins with the small differences in length between straight guard hair and underfur (short napped skin) are composed of shorter straight guard hair and longer underfur.

The variations in hair length between Group I and Group II are given in table 5. The values shown in table 5 are plotted in fig. 3 which clearly show the difference between groups.

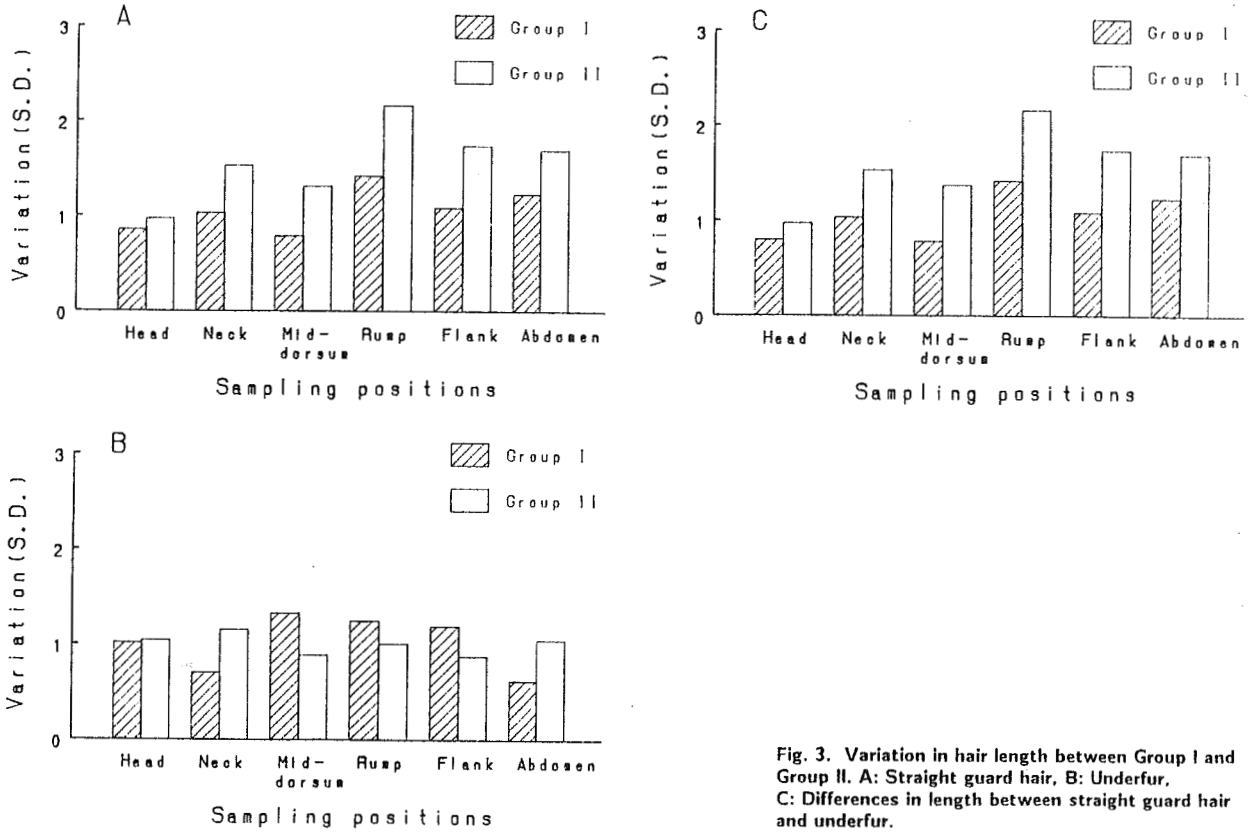


Fig. 3. Variation in hair length between Group I and Group II. A: Straight guard hair, B: Underfur, C: Differences in length between straight guard hair and underfur.

Table 5. Variation in hair length between Group I and Group II (S.D.).

	Sampling positions					
	Head	Neck	Mid-dorsum	Rump	Flank	Abdomen
	Variation in length of straight guard hair					
Group I	0.863	1.038**	0.794**	1.426**	1.091**	1.238**
Group II	0.973	1.531	1.313	2.167	1.737	1.693
	Variation in length of underfur					
Group I	1.021	0.709**	1.329	1.251	1.194	0.625**
Group II	1.044	1.155	0.889**	1.011	0.877*	1.049
	Variation of differences in length between straight guard hair and underfur					
Group I	0.802	1.038**	0.786**	1.422**	1.091**	1.238*
Group II	0.973	1.531	1.372	2.167	1.737	1.693

*: $P<0.05$ **: $P<0.01$

The variation of length of the straight guard hair in Group I was smaller than that of Group II (fig. 3-A), and there were statistically significant differences, except at the head positions, between groups ($p<0.01$, table 5).

On the other hand in the case of the length of the underfur, we could not find a clear difference between the groups (fig. 3-B). The valiations of length between the straight guard hair and underfur of Group I were smaller than that of Group II (fig. 3-C) and there were statistically significant differences (except for samples taken from the head) between the groups as seen in straight guard hair ($p<0.01$, table 5).

The results described above suggest that the uniformity in length of straight guard hair is very important for the fur quality.

Acknowledgements

We are indebted to Miss Yuuko Nomura, Faculty of Agriculture, Hokkaido University, for her technical assistance.

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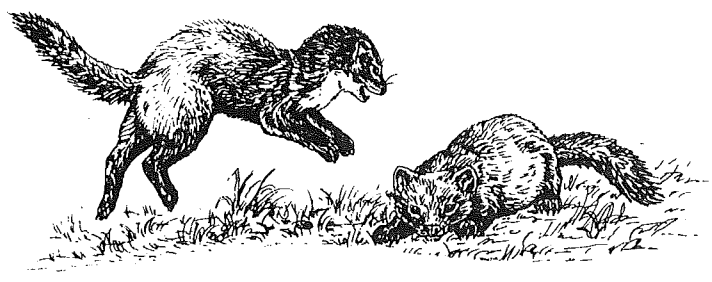

Original Report

Weight gain and hair chewing in mink kits placed singly or in pairs from September

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Summary

The effects on weight gain, skin length, fur quality, and hair chewing of placing mink kits individually from September until pelting were examined. The separation resulted in a lower weight at pelting, and shorter skins. The fur quality was, however, not improved. The number and degree of fur bites were reduced in the separated group. The practice use of separating mink kits is discussed.

Background

In North America it is customary to place mink kits individually either after weaning or in the latter part of the growth period. This way feed rationing and gain are easy to control. At the same time fighting and hair chewing among the animals are avoided. In Scandinavia, experience has shown that it is positive to keep the animals in pairs, one male and one female, until pelting. Quite a number of experiments have been carried out as regards number and composition of kits. A number of different possibilities exist, but experiments as well as practice show that more than two kits together are often likely to cause trouble. A male and a female kit together is therefore recommended in the internordic "Guidelines for Fur Animal Breeding" (The Danish Fur Breeders Association).

The possible advantages of placing the kits alone have not been examined very closely, one of the reasons being that such examinations require extra cages. In the present situation many farms have empty cages. It is, therefore, relevant to examine whether these free pens could be used, e.g. by placing the kits individually.

The purpose of this examination was to illustrate the effect on weight gain, fur quality and hair

chewing of placing the kits individually from September until pelting.

Material and methods

A group of 306 pairs of pastel kits was divided randomly into two groups. One group was placed individually on September 14th, and the control group was placed in pairs, one male and one female, until pelting. All animals were weighed when moved and at pelting. The kits were fed somewhat restrictively, i.e. leftover feed was distributed in the morning and should be eaten before feeding in the afternoon. The amount of feed was adjusted according to the amount of feed left over in the morning. The daily feed amount in grams was recorded for each group. At live animal grading and after pelting, fur quality was

graded and number of fur bites recorded for all animals.

Some of the animals were selected for breeding and the number of skins graded is therefore smaller than the number of animals at live animal grading. Altogether 300 males and 302 females were included in the live animal grading, but only 213 males and 170 females in skin grading.

Fur quality at live animal grading was divided into grades from 1 to 5. At skin grading, the quality was divided into grades from 1 to 15. In both cases the highest grade represents the best quality.

Hair chewing was divided into neck bites, back or tail bites, where bites placed from the shoulders and up were classified as neck bites. At skin grading, hair chewing was divided into grades from 1 to 3, with 3 as the most serious fur damage, where the hairs have been bitten off a rather large area.

The statistical calculations were performed on PC-SAS. Weight differences were analysed by means of an analysis of covariance in GLM, and number of fur bites was analysed with a "Chi-square" or "Fisher's exact" test.

Results

Feed

The animals were fed somewhat restrictively with feed from an ordinary feed kitchen. Quantity and distribution of feed for pairs, males and females, appear in table 1.

Table 1. Quantity and distribution of feed for pairs, males and females, from September until pelting.

	--------grams of feed per--------			
Date	pair	male	female	male+female
18/09	330	180	150	330
25/09	340	185	155	340
02/10	350	185	145	330
09/10	355	185	150	335
16/10	350	185	155	340
23/10	315	180	145	325
30/10	300	170	140	310
06/11	300	160	130	290
13/11	290	160	130	290

It appears from table 1 that in most weeks kits placed individually got a little less feed per animal than kits in pairs.

Weight

Kit weight at the start of the experiment on September 14th and at pelting is shown in table 2.

Table 2. Kit weight at separation on September 14th and at live animal grading on November 30th.

	September	November
Male kits, individually	1818 ± 270	1933 ± 275
Male kits, in pairs	1831 ± 194	2080 ± 272
Female kits, individually	1010 ± 129	1091 ± 183
Female kits, in pairs	1025 ± 114	1130 ± 126

It appears from table 2 that the kits that happened to be placed individually weighed a little less at the start of the experiment than the control group. An analysis of covariance of the weight in November, with the September weight as covariate, confirms this observation. The analysis shows a significant difference in weights in November, depending on whether the kits had been placed singly or in pairs. A difference was found for males ($p<0.001$) as well as for females ($p<0.05$).

The weight in September was also of great importance to the weight in November ($p<0.001$).

Length of skin for males and females of the two groups is shown in table 3.

Table 3. Length of skin of males and females kept in pairs or individually from September until pelting.

	Number of animals	Length of skin in cm
Male kits, individually	111	72.0 ± 4.3
Male kits, in pairs	102	73.4 ± 3.8
Female kits, individually	91	57.8 ± 2.9
Female kits, in pairs	79	59.3 ± 3.0

It will be seen from table 3 that the skins of animals that had been kept in pairs were approx 1.5 cm longer than the skins of animals that had been kept individually. The difference was statistically significant for males as well as for females ($p<0.01$).

Quality

The quality at live animal grading and skin sorting is shown for males as well as for females in table 4.

Table 4. Quality at grading of live animals and skins from males and females.

Quality of	live animals		skins	
	No.	1 - 5	No.	1 - 15
Males				
individually	149	2.89	111	8.27
in pairs	151	2.87	102	8.74
Females				
individually	145	2.70	91	8.54
in pairs	157	2.94	79	8.96

It appears from table 4 that the quality of live animals was a little lower for females that had been placed individually than for females placed in pairs. An analysis of covariance showed that the difference was very close to being statistically significant ($p=0.052$). The grouping did not influence the quality of males at live animal sorting.

Animals which had been placed individually had a lower skin quality than animals that had been placed in pairs. An analysis of variance showed, however, that no statistically significant difference in skin quality was found for males nor for females in the two groups. In both groups, the females had a slightly better quality than the males, but as the two sexes were evaluated separately, the quality is not immediately comparable.

Hair chewing

Fur bites were recorded partly at live animal sorting in November and partly on the dried skins. The results are shown in tables 5 and 6.

Table 5. Frequency and distribution of hair chewing at live animal grading.

	No. of animals	% of animals with fur bites neck	back	tail	totally	without fur bites
Males						
Single	149	3.4	0.7	0.7	4.7	95.3
In pairs	151	0.7	0.7	0.0	1.3	98.7
Females						
Single	145	2.1	0.0	2.8	4.8	95.2
In pairs	157	7.6	2.5	1.3	11.5	88.5

It will be seen from table 5 that there were more bites in males that had been placed alone and in females that were placed in pairs. As far as the males are concerned there was no significant difference between groups, whereas the difference was almost significant for females ($p=0.056$). If fur damages were considered in both sexes together, no significant difference showed whether the animals had been placed individually or in pairs.

If both groups are taken together, the frequency of hair chewing was with great certainty higher in females than in males ($p<0.01$).

A large proportion of the fur bites were neck bites, no matter whether the animals had been alone or in pairs. Females that had been alone only showed fur bites in the neck and at the tail.

Table 6. Frequency, distribution and degree of hair chewing at skin grading.

	No. of animals	% of animals with fur bites neck	back	tail	totally	without fur bites
Males						
Single	111	0.9	4.5	8.1	13.5	86.5
Degree		1.00	1.00	1.00	1.00	
In pairs	102	3.9	7.8	11.7	23.5	76.5
Degree		1.75	1.00	1.08	1.17	
Females						
Single	91	0.0	4.4	4.4	8.8	91.2
Degree		-	1.25	1.50	1.38	
In pairs	79	10.1	10.1	7.6	27.8	72.1
Degree		1.75	1.75	1.33	1.64	

Table 6 shows that both in males and females the highest amount of fur bites was found in animals that had been living in pairs. For male skins the difference was almost statistically significant

(p=0.06), whereas for female skins it was highly significant (p<0.001).

If all skins are taken together, the frequency of hair chewing was with great certainty higher if the animals had been kept in pairs than if they had been kept alone (p<0.001). There was no difference in frequency of hair chewing of male and female skins.

For animals that had been living in pairs fur bites were most often found at the tail and on the back of the males and in the neck and on the back of the females. Animals that had been living alone rarely had neck bites in the skins.

The degree of the individual fur bites was higher in skins from animals that had been kept in pairs than if they had been living alone. The degree was also higher in female than in male skins.

Number of fur bites in November and in skins from the pelted animals appears from table 7.

Table 7. Development of hair chewing in pelted animals from live animal grading until skin sorting.

Live animal grading	No. of animals	----% of animals---- with chewing	without chewing
Males, individually	111	2.7	97.3
Males, in pairs	102	2.0	98.0
Females, individually	91	4.4	95.6
Females, in pairs	79	11.4	88.6
At pelting			
Males, individually	111	13.5	86.5
Males, in pairs	102	23.5	76.5
Females, individually	91	9.9	91.2
Females, in pairs	79	27.8	72.2

It appears from table 7 that far more fur bites were found at pelting than at live animal grading. This was found for all pelted animals, for males and females, and for animals living alone or in pairs, respectively. All differences were significant (p<0.01).

Discussion

In most weeks, kits in pairs were given a little more feed per animal than kits living individually. This indicates a slightly lower appetite or feed intake when the kits were alone. The reason may be that kits in pairs may stimulate each other to eat more feed than they would otherwise.

Kits kept alone from September had a lower gain until pelting than kits in pairs. This confirms previous results by Schackelton et al. (1977) and Aldén & Tauson (1979) while Damgaard & Hansen (1991) could not prove this difference. Sønderup (1990) found that kits housed singly were heavier than kits housed in pairs. The reduced growth may be caused by the fact that animals living alone use more energy for heat production and therefore less energy for growth (Aldén & Tauson, 1979). The feed requirement is therefore higher to obtain the same growth. This was also found by Sønderup (1990). In this experiment feed intake was apparently reduced in animals living alone.

In consequence of the lower weight at pelting, the skin length was shorter, if the animals had been housed alone. The lower weight and the shorter skin length ought to result in a better fur quality

(Møller, 1988; Olesen, 1989). It was therefore surprising to find a poorer fur quality in animals living alone than in animals housed in pairs, even though the difference was not statistically significant. Possible explanations may also here be a change in energy distribution and a reduction of feed intake in animals kept alone. A reduced fur quality in animals without nest boxes was previously found by Hansen (1989), apparently caused by the missing nest box environment and an increase in energy consumption for heat production. The results therefore indicate that no improvement of quality can be obtained by separating the mink kits in September, whereas the opposite might be the case.

It has previously been shown that a number of factors may influence the frequency of bite marks. A feed with protein, vitamin or mineral deficiencies can increase the number of fur bites (Hernesniemi, 1981). De Jonge (1988) found that age at weaning and weight were of importance to tail bites which also seem to be hereditary. Disturbances of the fur maturing process may result in hair chewing shortly before pelting (Ellis, 1989). Falkenberg (1990) found that live animal grading reduced the number of fur bites.

Sønderup (1990) found that toys may reduce fur biting and that the time of pelting was of importance. Furthermore, light conditions, climate, puberty, cage size, hygiene, litter size, age etc. have been suggested as contributory or provoking reasons for fur biting. Even though attempts are made to avoid the known provoking factors, and the use of fur biters in breeding is avoided, the problem does not seem to be declining.

This investigation shows that if the animals are kept in pairs, the female shows most fur bites in November. If the animals are kept individually from September till November, the fur bites are more equally distributed on both sexes, but the frequency of fur bites does not change considerably.

At live animal grading in November the highest number of neck and tail bites was found. In females kept together with males the frequency of neck bites is particularly high, but as all categories of bites are seen in animals kept alone, it cannot be determined, which bites are made by the animals themselves and which are inflicted by other animals. The large difference in the frequency of bites between females kept alone and in pairs may either be due to the fact that the male bites the female or that the female bites herself more often if she is kept together with a male.

At skin grading no difference was found between males and females in the frequency of fur bites. On the other hand, the frequency and degree of fur bites were higher in kit pairs than in animals kept alone. This confirms previous results (Sønderup, 1990; Hansen & Damgaard, 1990) and agrees with the fact that the heaviest animals have the highest amount of bites (de Jonge, 1988). Nor in this case is it possible to determine which fur bites the animals make themselves and which are caused by the partner. Neck bites were only seen on one single skin from animals that had been housed singly. It shows, however, that mink are capable of biting themselves so far up on the back that it is described as a neck bite. Nevertheless, it seem far more likely that neck bites are inflicted by the partner. For animals living in pairs the higher frequency of fur bites may be caused by the partner as well as by the fact that the animals bite themselves more often when they live in pairs.

The degree of fur bites was also higher in animals living in pairs, but it is a question whether this can be regarded as an indication that the bites are inflicted by the partner. This is probably only the case if there are bite marks in the leather.

The frequency of hair chewing increased steeply from live animal grading in November until pelting. This is a confirmation of the well known picture that many fur bites occur immediately before pelting. A contributory explanation might be that it is easier to discover fur bites on skins than at evaluation of live animals in traps. Another reason might be disturbances in the fur maturing process (Ellis, 1989), whereas apparently the disturbances in connection with live animal grading and pelting do not cause hair chewing (Falkenberg, 1990).

An important question in the further investigation of hair chewing must be to examine which fur bites are caused by the animals themselves and which are inflicted by the partner in the cage.

Conclusion

Separation of pastel kits in September resulted in a lower weight at pelting and a reduction in skin length. The lower weight and shorter skins could

be expected to result in an improved quality, but the tendency rather showed a decrease.

Separation of the animals leads to a reduction in number and degree of fur bites, but no sexual difference in the frequency of bites is seen. The difference in number of fur bites is likely to be caused by the partner.

A considerable increase is seen in the number of fur bites observed from November till pelting - for animals living alone as well as in pairs.

Practical use
This examination shows that fewer and less serious fur bites are to be expected if the animals are kept alone from September until pelting. On the other hand shorter skins and presumably a poorer quality can be expected, too.

Grade 1 fur bites reduce the fur price by approx 12% and grade 2 fur bites by approx 25%. 1 cm of skin costs approx 1.5% for males between size 0 and size 2 and approx 3% for females between size 3 and size 4. Based on these facts, the average skin price can be calculated for animals living in pairs or singly. The quality is not included, as the difference was not statistically significant.

Compared to animals living in pairs, the average skin price will be increased by approx 1.7% for males and by approx 4.2% for females kept individually - due to the difference in hair chewing.

The difference in skin length will reduce the average skin price of animals housed alone by approx 2.2% for males and approx 4.7% for females.

What has been gained through fewer fur bites is therefore lost on shorter skins. To this must be added the possible loss from a poorer quality and extra labour for feeding, bedding etc. On the other hand, the reduction in feed consumption for animals kept alone results in slightly reduced costs.

Even though the extra cages are available for nothing, it must be concluded that there are no immediate advantages of letting mink kits live alone from September until pelting. If animals living alone could be tempted to eat more feed, the weight could be kept at the same level as the weight of animals living in pairs. Experiments must show if skin length and quality can be maintained at the same time as a reduction of fur bites.

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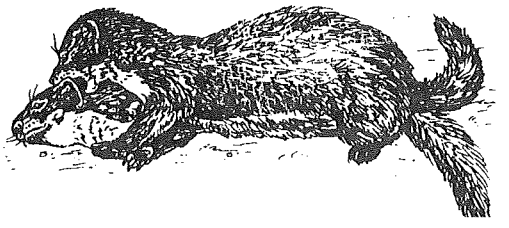

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Original Report

A study on shedding cover hair in the raccoon dog (Nyctereutes procyonoides).

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Raccoon dogs are a subgenus of the dog family Canidae. Recently some zoologists feel that they even form a genus. The Latin name, *Nyctereutes procyonoides*, is connected with the raccoon since they look alike and have very similar hair color. However, the habits of the raccoon dog and its anatomical build is more dog-like.

Raccoon dogs live in dens near damp areas, avoiding large forests and high altitudes.

In the wild state, raccoon dogs live in China, Korea, Japan and the USSR in the extreme east up to 50° north latitude. During the 1930's attempts were made in the USSR to acclimatize raccoon dogs in the forests of the European parts. From these areas raccoon dogs wandered to Poland and Finland. Foresters and zoologists have recently reported raccoon dogs in West Germany (*Lykkeberg, 1978*).

The raccoon dog is the only representative of the dog family which hibernates, however its sleep is not very deep. If, in the autumn, it doesn't put on enough fat it will hunt during the entire winter.

Rearing raccoon dogs in cages began in 1979 in the USSR and was limited to rabbit farms, where dead or unwanted rabbits were fed to the raccoon dogs (*Herman, 1968*).

During the 1970's cage rearing of raccoon dogs was undertaken in Finland, and was limited to fox farms in order to avoid waste (*Valtonen and Makela, 1980*). In Poland, the first attempts to raise raccoon dogs in cages were made in 1959 (*Perczek, 1963*). Although the results were good, the fur industry showed little interest, discouraging production. Attempts were begun again during the 2nd half of the 1970's, based on the animals from Finland. Presently there are approximately 4,000 males kept for the production of 20,000 skins yearly.

To date, there have been no reports in the literature on shedding cover hair in raccoon dogs, not only seasonal, but also related to age. Therefore this study was undertaken to describe the shedding of cover hair in raccoon dogs in southern Poland.

Material and methods

The study on the shedding of hair cover in raccoon dogs was carried out in the Animal Husbandry Experimental Station of the Institute of Animal Husbandry in Chorzelów. Observations included a totoal of 50 both young and mature raccoon dogs. Of these there were 25 young (from birth to pelt maturity) and 25 mature raccoon dogs for a 1 year period. Observations on the

young were made at 1 week intervals, and on the mature animals, every 7-10 days. Particular attention was paid to the cover hair structure from 5 topographical parts - 3 along the backbone, 1 along the side and 1 on the tail (fig. 1). Apart from these observations the length of the cover hair was also measured in young animals in 5 topographical parts of the animal (*Crevitinowa, 1962*). The intensity and manner of shedding was observed according to the hairs found under the cages.

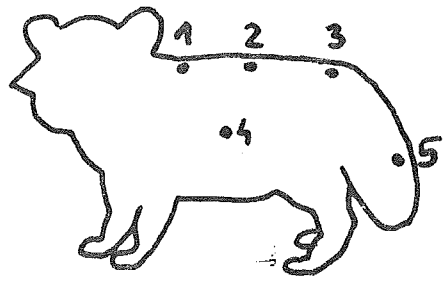

Fig. 1. Topographical parts where cover hair samples were taken.

On the basis of the observations the timing of shedding was divided into months in mature animals, and the primary shedding to the secondary, and the change from summer to winter coats, in young animals, at weekly intervals.

Results and discussion

Most fur-bearing animals are born bare or covered with a very thin covering of individual fetal hairs. Hair growth begins in the fetal stages and continues after birth so that at 2-3 weeks of age they are covered with thick, curly, soft down.

In southern Poland, raccoon dogs are born from the beginning of April to mid-May. Young raccoon dogs are born blind and with hair. They weigh from 100 to 120 g depending on how many offspring were born in the litter. The larger the litter, the less the mean body weight of the young. Seven days after birth they open their eyes, and 14 days after birth, when they have teeth, they become interested in solid feed which the mother supplies.

Young raccoon dogs start leaving the nest at 2-3 weeks of age, depending on litter size and the dependency on the mother. Puppies from large litters (8-10 animals) after birth begin looking for feed already at 14 days, while puppies from smaller litters (up to 6 puppies) at 18-21 days.

The primary cover hair is almost black and is short, about 25 mm and dominated by down hair. The entire body is evenly covered with hair. At 3-4 weeks of age the primary hair begins to shed and is replaced by secondary hair (fig. 2). At this time brownish silver hair begins to appear in the cover hair. Hair grows on the head, tail and along the side. By 6 weeks the secondary hair covered the entire body except along the backbone. By 8 weeks secondary hair was everywhere.

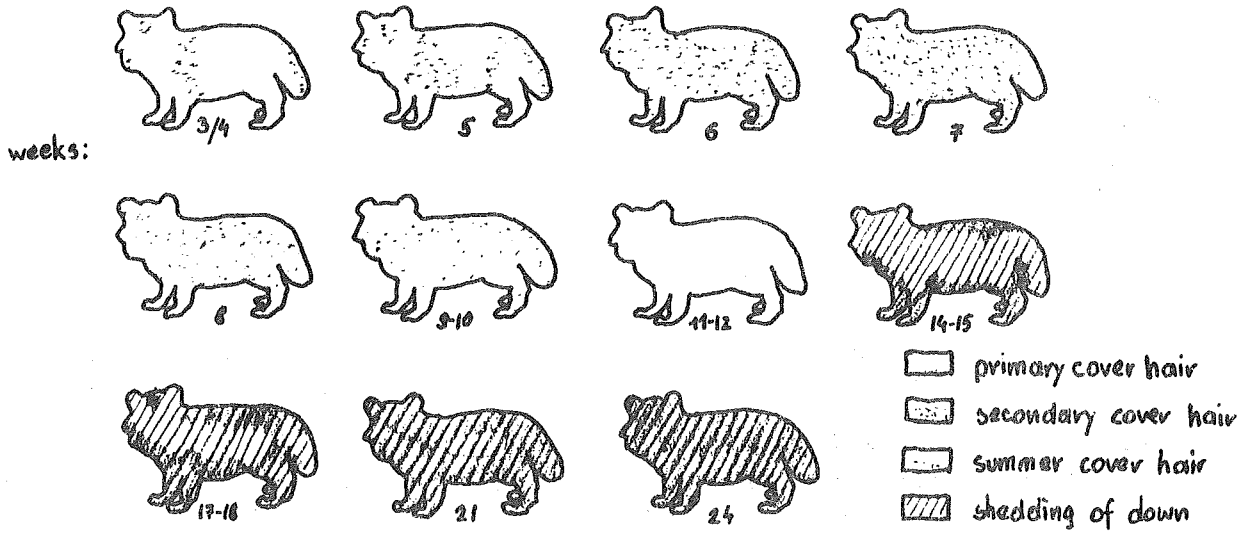

Fig. 2. The shedding of cover hair in young raccoon dogs.

Secondary cover hair is thinner and is made up of down and cover hairs. The lengths of down and cover hairs found are given in table 1. At 4 weeks of age the longest down hair occurred along the middle of the backbone. In this area the hair was longest at all times of measurements. At 8 weeks the down hair was 27-30 mm long, and the cover hair 67 to 75 mm.

Table 1. Mean cover and down hair length of secondary cover hair in young raccoon dogs (mm).

Age (wks)	Samples									
	1		2		3		4		5	
	down	cover	down	cover	down	cover	down	cover	down	cover
4	25	60	31	70	25	63	22	70	24	63
5	25	60	32	70	25	63	22	70	25	63
6	28	65	32	72	28	65	25	70	26	67
7	28	70	33	75	28	67	25	70	26	66
8	30	70	33	75	30	67	25	70	27	67

During the following weeks (8-12) when the young raccoon dogs grew quickly, they began to shed first the down and then the cover hair. At 11-12 weeks the young animals had mature hair cover. The color of the cover hair looked like the winter cover hair except that it was shorter. Mid-August, when the young raccoon dogs were 14-15 weeks old, the winter down hair began to grow intensively. It began along the backbone, the stomach and the underside of the tail. The fur of the young animals at this time gave the impression of being "pressed" and the cover hairs were long and sticky creating strands along the backbone and the sides.

At the end of September the down hairs measured approximately 50 mm in sample 1 to 57 mm in sample 2, and cover hairs, 108 and 112 mm, respectively. During this time the growth rate of both types of hair was slower. Cover hair continued to be shed. The down hair in great masses "take over" the cover hairs and the fur became fluffy. The cover hair fell evenly into place and began to form a voile.

At 24 weeks of age the young raccoon dogs got complete adult winter cover hair. In Poland this period is from October 20 to November 10. At this time the young raccoon dogs should be slaughtered for the good fur quality.

In observing the changes from primary to secondary until they get their adult winter fur one can say that it is similar to that of the fox Vulpes vulpes (*Wolinski and Slawon, 1964*).

Cover hair shedding in adult raccoon dogs was related to the time of year and occurred differently. Shedding of winter cover hair for the summer begins in February. At the end of March and the beginning of April, hair was shed intensively in pregnant females (fig. 3). At this time the hairs fell out very intensively around the head, backbone and tail. In males and non-pregnant females seasonal changes of hair began about 2 weeks later and was much less intensive. At the beginning of June there was practically no down hair except in the hind parts. At this time an intensive change of winter cover hair to summer

cover hair began. In July the raccoon dogs had their entire summer hair. The mean cover hair length from the 5 topographical parts was 32 mm. In July there were few cover hairs.

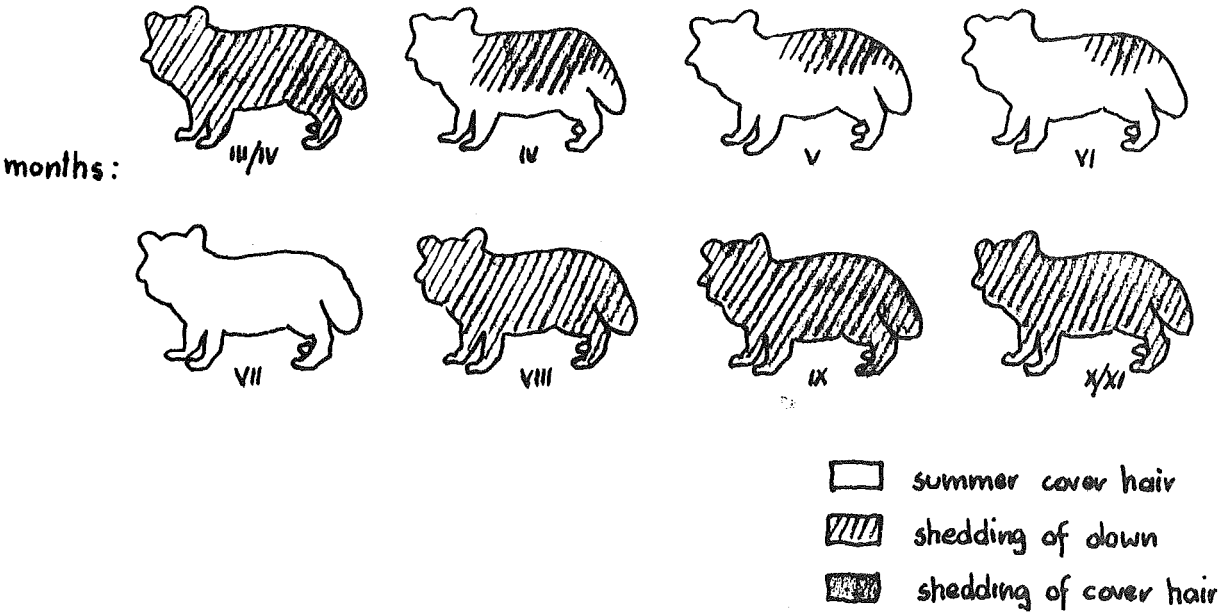

Fig. 3. The shedding of cover hair in adult raccoon dogs.

Adult animals began getting their winter cover hair about 2 weeks later than young animals. Summer hair fell out at the end of August leaving room for down and winter cover hair. The growth rate of the winter cover hair was slower than in young animals. Adult animals had their complete winter cover hair by the beginning of November.

These observations on the seasonal changes of cover hair, apart from being informative were also practical. They showed that young raccoon dogs should be slaughtered under Polish conditions from October 20th to November 15th. Adults that are to be eliminated should be slaughtered approximately 2 weeks later.

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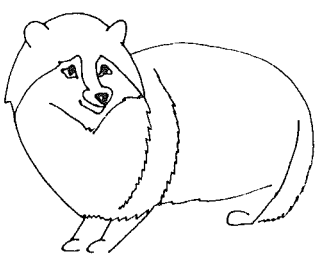

Original Report

Social behaviour in raccoon dogs kept in large enclosures

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Summary

The paper describes activity patterns and social behaviour of raccoon dogs housed in large ground-floor enclosures. Most of the patterns found are very similar to those observed previously in animals kept in conventionally-sized farm cages. However, particularly the pair, litter and family bonds were more pronounced in large enclosures, and are comparable to those found in wild raccoon dogs. The paper further deals with communal utilization of latrines and scent-marking which seem to be well-developed in the raccoon dog. It is emphazised that raccoon dogs are very social animals whose social organization with various mutual relationships is exceptionally well-formed.

Introduction

The raccoon dog (*Nyctereutes procyonoides*) is a medium-sized fur-bearing animal (family *Canidae*) with a small and short head, pointed muzzle, moderately long body and short legs. Originally it inhabited mainly the broad-leaved forest, the thick, shrub and the marshy areas but nowadays it can be found also in some extremely varying circumstances like in subarctic conditions of Scandinavia *(Notini, 1948; Heptner et al., 1974; Viro, 1983)*. Among the *Canidae*, the raccoon dog is known to be in a low systematic position, which obviously has made it adjustable to new living conditions *(Heptner et al., 1974; Clutton-Brock et al., 1976)*.

Behavioural patterns have been studied intensively among the *Canidae (c.f. Kleiman, 1967; Fox, 1971; Kleiman and Eisenberg, 1973; Ikeda et al., 1979; Ikeda, 1982)*. Although social organization of canids varied from solitary (*Burrows, 1968; Kleiman, 1972)* to social group (*Mech, 1970; Kruuk, 1972; 1976*), the basic social unit evidently is permanent or seasonal pair bond. The canids developed sophisticated pack-hunting technique by the pair bond as an adaptation to hunting large prey (*c.f. Kleiman and Eisenberg, 1973*).

Social behaviour of the raccoon dog has also been studied, both in captivity (*Seitz, 1955; Kleiman, 1967; Yamamoto and Hidaka, 1982; Korhonen et al., 1986; Korhonen and Harri, 1988; Korhonen, 1988*) and in the wild (*Novikov, 1956; Ikeda et al., 1979; Masui, 1980; Ikeda, 1982*). Often the raccoon dog has been classified as a solitary animal (*Kleiman, 1967*), but some data also describe that raccoon dogs spent their life as pairs, litter or family (*Novikov, 1956*), and mated so that they stayed together in order to take care of the offsprings (*Bannikov, 1964*). On the other hand, Ikeda

et al., (1979) emphasized a social behaviour which was different from the conventional family system; the animals cooperatively utilized certain habitats throughout the year, and not necessarily with any family linkings. These findings suggest that the basic feature of the social system in the raccoon dog is not completely known, and more data are needed, especially about social behaviour of the raccoon dog at northern latitudes like in Scandinavia. Previous works deal mainly with social organization of the raccoon dog in regions of eastern Asia and Far East.

The objective of the present work was, firstly, to describe behavioural patterns and activity of farmbred raccoon dogs housed in large-sized enclosures and, secondly, to clarify their social ranking, mutual interactions and scent-marking patterns in order to understand their social organization system in captivity.

Materials and methods

General procedures

The experiments were carried out (1) on the Research Fur Farm of Kuopio University, in eastern Finland, and (2) at the Muddusjärvi Research Farm, in Kaamanen, Lappland during 1989-90. All the animals used were farmborn, and housed according to conventional farming procedures before the experiments. They were fed basal ready-mixed farm feed which was manufactured (1) by the local central feed kitchen of Koillis-Savon Rehu Ltd. and (2) by the Muddusjärvi farm kitchen. It was mainly composed of slaughter-house offal, fish and chemicals. For the chemical composition of feed see Korhonen and Harri (1986). Feed composition and ratios were based on the standards recommended by the Finnish Fur Breeders' Association. Feeding each time occurred by hand once or twice daily. Water in summer and snow/water in winter was supplied conventionally, and supplementation in water-cups took place as required. The animals were inspected daily, and they remained healthy during the course of the experimental period.

Animals and housing managements

The following experimental animals were used: (1) 3 males which were born in late April 1989. They were allocated to the experimental arrangements from weaning (occurred in July) until next May in 1990. They originated from the same litter and were kept in the same cage throughout the entire study. (2) Mother and 7 kits (4 males, 3 females) which were allocated to the experiment from weaning until pelting time in December. (3) Mother with 6 kits (3 males, 3 females) which also were studied from weaning until pelting. (4) Mother, father and 5 kits (4 males, 1 female); mother and father were put into the cage in November 1989 and the kits were born in late May 1990, and (5) mother, father and 2 kits (1 male, 1 female) together from whelping (late May 1990) onwards. The animals were sexed and identified by earmarks. Before the observation period they were painted with phosphorized colour to make it easier to watch them in the dark. Experiments 1, 2, and 3 were made on the Research Fur Farm of Kuopio University, and experiments 4 and 5 at the Muddusjärvi Research Farm. Outdoor temperatures in the former farm varied from -5.2°C in February to +18.1°C in July, and in the latter farm from -12.2°C in December to +12.8°C in July.

The experimental groups were housed in outdoor enclosures (with ground floors) which sizes were (1) at the Kuopio Research Farm 5 m wide x 6 m long x 2 m high, and (2) at the Muddusjärvi Research Farm 8 m wide x 17 m long x 2 m high. The enclosures were placed in the experimental fields distanced about 10 m from farm shade houses. The enclosure contained three wooden nest boxes measuring 40 cm wide x 70 cm long x 40 cm high. The nest was made of 2 cm thick board. Three feeding trays and water-cups were placed inside each enclosure.

Quantitative measurements

Feed consumption of the animals was carefully controlled daily. The group received a weighed quantity of feed in excess of what it would consume. Feed refusals were collected and weighed on a group basis to allow calculations of the daily feed intake. Metabolizability of the feed used was based on our previous results (*Korhonen and Harri, 1986; Korhonen et al., 1986*). Chemical analyses of feed were performed by conventional procedures (*Korhonen and Harri, 1986*).

Body weights of the animals were measured during the experiments. Weighings were performed with an accuracy of 50 g by an Alfa-laval bowbalance, and occured each time before feeding time.

Behavioural observations

The animals deposited their feces on particular sites called latrines. The latrines inside the enclo-

sure were mapped and size of latrines and inclination degree around latrines was approximately estimated. If possible, all latrines were checked daily for newly added faeces. Also the sites of urine were recorded.

Behavioural patterns and activity of the animals were recorded by visual observations which lasted 24 hours per time and were made by three or two different persons together. Each behaviour was recorded by certain codes, and analysed later at the University. The observations were made through the window and, therefore, the animals were disturbed as little as possible. Feeding each time occured before the observation period.

Results

The reasons why exactly these farms were selected for the experiments were the following: (1) Eastern part of Finland where the Research Fur Farm of Kuopio is situated, represents typical raccoon dog farming area. (2) Eastern Finland also belongs to the natural distribution area of the Finnish raccoon dog, and for example, one of the first wild raccoon dogs found in Finland, was captured just around this area. (3) The natural distribution area of the Finnish raccoon dog does not cover the province of Lapland. The Muddusjärvi Research Farm is situated over 300 km north of raccoon dog's natural habitats in Finland and, probably, is the northern most place in the world where raccoon dogs can be found. The climate there can be judged almost like arctic; the polar circle, for example, lies in the southern part of Lapland.

The general conclusions from the previous results seem to be that there are not any significant differences in activity patterns or social behaviour between the animals of two experimental farms. Therefore, the results from the two farms will often be treated together here, and the conclusions from one farm mainly concern the other farm too. Comparative examples, of course, will be presented. Furthermore, most of the behavioural and activity patterns observed are the same as previously described for animals housed in conventional farm cages and, thus, are not necessarily repeated here but can be found from Korhonen (1988).

Activity patterns

The animals used in the present study were all kept in groups. This was also reflected by their behaviour and activity. Typically, all animals in the same cage tended to be active and rest almost at the same time. Because the shadehouses were so close to our enclosures, we were able to observe animals inside them also. It was interesting to note that often almost the entire farm (including animals in the shade houses and enclosures) showed rather similar rhythm of activity. Especially in the evening, after working day the entire farm seemed to sleep at the same time and, similarly, in the morning they all tended to rest before the start of working day. The time when the farmer came into the farm was observed by the animals; they typically woke and became active. During working hours there existed more individual differences in behavioural patterns between the animals. In spite of many similarities every animal sustained its own individual rhythm, too. Behavioural differences between adults and juveniles were also evident in some cases. In adults the behavioural figures were well-developed and fixed whereas in juveniles these were often still loose and at the state of imitation.

In cases where male and female were put together already before mating season, the pair bond was typically very firm. After whelping the entire family grew into a very firm and close group.

Good examples of this are found in tables 1 and 2. It can be seen how similar are behavioural patterns of mother and father especially, but also that of kits. Typically the whole family was active at the same time; they walked, ate, drank, slept etc. together. Thus, individual differences among family group members were rather small. Activity patterns of the group normally consisted of a system of shorter or longer bursts of activity alternating with rest periods. Typically the family group kept up a fairly regular activity rhythm which could persist for longer periods of time, i.e., several months. Seasonal changes in circadian rhythm, of course, appeared but the annual data, unfortunately, was too limited to make any definite conclusions.

Table 3 well illustrates how the arrangement where kits are alone in a cage (without their parents) can produce very typical and normal behavioural pattern. These kits were put together after weaning and kept together almost a year. The activity pattern of animals is probably endogenous and not only learnt because these kits showed very similar patterns to those kits which were kept with their parents. However, observations of family groups

showed that kits eagerly imitated everything their parents did. Under such circumstances they can, of course, easily learn the acitvity patterns of their parents.

Circadian activity profiles of the animals were more nocturnal than diurnal; proportion of daytime activity varied between 28 and 42% and, thus, the darktime activity accounted for 72-58% of total circadian locomotion. All animals showed relatively similar activity patterns despite the difference in age and observation period. Beginning and ending of activity normally occured almost at the same time within the group. Often there were not any considerable decrements of activity level even around midnight.

Table 1. Behavioural activities (in minutes/24 h) of raccoon dog family at the Muddusjärvi Research Farm, in Lapland, during summer.

Variable	Mother	Father	Kit 1	Kit 2	Kit 3	Kit 4	Kit 5
Walking	729	778	566	484	520	572	520
Standing	66	54	60	60	90	54	54
Sitting	84	78	108	138	166	108	148
Self-grooming	10	12	7	12	9	10	7
Eating	9	10	11	10	12	10	11
Drinking	5	5	6	6	7	6	6
Lying awake	186	174	198	258	216	216	258
Sleeping	348	325	480	469	417	460	436
Others	3	3	4	3	3	4	3

Table 2. Average daily activities (in minutes/24 h) of raccoon dog pair with two kits during summer. (Muddusjärvi Research Farm, Lapland).

Variable	Mother	Father	Kits	
			Male	Female
Walking	736	743	470	497
Standing	66	48	129	150
Sitting	55	48	105	126
Self-grooming	10	7	12	12
Eating	8	11	11	12
Drinking	5	5	6	6
Lying awake	103	132	222	178
Sleeping	484	443	482	456
Others	3	3	3	3

Table 3. Average daily activities (in minutes/24 h) of three male raccoon dogs belonging to the same litter. (Research Fur Farm of Kuopio University, summer period).

Variable	Animal 1	Animal 2	Animal 3
Walking	717	917	795
Standing	140	142	151
Sitting	29	18	43
Self-grooming	7	8	7
Eating	11	12	10
Drinking	5	5	5
Rest inside the nest	528	335	423
Others	3	3	6

Use of cage area

The animals did not normally move here and there all over the enclosures; typically there existed constant paths following the wire-mesh walls around the enclosures which they used (see figures). We measured the lengths of these path routes and, for example, for three kits in 5 m x 6 m cage we got a mean value of 2.2 m (table 4). There existed on average from 2 to 3 side paths which they also used but not as often as the main paths. These side paths could also cross the middle part of cage.

Table 4. Use of path routes and scent-marking during winter period. The table includes data from three male raccoon dogs kept at large enclosure between November and May. (Research Fur Farm of Kuopio University). TLR= total length of path routes, NSP= number of side paths, NL= number of latrines.

Date	TLR	NSP	NL
Jan 22	27	4	2
Jan 24	30	7	3
Jan 30	24	2	3
Feb 1	27	4	3
Feb 26	32	5	1
Feb 28	32	5	1
Mar 6	24	2	1
Mar 11	24	1	1
Mar 21	28	3	2
Apr 4	27	4	1
Apr 5	22	0	1
Apr 18	22	0	2
Apr 24	22	0	2
Mean value	26.2	2.8	1.8

Often the animals used only a certain part of the cage area at once. A good example of this is seen in table 5; we can see how the locomotor activity of the animals is concentrated on certain sites of the enclosure. Mother and father preferred to walk on the longer sides of the cage, i.e. B-C and D-A. These two composed over 90 percentage of all routes they used. The kits mostly moved between B and C but also C-D and D-A were favored to some extent. A-B was the least used main path by both parents and kits. Locomotor activity very seldom concentrated on the side paths of the enclosure.

During winter the routes were often covered by snow. Soon after that, however, the animals made new ones which very regularly situated at the same places as the previous routes. Only the sites of side paths varied to some extent (see figures). The different litters could use the same path routes, too. At the Muddusjärvi Research Farm, for example, the same routes were used during three succesive years by three different litters.

Defecation and use of latrines

The animals within the same cage typically deposited their faeces on a particular site (fig. 1). This led to formation of large dung piles within a cage which are called latrines (Ikeda et al., 1979). Often there existed only one latrine within a cage, or in the case of there being more, one was the main latrine with 1-2 smaller latrines (table 4). The size of latrines depended on the number of animals in a cage, and on the length of time the animals were housed there. The biggest latrine we found measured about 80 cm wide and 150 cm long. Its height was only some 20 cm. This latrine belonged to a whole family (parents with 5 kits).

Table 5. **Use of cage area by a raccoon dog family during summer period. (Muddusjärvi Research Farm). The sides of enclosure were marked as follows: A-B and C-D are shorter sides and, correspondingly, B-C and D-A the longer sides. Left down corner: A, left up corner:B, right up corner:C, right down corner:D.**

	A-B	B-C	C-D	D-A	Others
Mother	1.6	48.4	6.6	42.2	1.2
Father	0.9	47.3	5.9	44.4	1.4
Kit male	6.3	63.5	14.6	14.8	0.8
Kit female	6.9	66.7	12.4	13.1	0.9

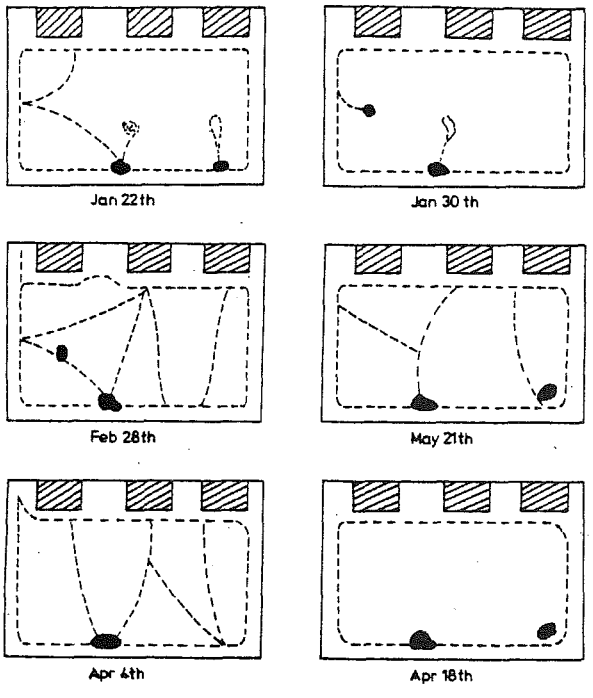

Figure 1. Schematic pictures of path routes (broken lines) at large enclosures (Research Fur Farm of Kuopio University). Sites of latrines are marked as dark dots. Each enclosure contains three nest boxes. In each case three male raccoon dogs were kept in the enclosure.

The site of latrines within the same group were very fixed. For example, we took the latrine away and cleaned the site but, in spite of that, the animals again started to defecate at the same place. We also changed the places of nestboxes, but it did not in any way affect the latrine site. However, we noticed that during succesive years different litters kept in the same enclosure could place their latrines at different sites. Although the animals normally defecated individually some communal defecation patterns were observed. We noticed that sometimes mother, father and a few kits may defecate at the same time. Urination was often connected to defecation and normally took place at the same site as defecation. Sniffing of the latrine often occurred before and after defecation or urination. Anal sniffing by the partner often occured when the other one was defecating. The occurance of defecation per animal varied from 2 to 5 in 24 hours.

Eating and drinking

The animals were fed twice a day: at about 09.00 o'clock and at 15.00 o'clock. This was partly reflected to their eating patterns, too. After morning feeding the animals came to eat and ate almost all the feed. However, after afternoon feeding they often did not eat, until the evening about at 18.00-19.00 o'clock and after that also in the night (between 23.00 and 02.00 o'clock). The whole family typically ate at the same time and without any competition for feed. However, the animals seemed to know from the farmer's activities, noises and behaviour when feeding time occurred. This was observed in their behaviour as increased activity and "restless walk". Consumption of water was rather small and normally the animals drank only a few times per day.

Social interactions

Social interactions can mostly be classified as "friendship behaviour" and no marked aggressive behaviour was evident. Some "nose to nose" contact was found; the animal directed its nose to the others, with the body at normal position, the ears slightly flattened and the mouth closed. This posi-

tion resembles sniffing of the animal when it encounters unknown things like the hand of the farmer.

"Muzzle-nibbling or licking" was also observed. It was done on the lips, muzzle and near the dark facial mask. Particularly in the family where mother and father were put together before mating time, this behaviour was well-developed; mother and father made it very tenderly and it may last over 10 minutes a time. It was very fascinating to observe. Often the kits tried to imitate their parents.

Sexual behaviour, i.e. copulation activity occurred sometimes but normally not outside the mating season. Kits were observed to imitate the copulation. Pure aggressive behaviour was not observed at all. In some agonistic encounters none of encounters extended to biting. Submissive behaviour which, according to Ikeda (1982), is some sort of aggressive behaviour and normally expressed by the position of the body, ear flatness and jaw gape, was not common. Thus we can say that the animals had friendly interrelationships supported by flexible mutual tolerance. This probably was due to the fact that the animals in each group belonged to the same litter or family. The litter and family bond in the raccoon dog seems to promote social behaviour and cooperation.

Productive data

Because of very limited data, we cannont draw any significant conclusions about reproductive success in large enclosures. At Muddusjärvi Research Farm we kept male and female together during three breeding seasons and each time the whelping succeeded. During the years 1988, 1989, and 1990 their litter size was 7, 8 and 6, respectively. This is a normal whelping result and supports the conclusion that raccoon dogs can be housed and bred in large enclosures. We also measured body weights of some of the animals both during body growth and weight loss periods. Our very limited material showed that these animals grew normally and reached the final body weight which is typical for the farm-raised raccoon dogs (*Korhonen and Harri, 1986*). Body weights of the kits at weaning varied between 2.5 and 3.5 kg which well fits the frames of normal variation. Tabel 6 gives an example of body weights of raccoon dogs during winter and spring periods. These values are of the same order of magnitude as measured for conventionally caged raccoon dogs (*c.f. Korhonen and Harri, 1986*).

Feed consumption of the animals were measured in some groups. Table 6 provides mean values for three male animals during the weight loss period. These amounts are quite normal. We measured feed consumption of the kits during the growth season. Typically kits in large enclosures ate more than those in conventional cages. This, however, was due to the fact that feeding of large groups is not so easy; we cannot feed the animals individually and therefore we have to give them more than normal to guarantee that each animal can receive the amount it requires. We did not, however, observe any marked competition for feed.

We also tried to estimate the fur quality of live animals. The conclusion was that the quality of fur was not better than normally found in animals caged conventionally. The ground floor easily makes the fur coat dirty, and with large groups the animals can easily soil eachother.

Table 6. Weight loss and feed consumption of three male raccoon dogs during the winter period. (Research Fur Farm of Kuopio University).

Variable	January	February	March	April	May
Body weight, kg					
Animal 1 7.7	7.5	6.6	6.6	6.7	
Animal 2 7.7	6.7	6.2	5.6	5.7	
Animal 3 6.0	5.6	5.5	4.9	5.0	
Feed intake, g/animal daily	270	300	247	400	400

Discussion

In our previous works (*Harri et al., 1987; Korhonen and Harri, 1988*) we clarified how cage size affects growth, feed intake, fur quality and activity pattern of farmed raccoon dogs. Those experiments were done under shadehouse conditions i.e., the animals were kept in conventional cages with wire-mesh floors. Cage sizes varied from 60 cm wide x 60 cm long to 105 cm wide x 240 cm long, the height always being 60 cm. Additionally we carefully described behavioural patterns of raccoon dogs under conventional farm conditions (*Korhonen, 1988; Korhonen and Harri, 1988*). Thus, we have lots of data to compare behaviour, activity and growth parameters between raccoon dogs kept under conventional farm conditions and in large enclosures.

First of all, it can be concluded that the main features of behaviour are rather similar under both farm and enclosure conditions, and the animals can well survive and exercise their normal activities in spite of the size of the cage. However, there also occurred some differences which are worth further discussion.

Previously we found that the locomotor activity of adult raccoon dogs under conventional farm conditions varied seasonally from 111 minutes in October to 345 minutes in April. Also the kits spent about the same time walking (*Korhonen, 1988*). The present study, however, supports the conclusion that the animals are more active in large enclosures because the adults typically used over 700 minutes for walking and the kits, correspondingly, close to 500 minutes (see tables). The results were of the same order of magnitude in both farms, i.e., at the Muddusjärvi Research Farm and on the Research Fur Farm of Kuopio University. Ikeda (1982) studied activity patterns of wild raccoon dogs in some Japanese islands by radiotelemetry and noticed that the animals were active slightly less than half of the daily 24 hours. This fits well with our presents findings. In other carnivores the duration of daily activity is less; in stoat about 25% (*Erlinge, 1980*), in mink 13.6-41.8% (*Gerell, 1969*), in polecat 5-40% (*Korhonen and Harri, 1986*), in red fox 38.4-48.5% (*Eguchi and Nakazono, 1980*) and in hyaena 16.26% (*Kruuk, 1972; 1976*). It is known that in nature raccoon dogs eat a wide spectrum of food items like insects, fruits, fish, small mammals, carcasses, birds etc. Thus, Ikeda (1982) concluded that a large amount of active time is necessary for searching and treatment of their small food items.

The proportion of nocturnal and diurnal activity was in the present work different from that found in our previous work (*Korhonen, 1988*), in which the raccoon dogs were noticed to move by night only 10-20% of the total 24 h activity. Now the night-time activity was much higher, i.e. 58-72%. According to Ikeda (1982) wild raccoon dogs were 68-80% nocturnal which seems to be a rather typical spectrum for most wild carnivores. It has been demonstrated that in captivity circadian activity patterns normally are different from that of wild conditions because farm-raised animals are in a looser relation to environmental conditions (*Klochkov, 1966*). Daily activity patterns of our raccoon dogs in large enclosures resemble markedly that of wild raccoon dogs, and it is tempting to conclude that behaviour of the animals in large enclosures can be more similar to that in nature. Although wild raccoon dogs are mostly nocturnal, it does not mean strictly nocturnal habit of the species. According to Ikeda (1982) changing of the site or moving activity was sometimes detected even in the daytime. He also pointed out that individual and seasonal variation also occurs. Because of our limited annual data, we cannot give any definite conclusions of seasonal variation in activity patterns. Our previous works, however, have shown that seasonal changes in behavioural patterns and activity of farmed raccoon dogs existed (*Korhonen, 1988; Korhonen and Harri, 1988*). Similar observations are available for wild raccoon dogs (*Heptner et al., 1974; Ikeda, 1982*). It is known that raccoon dogs spent their winter by superficially hibernating in a den. Occasionally, when the temperature becomes higher, they come out searching for food. Normally this searching activity occurs at night (*Korhonen, 1988*).

During the past decade there have been many speculations about the necessity to provide farmed animals with bigger cages. This led to experiments where different-sized cages with various rearing systems were tested and compared (*Korhonen et al., 1986; Harri et al., 1987; Korhonen and Harri, 1987; 1988*). The main conclusions from those works were that the animals did well despite cage size, and that there existed only minimal behavioural or growth differences between the rearing systems. Thus, the animals do not necessarily need larger cages than those conventionally used. The present work provides some more perspectives to the previous conclusions. Interesting is the observation that the animals in large enclosures did not totally use the entire cage area but use fixed paths which follow the wire-mesh walls. Thus, the middle part

of cage area is used very little. Furthermore, they did not normally walk around the enclosure but used only a certain part of the path routes. It can thus be concluded that the entire cage area is not very efficiently used. Is there then any reason to provide large-sized enclosures for them or do the animals get any use from large cages? These are the questions which we cannot accurately answer here. Nevertheless, we can say that the behavioural and activity patterns in large enclosures are to some extent more close to that observed in thr wild state. Any productive data, i.e. possible better growth, fur quality or whelping result does not, however, support the conclusion that farmed animals should be housed in large enclosures.

The social system of canids can be classified into three types depending on their hunting strategy, i.e. solitary, permanent pair or pack (*Fox, 1975*). Generally, however, the basic social unit of canids seems to be seasonal or permanent pair bonds (*Kleiman and Eisenberg, 1973*). The present study illustrated well that raccoon dogs willingly live as pairs, litter or family, and that they seem to be very social animals. In cases where we kept mother, father and the kits together for a longer periods of time, it was observed that the social interactions between individuals were well-developed. Various kinds of "friendship behaviour" were general and mother and father seem to have very strong pair bonds with many mutual contacts. The same holds true concerning the whole family. In our previous works (*Korhonen and Harri, 1988; Korhonen, 1988*) such kind of behavioural patterns were not observed. The reason for that was probably that the animals were not kept together as litters or family. Perhaps the small cage size also can prevent the formation of such social interactions, although we do not have any definite accuracy of that. According to Ikeda (1982) long term pair bonding is rather typical in wild raccoon dogs. He described that raccoon dogs showed traits of fixed pair bonding where the male also took a part in kit caring. The kits frequently remained with their parents until the end of the next breeding season. The long term pair bond in wild raccoon dogs can be explained further by wide home range overlapping and communal feeding (*Ikeda, 1982*). Under such circumstances the interactions among individuals will increase which promotes the acquistion of mutual tolerance and the development of social behaviour (*Kleiman and Eisenberg, 1973*).

Communal utilization of latrines observed in the present work resembles that found in small farm cages (*Korhonen, 1988*). Correspondingly, Ikeda (1982) noticed that overlapping of individual home ranges and communal utilization of latrines was typical for wild raccoon dogs. It is obvious that in nature latrines may operate as functions of land marking and orientation for individuals. It can also serve as a communal information site which, perhaps, can decrease agonistic interrelationships and means more cohesion than avoidance among individuals. Thus the latrines can maintain the mutual tolerance between raccoon dogs, and may be one of the main reasons for the very social nature of this species. That the animals can also defecate at the same time onto the same latrine, as observed in the present study, was very amazing. This is quite a new feature for the raccoon dog, and Ikeda (1982) who has very carefully described scent marking behaviour in the raccoon dog, did not mention it. This is again one example of sociality and firm family bonding in this species. However, such features do not normally occur under commercial farm conditions because the litters and families are kept together for only a very short time. That we succeeded in seeing it was due to the fact that mother and father were put together so early before the mating season, and that the whole family lived together past the weaning time. Maybe also the large cage size can promote occurence of such features.

It is a well-known fact that olfactory communication has a marked socioecological importance among the Canidae (*Kleiman, 1967*). In most canid species the dominant mode of scent-marking is urination while others are less used (*c.f. Fox, 1975*). A good example of this is the Arctic fox which typically urinates small amounts of urine all over its territory. In the raccoon dog, however, the use of latrines as the main scent-marking method seems to be evident. It seems obvious that the latrine means not only the dung pile but also includes the urine. As it was observed in the present work, the raccoon dogs often urinated onto the latrines, too. Thus the olfactory communication of the raccoon dog can contain the information from both faeces and urine.

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Original Report

Factors influencing reproductive performance, kit growth and pre-weaning survival in farmed mink

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Introduction

The mink (*Mustela vison*) is a small-sized carnivore (family *Mustelidae*) which typically has short legs, elongated body shape, thin fur coat and small stomach volume with relatively short digestive tract (*Sibbald et al., 1962; Korhonen et al., 1983; Korhonen, 1988*). Like in many other mustelid species, there also exists a pronounced sexual dimorphism in the mink which means that the male often weighs more than twice as much as the female (*Moors, 1980; Ahola et al., 1988*). This markedly influences social status and mutual interactions between animals setting the male dominant to female (*c.f. Wakely and mallory, 1988*). Social ranking, i.e. body size of animals, seems to have significant influences on pre-weaning kit growth performance also, as previous works (*Tauson, 1985; Korhonen et al., 1986; Korhonen and Harri, 1988*) let us suppose.

For many decades the Scandinavian countries have been marked commercial mink producers. Still nowadays they are producing about half of all mink furs in the world (*Tarhaajan kalenteri, 1989*). High reproductive performance is one of the most important factors in achieving profitable mink production. This is due to the fact that when the number of offspring per mated female is increasing, the production costs per skin will decrease, and vice versa (*c.f. Tauson, 1985*). In northern latitudes the spring can often be rather cold which easily affects negatively reproductive performance and whelping results. Kit losses can be also high particularly during the pre-weaning period which is due to many known and unknown factors. For the farmer it is, of course, very important to keep as many kits alive as possible until pelting.

The aim of the present work was firstly to clarify how mating time affects the whelping result and litter size of farmed minks and, thereafter, to find out to which extent litter size, body condition of mother and whelps, sex, body weight at birth and gestation time influences kit growth and survival during the pre-weaning period.

Materials and methods

General procedures

The experiments were carried out at the Experimental Fur Farm of Kuopio University in Juanko-

ski, Finland. The minks used were scanbrown wild type, all in good condition. They were all farm-born, and 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 experiments were started in February 1989 before mating season and finished in July at weaning.
The animals were fed twice a day by hand. The ready-mixed fresh feed was manufactured by the local central feed kitchen of Koillis-Savon Rehu Ltd. It was mainly composed of slaughter-house 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 supplied by an automatic water system and supplementation in water-cups took place as required.

Mating routines and further arrangements
Mating started on March 8th. Before mating the testicles of all males were palpated. Males with hypoplasia, with very small or otherwise defect testicles, were excluded (*Venge, 1973*). The females were mated according to a 1+1 system (*Tauson, 1985*). For females rejecting mating, the date of exposure was recorded and another attempt to mate was made within 2 days. Before mating body weights of females were recorded.
At whelping, the date of parturition and the number of live born and stillborn kits were recorded. Within 24 h after parturition the entire litters (also each kit and mother individually) were weighed with an accuracy of 1 g by the Mettler PE 12 Electric Avering Balance. Since then, each individual kit of every litter was weighed weekly until whelping at an age of 7 weeks. Each kit was sexed and identified. At the same time the mothers were weighed. The weighing occurred before feeding each time. Weighing and other experimental handling did not cause any marked disturbances to the animals because only one litter was lost during the experiments. The kits used for handling became rather tame in character.

Statistical analyses
The results are expressed as mean ± 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

The females were mated between March 3rd and 22nd. Mating routines proceeded normally and the females whelped in the end of April or in the first half of May. Their gestation period varied between 37 and 57 days, of which 47 days wasan average. the barren females were left out of the further experiments. The number of females for the rest of the experiments was 44. Total number of kits born (stillborn left out) was 243 (123 males, 120 females). The mean litter size was 5.0 and the mean whelping result per whelped female 5.5. Kit losses during the pre-weaning period was 9 (only one litter). All whelped females survived until weaning time which occurred when the kits reached the age of 6-7 weeks.

Tables 1 and 2 summarize the basic data. Length of gestaion period in most of cases was rather stabile (most often between 49 and 52 days). The scale is therefore rather limited to permit any definite conclusions. According to statistical analyses the length of gestation period did not have any affect on whelping result or litter size. Nor did the date of mating or whelping. Body weight of the mother at birth or at mating did not influence litter size or length or gestation period.

Table 1. Length of gestation period (GP), number of females (N), number of kits per each litter, and body weights of whelped females (0=at whelping, 6=after 6 weeks of whelping). Only the mean values are given. For the statistical significance see results.

GP	N	Kits/ litter	BW 0	BW 6
57	1	1	1478	1338
51	2	2	1468	1296
49	6	3	1323	1069
38	7	4	1432	1093
50	6	5	1371	1128
54	6	6	1280	949
39	8	7	1331	1095
52	6	8	1379	1003
51	2	9	1473	1174

Figure 1 schematically illustrates the interaction between litter size (grouped in three classes) and body weight of mothers in relation to pre-weaning time. Until the kits were at the age of 4 weeks, there did not exist any significant differences in body weight of mothers; in all groups it declined during that time slightly over one kg. Thereafter, however, some statistically significant differences started to appear. Body weight of those mothers which had 1 to 3 kits, stayed rather constant and only in the late part of pre-weaning period did some weight loss typically exist. On the other hand, those mothers which had over three whelps, started to lose body weight more and more from three weeks after whelping. Particularly when the kits were at an age of 4-6 weeks, their weight loss was rather high. However, there was no statistical significance in weight loss between mothers of 4-6 or 7-9 kits. According to multiple regression analyses, not only the number of kits affects weight loss of mothers but also the weight of kits. In the biggest litters the kits are typically weighing less than in the litters of smaller animal number. The sex ratio (males/females) varied in different litters. It in itself, however, did not affect body weight or well-being of mothers. More imortant was the total number and weight of the kits per litter.

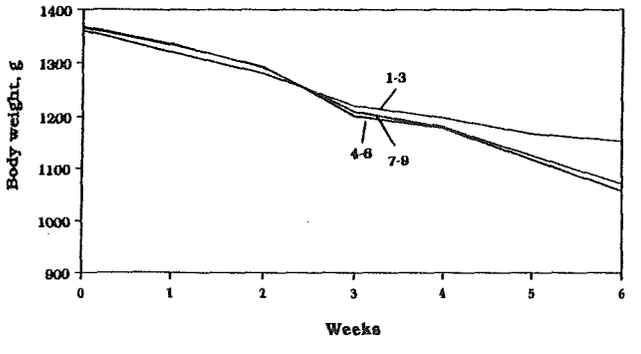

Figure 1. Body weights of whelped females (N=44) in relation to litter size from the time of whelping until the weaning. For the statistical significance see results.

Already at birth the males were significantly heavier than the females (table 2). This same trend continued firmly throughout the entire preweaning period. The males get relatively bigger and bigger than the females. As individually inspected, those kits which were bigger at birth were also bigger at the age of 6 weeks and vice versa.

This conclusion typically held true for both sexes.

Table 2. Development of body weights for male and female kits during the pre-weaning period. N=123 for males, N=120 for females).

Body weight	Males	Females
At birth	11.4	10.4
At age of 1 week	35.5	31.3
At age of 2 weeks	72.4	63.0
At age of 3 weeks	114.7	100.2
At age of 4 weeks	165.4	144.2
At age of 5 weeks	223.2	197.3
At age of 6 weeks	336.6	279.0

In each case males significantly ($p<0.001$) differed from females.

Figure 2 gives the relation between the body weight and size of the litters during the pre-weaning period. The litters are grouped again into three different categories. As can be seen, the bigger the litter, the more its growth ceases towards the weaning date. Those litters which contain only from 1 to 3 kits, are growing fastest, and vice versa; those which have 7-9 kits are doing it slowest. This conclusion was statistically very significant ($p<0.001$).

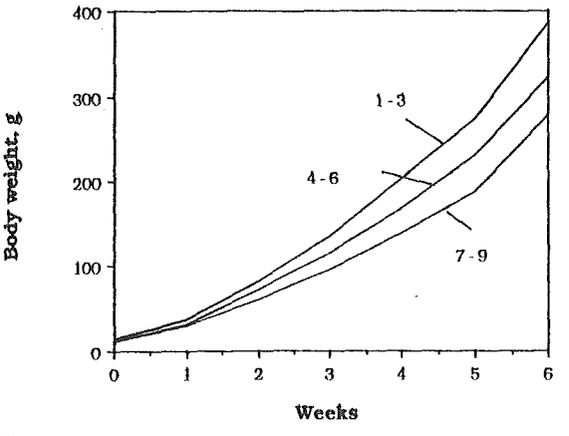

Figure 2. Development of live weights at different sized litters during the pre-weaning period. (Number of litters 44, total number of kits 243).

Body condition of mother, number of kits or whelping time did not affect on kit survival during the pre-weaning period. Only 9 kits were lost during the experiments which is a really surprisingly small number. The handling of kits and mothers possibly influenced survival positively. However, the data are far too limited to permit any definite conclusions.

Discussion

The mink is a seasonal breeder which reproductive cycle is highly related to photoperiod, i.e. day length of day (*Holcomb et al., 1962*). Its reproductive physiology is extraordinary different from most domesticated species with delayed implantation, induced ovulation and embryonic diapause of varied length (*Hansson, 1948; Venge, 1973*).

Reproductive performance of the mink depends on many coexisting factors with several known and unknown interactions. One of the first is the body condition of females. High female pre-mating body weight can easily result in increased frequency of barren females, increased kit losses and decreased litter sizes (*c.f. Sanne and Åhman, 1966; Jørgensen and Glem-Hansen, 1972; Tauson, 1985*). In the present study, body weights of females were kept normal by aiming at increasing body condition towards mating season. Thus, the negative influences of excessive pre-mating fattening on reproductive performance were excluded as far as possible.

Reproductive performance depends also on the mating system (*Venge, 1973*). Typically, single matings often result in poor whelping results. Additionally females mated later have decreased barren frequency but increased litter size. Re-mating after one day has been found to improve reproductive results, and another re-mating one day after the second mating can further better the results (*c.f. Tauson, 1985*). The females used in the present work were all mated according to a 1+1 system. The effect of mating system on reproductive success was eliminated by having rather homogenous female material.

The length of gestation period can also affect reproductive performance. It has been claimed that a prolonged gestation can cause decreased reproductive result which is probably due to increased mortality during the embryonic diapause (*c.f. Tauson, 1985*). The present results, however, do not confirm this conclusion. The length of gestation period varied between 37 and 57 days (on an average 47 days) but any significant differences in whelping results of females were not found. The explanation, of course, can be the fact that the number of females is too small. The other reason may be the small variation in the length of gestation period. Only a few females here really had a prolonged gestation. So, maybe the material was too homogenous or the light conditions were such that it set the length of gestation period rather constant. There are data available which show that, for example, use of artificial light during the breeding season can reduce the length of gestation (*Holcomb et al., 1962; Aulerich et al., 1963*). As a matter fact, lights were kept on during the working time in our experimental farm.

As the results showed, litter size affects kit growth during the pre-weaning period. There are previous works (*Hoogenbrugge and Baud, 1975; Tauson, 1985*) which confirm the same fact; an inverse relationship between kit growth performance and litter size. Tauson (1985), in addition, found that litter size affects growth performance more than the experimental treatment in many cases. Our results further let us suppose that handling during pre-weaning period can improve the survival and well-being of the kits and mother. Our data, however, is rather limited to make too wide conclusive remarks.

The fact that the birth weight and body growth of the female kits was lower than that of the male kits is quite normal, and is due to sexual dimorphism of this species (*Moors, 1980*). When the feed is normally available, both sexes grow at their normal growth rate and can be raised together. However, in case the feed supply is for one reason or another restricted, there can appear some difficulties because of mutual conflicts and social competition (*c.f. Korhonen et al., 1986; Korhonen and Harri, 1987*). Correspondingly, Tauson (1985) reported that female kits on a low feeding intensity had a poorer development than their male litter mates. The reason for that was the fact that male kits were more able to fight for the feed than the female kits in situations of limited feed supply.

Typically the body weights of kits until the age of three weeks reflect the milk production of the female. This is due to the fact that kits are totally dependent on milk production of the mother for about the 24 first days (*Rochman, 1969*). As our results showed, the litters with 7-9 kits did poorest. This held true already before the kits reached the age of three weeks. We can therefore conclude that

the milk production of mothers with large litters is able to produce normal but not the best growth performance.

The finding that the kits which are big at birth will be big at weaning too, is very important, although reported already previously in the literature (*c.f. Rimeslåtten, 1960; 1982; Jørgensen et al., 1962a,b; Skrede, 1983*). Additionally Tauson (1985) concluded that the initial growth rate of mink kits can be considered of utmost importance for the final size of the animal.

Summary

The present paper describes reproductive performance of whelped females (barren females left out) in the scanbrown wild farmed mink. The paper further aims to clarify to which extent such factors like litter size, body condition of mother and kits, sex, live weight at birth and length of gestation period can affect kit body growth and survival during the pre-weaning period (from birth to the age of 6 weeks). The results showed that the length of gestation period did not affect reproductive results; nor did the live weight of mother at birth or at mating. Body weights of male kits were significantly higher at birth than that of female kits. The differences continued simultaneously throughout the pre-weaning growing period. Litter size has an influence on live weights of kits and mothers; particularly in larger litters weight growth of kits was ceased. Mothers with large litters lost the most body weight during the pre-weaning period. Several interactions between different coexisting factors were obvious. The results confirm the complexity of reproductive performance in the farm-raised mink.

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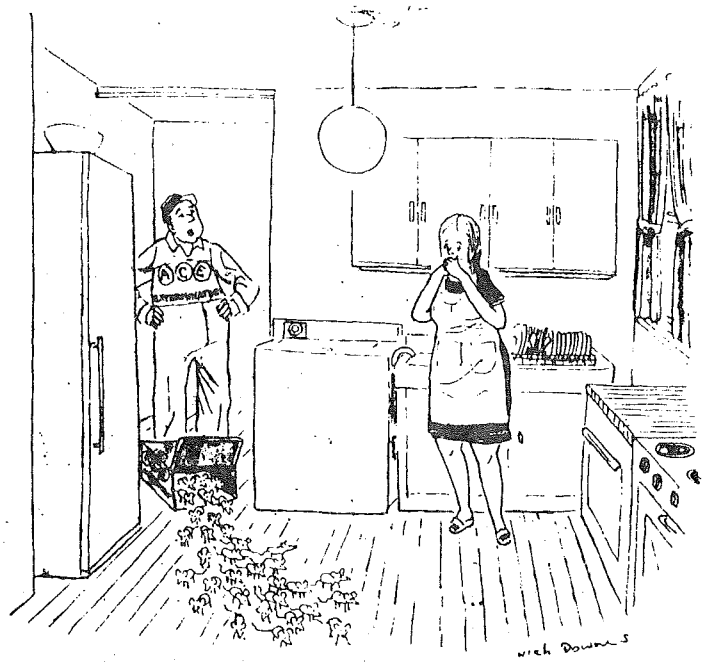


"They're natural enemies of roaches."

Activity in silver fox kits may provide an indication of reproductive performance.

M. Bakken.

The behaviour of 58 silver fox females was observed at 30 days by means of open field tests, and social behaviour was observed at 5 months of age; the reproductive performance was studied in 19 of the females. There was no significant correlation of behaviour at 30 days with litter size at birth, but females which showed fear at 30 days tended to wean smaller litters than those which did not (2.16 vs. 2.16 cubs), and active females tended to wean larger litters than passive females. Females which showed fear and passive behaviour at 30 days tended to have low social rank at 5 months. It is suggested that it may be possible to predict maternal ability in silver foxes at an early age.

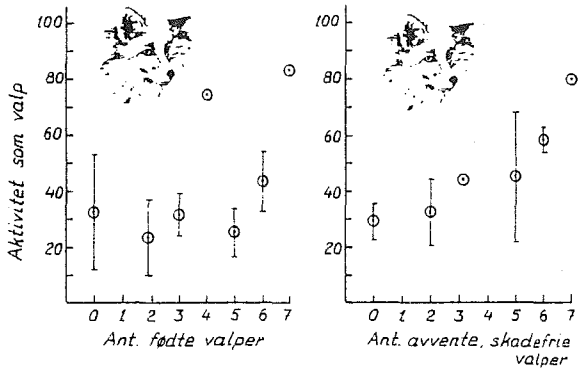


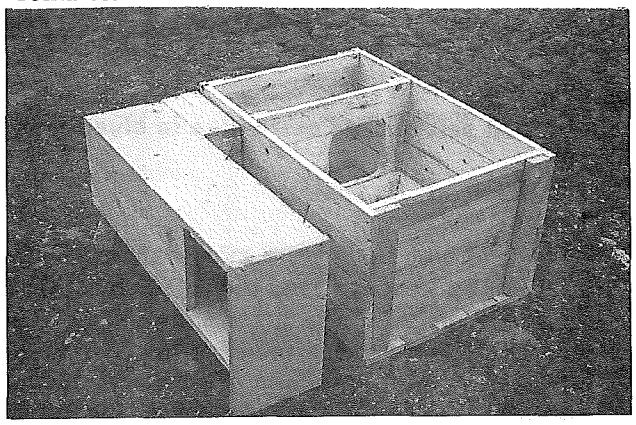
Fig. 2. Antall fødte og avvendte skadefrie valper i relasjon til tispenes aktivitet som 30 dager gamle valper (Middel, SE).

Norsk Pelsdyrblad; 64; 6; 6-7, 1990. 1 fig., 3 references, In NORG. CAB-abstract.

Design of nest boxes for fox females.

B. Braastad.

From mating to the weaning of their cubs, 207 young and 290 adult silver fox females were housed in a traditional nest box, measuring 44.5 x 44.5 cm (group 1, controls), in a nest box measuring 44.5 x 44.5 cm, with a narrow tunnel attached (group 2), or in a nest box measuring 35 x 50 cm, with 2 exits to an L- shaped tunnel (group 3). Adult females in group 2 had a significantly better reproductive performance than in groups 1 or 3, with 7,7% of mated females being infertile vs. 14.4 and 13.7, and 87.9% rearing litters with a low incidence of damaged or dead cubs vs. 69.2 and 73.7. For young females, there were no significant differences between groups 2 and 3, which both performed better than group 1. For adult females in the 3 groups , litter size averaged 4.15, 4.45 and 4.42 resp. at birth and 3.57, 4.16 and 3.89 at 3 wk vs. 3.96, 4.20 and 3.93 at birth and 3.14, 3.79 and 3.60 at wk for young females.



Kasse 2 i forsøket. Den er lik kontrollkassa, men påmontert tunnel.

Kasse 3 i forsøket. Den har to utganger fra reiret til et tunnelsystem i vinkel rundt reirdelen.

Norsk Pelsdyrblad; 64; 5; 6-8, 1990. 4 tables, 11 references. In NORG. CAB-abstract.

The nest box is of great importance in the breeding of mink.

S. Møller.

Shortly before expected parturition, 163 Pastel mink females were placed in cages with a nest box and a special feeding area (group 1), with a nest box not containing a feeding area (group 2) or without a nest box. In the 3 groups resp., the percentage of females not giving birth to a litter

was 5.7, 8.6 and 17.5. Litter size at birth averaged 6.1, 6.6 and 7.1 of which 0.4, 0.7 and 1.4 were stillborn, and litter size at 2 wk of age averaged 5.2, 5.0 and 3.1, the differences between groups for stillbirths and kit losses being significant. Body weight of male kits in the groups averaged 159, 162 and 123 g resp. at 4 wk of age and 338, 339 and 295 g at 6 wk, the corresponding weights for females being 146, 146 and 108 g at 4 wk and 295, 302 and 261 g at 6 wk.

Dansk Pelsdyravl; 53; 4; 173-174, 1990. 3 tables. In DANH. CAB-abstract.

Repeated pelt quality evaluation in blue foxes.

H. Kenttamies, K. Smeds.

In Nov., 77 blue foxes were each evaluated on 2-3 occasions by 3 experienced judges for general pelt colour, fur density, fur cover and purity of colour, inside and outside the cage in daylight and outside the cage in the light of a halogen lamp (a total of 21 appraisals per fox). The overall repeatability of the scores was 39.2 plus or minus 5.8 and 34.2 plus or minus 6.1% for pelt size of males and females resp., 48.2 plus or minus 4.4% for pelt colour, 35.1 plus or minus 4.1% for fur density, 26.1 plus or minus 3.6% for fur cover and 16.0 plus or minus 2.8% for purity of colour. When the same light conditions of evaluation were used by the same judge, the repeatabilities ranged from 52.5 plus or minus 2.5 for purity of colour to 66.9 plus or minus 1.9% for pelt colour. When different conditions were used by the same judge, the repeatability ranged from 47.3 plus or minus 2.9% for purity of colour and fur cover to 62.3 plus or minus 2.6% for pelt colour, and when the same conditions were used by different judges, it ranged from 13.7 plus or minus 3.3% for purity of colour to 48.2 plus or minus 2.9% for pelt colour. There were marked differences between the scores awarded by the different judges.

Finsk Palstidskrift; 24; 4; 100-102, 1990. 2 figs., 2 tables.In SWED.CAB-abstract.

Different areas of mink pelts stretch at different rates during processing.

N. Therkildsen.

The pelts of 32 male and 39 female Standard mink were measured before and after processing. There were significant differences between various part of the pelt in the increase in size after streching, ranging from 5.7% for the area from the front legs to the back to 38.5% for that between the back and the tail root in males and from 15% for the area between the snout and the ears to 22.6% for that the back and the tail root in females; the differences between the sexes were also significant. The correlations of body weight at pelting with pelt length after processing were 0.89 and 0.92 for males and females resp., and those of pelt length before stretching with that after strething were 0.93 and 0.95 resp.

Dansk Pelsdyravl; 52; 325-327, 1989. 1 fig., 5 tables. In DANH. CAB-abstract.

Fine Structure of the Retinal Photoreceptors of the Ranch Mink *mustela vision*.

C.R. Braekvelt.

The structure of the retinal photoreceptors of the ranch mink (*Mustela vision*) has been investigated by light and electron microscopy. In this mammalian species, the photoreceptors can be readily differentiated and adequately described by the classical terminology of rods and cones, with the rods being the more numerous. Rods are long slender cells while cones shorter and stouter in appearance. Both rods and cones are highly differentiated and extremely polarized cells consisting of an outer segment, a non-motile connecting cilium, an inner segment, a nuclear region and a synaptic process extending to an expanded synaptic ending. Morphological differences are noted between rods and cones for most of the various regions of these cells. While rods reach to the cell body of the retinal pigment epithelial (RPE) cells, larger apical processes from the RPE

extend to the shorter cone cells, so that both photoreceptor types are in intimate contact with the retinal epithelial cells.

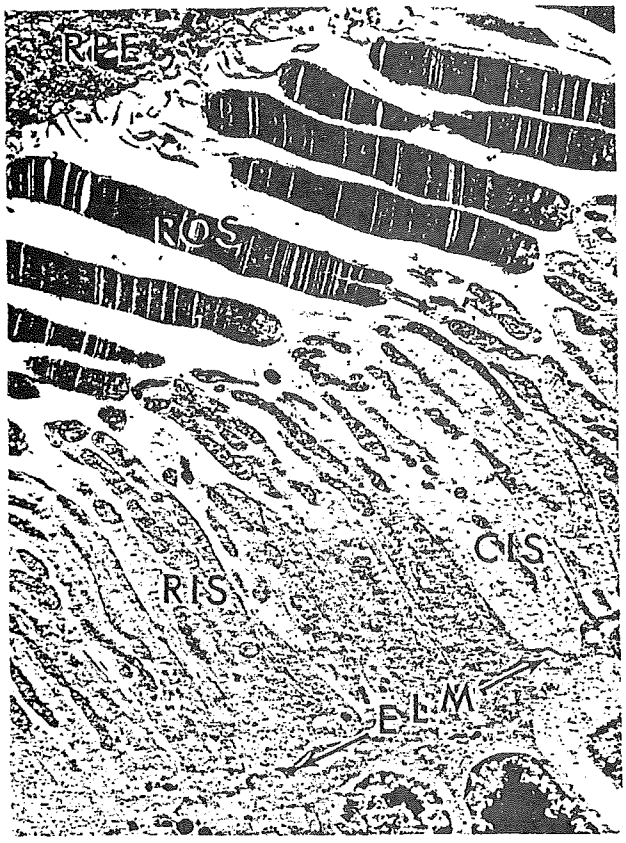


Fig. 1. Low-power electron micrograph of the photoreceptors of the ranch mink. Rod inner (RIS) and outer segments (ROS) are indicated as is a cone inner segment (CIS). The RPE and ELM are also indicated. x 4,200.

Acta Anatomica; v. 138 (3); p. 254-260, 1990. 8 figs., 44 references. Author's abstract.

Prolactin or Dopamine Mediates the Induction of Puberty by Long Days in Female Ferrets.

Kathleen D. Ryan, Susan L. Robinson.

The role of PRL in sexual maturation of female ferrets was examined in these studies. Longitudinal profiles of PRL secretion were obtained by thrice weekly blood sampling of intact female ferrets undergoing photoperiod-stimulated development as well as age-matched control females which remained in nonstimulatory short days. Two additional groups of intact females, one in each photocycle, were treated with the dopamine agonist drug bromocryptine throughout the study. The relationship between developmental changes in PRL secretion and the critical pubertal decrease in the efficacy of estradiol (E_2) inhibitory feedback on LH secretion was studied by using additional groups of females which were ovariectomized and treated with E_2 implants (OVX + E_2).

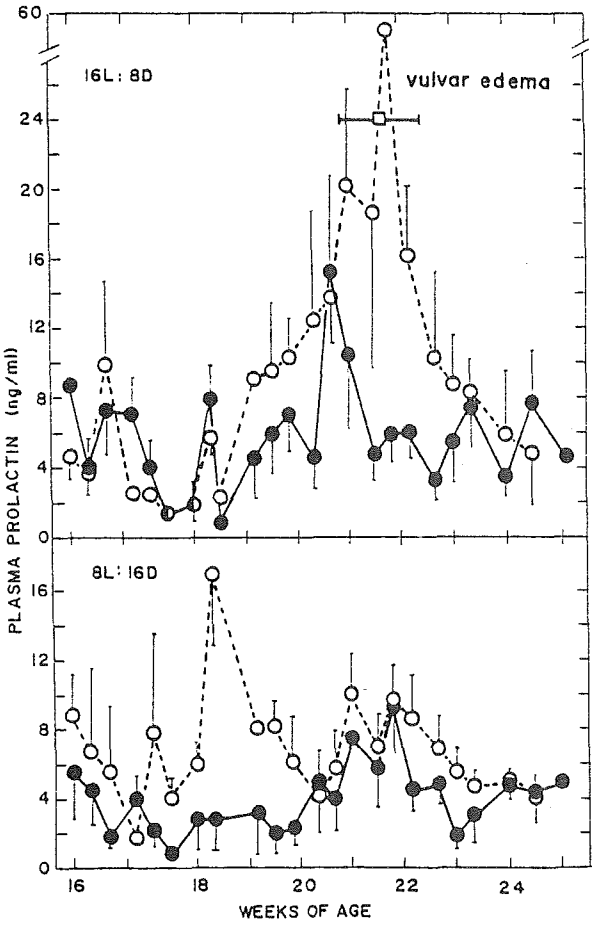


Fig. 3. Patterns of plasma PRL concentrations exhibited by intact females housed in long days (*upper panel*) or short days (*lower panel*) ● ,Data from females trated with bromocryptine; O, vehicle-treated females. *Verticle bars* represent the SEM. The *open square with horizontal error bars* shows the date of onset of vulvar edema in intact females housed in stimulatory long days (mean ± SEM).

These latter females were housed in either long or short day photoperiods; some were treated with

bromocryptine, the remainder were treated with the vehicle only. Results of this study revealed that PRL secretion in ferrets does not change acutely with an abrupt increase in day length. After 4 Weeks of exposure to long days, however, a marked increase in PRL secretion occurred. This increased secretion of PRL was contemporaneous with the onset of pubertal ovarian activity in intact females and with the escape of LH from the negative feedback of E_2 in OVX + E_2-treated females. The further observation that pharmacological blockade of the long day-induced rise in PRL secretion also prevented the pubertal onset of ovarian activity suggested that PRL may play a critical role in the induction of puberty in this species. The mechanism by which bromocryptine prevented puberty induction was illustrated in the OVX + E_2-treated ferrets in stimulatory photoperiod. The drug treatment prevented the pubertal decrease in the efficacy of E_2 negative feedback on LH. These studies suggest an important interaction between the dopamine-PRL system and the GnRH-LH system in the regulation of sexual maturation of female ferrets.

Endocrinology (Philadelphia); 125; 5; 2605-2611,1989. 5 figs., 40 references. Authors' abstract.

Immunological detection of cat uterine proteins in ferrets, dogs and baboons.

Cyntia M. Scalzo, Weiguo Li, Patricia A. Mavrogianis and Harold G. Verhage.

In the cat, a high molecular weight (> 320 kDa) estrogen (E_2)-dependent protein (CUPED) and a group of low molecular weight (28 kDa, 36 kDa, 41 kDa) progesterone (P)-dependent proteins (PDP) are synthesized by the epithelial cells of the deep uterine glands and secreted into the lumen. The present study was designed to investigate the possibility that other species synthesize similar proteins to CUPED and PDP in response to steroids. Uterine flushings and media from cultured endometrial explants obtained from E_2 or P dominated animals were analyzed on Western blots for the presence of proteins which cross-react with antibodies raised against CUPED and PDP. CUPED antibody immunoreacted with a protein band at approximately the same molecular weight af CUPED in the media and flushings from E_2-treated ferret, dog and baboon, but not from rat, mouse or hamster. In the cat, ferret and dog specific immunocytochemeical staining was observed in the apical portion of the secretory cells. In the baboon, staining was observed in both the basal and apical areas of the epithelial cells. The presence of CUPED in the uterine lumen during the E_2-dominated phase of the reproductive cycle in several species suggests that CUPED may play a general role in providing the necessary biochemical milieu for reproductive succes. The PDP antibody did not cross-react with proteins in the media of species other than cat, and therefore may be unique to the cat.

Journal of Reproductive Immunology; 17; 3; 265-277, 1990. 6 figs., 29 references. Authors' summary.

Recording of mortality in mink.

N. Therkildsen.

In 1988, in Denmark, mortality of adult breeding mink from Jan. to Oct. was 4.7% and kit mortality from June to Oct. was 2.3%. Both adult and kit mortality were significantly higher in June than at other times (1.8 and 1.2% resp. vs. 0.2-0.7 bs 0.3-0.4). Kit mortality from birth to 45 days of age was approx. 15%. The cause of mortality was not evident in 35.9% of mink.

Dansk Pelsdyravl; 52; 7; 433-435, 1989. 2 tables. In DANH. CAB-abstract.

Breeding of martens.

H. P. Evensen.

In 1989, in Norway, a litter of 3 martens was born in captivity for the first time since 1927. At present there are 5 females and 6 males at the farm, and at least 1 of the females is belived to be pregnant. Possibilities of breeding martens commercially are considered.

Norsk Pelsdyrblad; 64; 3; 24-25, 1990. In NORG. CAB-abstract.

Prey Storing in the Polecat (*Mustela putorius*).

Thierry Lode.

An examination of food reserves kept by Polecat

(*Mustela vision*) in a wetland in the west of France reveals an intensive seasonal exploitation of some periodically available trophic resources. The food reserves are mainly composed of Amphibians (*Bufo* and *Rana sp.*) and we noted that seasonal variations of Amphibians in the caches are correlated with the abundance of this in the diet. This storing behaviour reveals some temporal degree of specialization upon temporarily abundant prey and a delayed consumption of available resources that stress the plasticity and the opportunism of the feeding behaviour of the Polecat.

Cahiers d'Ethologie Appliquee (Belgium); .v.9(1); p. 19-30,1989. 3 figs., 3 tables, 45 references. Available at: Liege Univ., Institut de Zoologie, 22 Quai van Beneden Liege, B-4020 Liege (Belgium). ISSN 0770-3767. In FREN, Su. ENGL, FREN. Author's summary.

A comparison of cardiac glutathione S-transferases from wild and domestic animals.

Abdelrahim A. Hunaiti.

1) Cardiac glutathione S-transferases from wild animals; hyena, red fox, porcupine, coypu and mountain gazelle were purified and compared with the enzymes from domestic animals; cow, camel, goat and sheep. 2) By using 1-chloro-2,4-dinitrobenzene as a substrate, domestic hearts expressed higher glutathione conjugating activity than wild animal hearts. 3) In all the studied hearts, the bulk of the activity was associated with near neutral and acidic glutathione S-transferase isozymes with pI values ranging from 4 to 7.4. 4) The enzymes from domestic animals displayed homodimeric structure of 25,000 mol. wt subunit while of the wild animals both hyena and coypu displayed homodimers of 26,500 mo. wt subunit and the rest exhibited heterodimers of 25,000 and 28,000 mol. wt subunits.

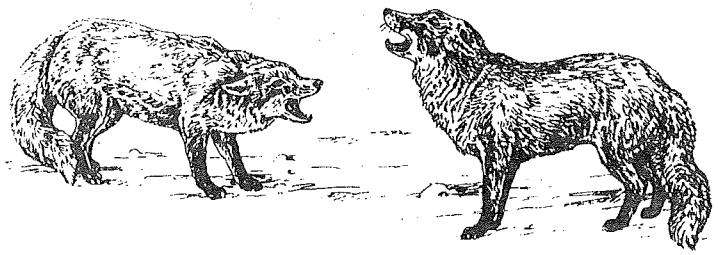
Comp. Biochem. Physiol., Vol 95B, No. 2, 275-280, 1990. 5 figs., 3 tables, 22 references. Author's abstract.

Guidelines for the use of the ferret as a model for pediatric endotracheal intubation training.

Douglas A. Powell, Carlos Gonzalez.

Ferrets were used as an animal model to teach endotracheal intubation of infants and children. This study was designed to establish guidelines for acceptable frequency of same day intubation in this model without causing laryngeal injury. Endoscopic photographs were taken of the larynxes of four normal ferrets after 5, 10, 15, and 20 intubations over a period of 45 minutes to one hour. The ferrets were euthanized 12 hours after the last intubation and the larynxes were exposed and photographed. Twelve additional ferrets, divided into four subgroups of three each, were intubated either 5, 10, 15, or 20 times, were phototgraphed ensoscopically, and were euthanized 12 hours after the photographs were taken. The larynxes were exposed and photographed. A trauma scale was developed to evaluate the laryngeal damage. The number of intubations was not directly proportional to the degree of trauma that ranged from erythema with or without submucosal hemorrhage to frank hemorrhage. Trauma was greatest in those animals intubated 10 and 15 times. Trauma appeared in 29% of the subjects after five intubations and in 100% of the subjects after ten or more intubations. Based on this study, the ferret is a suitable model to teach pediatric intubation. However, to avoid undue injury to the ferret, the laryngeal area must be continously examined after five intubations. Further intubations should be discontinued before the appearance of erythema with submucosal or frank hemorrhage.

Dept. of Laboratory Animal Medicine, Uniformed Services University of the Health Sciences; Bethesda, Md. (USA): 14 leaves; ill. bibliographical ref. (leaf 12). Cover title. Available at: US (DNAL SF407.F39P6). 1 fig., 3 tables, 1989. Authors' abstract.



Use of a breeding value index has resulted in considerable breeding progress.

Ejner Børsting.

Data on 2090 young mink females at a Danish mink farm were analysed. When females were selected on the basis of the size of their own birth litters, litter size averaged 5.30 and 5.60 kits resp. for females born into litter of 8 or more kits vs. 5.21 and 5.76 resp. when females were selected on the basis of a litter index value of 106.5 or more (taking into account the size of their parents' birth litters in addition to that of their own). Pelt quality score of 500 male and female mink selected on the basis of the performance of their parents averaged 2.84 vs. 2.97 for 500 mink selected on the basis of the pelt quality index of their parents.

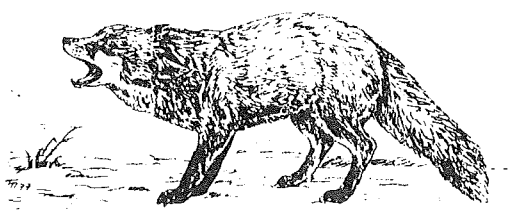
Dansk Pelsdyravl; 52; 4; 250-251, 1989. 5 tables. In DANH. CAB-abstract.

Ontario: a complex amino-acid encephalopathy in mink.

P. B. Little, G. Zellen, R. O. Ball.

During the summer of 1987, a mink rancher observed incoordinated sapphire kits in one litter and culled the entire litter. Three similarly affected litters on the premises were noted in the summer of 1988, with 50% of these kits seen to be incoordinated at weaning. Clinically, all affected three-month-old kits had vision, were alert but had a prominent head tremor, good muscle strength but severe incoordination which caused them to sway and drag themselves about their cage. At necropsy, all mink were devoid of gross lesions but neuropathologically there was spongiform encephalopathy, loss of neurons in the cerebral cortex, mesencephalic and medullary centers, as well as loss of Purkinje's cells. There were diffuse reactive astrocytosis in white matter, enlarged astrocytic nuclei and early gemistocytic change. A striking Bergmann astrogliosis was also present in the Purkinje's cell layer as a result of neuronal loss. Some of the vacuoles in the white matter contained debris and axonal bodies. Vacuolation of the U-fiber layer beneath the cortex was particularly apparent. The lesions are similar to those of calves affected with neuraxial edema caused by accumulation of the amino acids, valine, isoleucine and leucine, as a result of recessively-transmitted deficiency of branched chain keto acid decarboxylase (1). Examination of stored frozen brain from one affected kit and three age-matched controls showed that values of several amino acids, notably glutamic acid, glutamine, histidine, taurine, aspartic acid, alanine, proline, and serine, in descending order, were markedly elevated. Values of glutamic acid averaged 1,319 nmol/g of brain compared to those of 503 nmol/g in controls, whereas the value of serine was 86 nmol/g compared to that of 61 nmol/g in controls. This disease appears to be previously unrecognized aminoacidopathy probably genetically transmitted as autosomal recessive. To our knowledge it is separate from aminoacidopathies yet described in man (2,3). Pathologically, the disease may be confused with mink encephalopathy caused by a prion/unconventional agent similar to that causing scrapie, however, the age of the kits and the pattern of lesions are different. We would be interested in hearing if other workers in Canada or overseas see a similar condition. Frozen brain, kidney, serum and urine will be helpful to confirm its relationship to these reported cases as we continue this investigation.

Canadian Veterinary Journal; 30; 9; 757,759, 1989. 3 references. Authors' short report.



Optimal dose of human chorionic gonadotropin for inducing ovulation in the ferret.

Rodney A. Mead, M.M. Joseph, Sandra Neirinckx.

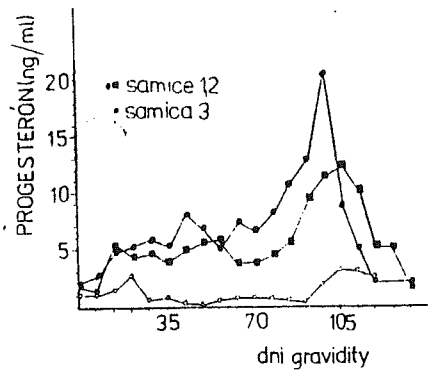
The optimal dose of human chorionic gonadotropin (hCG) for induction of ovulation was determined by comparing the ovulatory response of 119 mated ferrets (controls) with that of estrous females induced to ovulate with five different dosages of hCG. Copulation induced formation of 12.7 ± 4.5 corpora lutea (CL) in all 119 females and resulted in a 90.7% conception rate as evidenced by finding approximately eight blastocysts/-female in the uteri of 108 ferrets. All doses of hCG tested induced ovulation; however, the lower doses (50 and 75 IU) resulted in a lesser percentage of females ovulating. The highest doses of hCG (150 and 300 IU) resulted in fewer CL/female being formed. The optimal dose of hCG for simulating copulation induced ovulation was 100 IU. Tubal transport of unfertilized oocytes in pseudopregnant females was found to be significantly retarded when compared to the rate of transport of embryos in the control group.

Zoo Biology 7, 263-267, 1988. 1 table, 17 references. Authors' abstract.

Fluctuations in the progesterone concentration of the peripheral blood of nutria during pregnancy.

I. Jakubicka, M. Barta, J. Nitray, O. Szeleszezukova.

Radioimmunoassay was used to measure the progesterone concentration in blood samples from 3 non-pregnant nutrias and 3 animals after natural mating.



1. Koncentrácia progesterónu v periférnej krvi nutrií počas gravidity — Progesterone concentration in the peripheral blood of coypus during pregnancy

In the non-mated animals the concentration varied between 0.2 and 1.5 ng/ml over a 4-month period. Immediately after mating the values remained low (1.5-2.4 ng/ml), then from the second week gradually rose to a maximum value (12.5-20.7 ng/ml) in the 14-15th week of pregnancy. The values then gradually declined until the last few days of pregnancy, when there was a rapid fall; they were very low on the day of parturition (1.0-2.5 ng/ml).

Veterinarni Medicina 34;4, 251-256, 1989. 1 fig., 2 tables, 16 references. In SLOV, Su. RUSS, ENGL, GERM. Authors' abstract.

The effect of the secretion of the seminal vesicles on some qualitative indices of ejaculates of male nutria.

I. Jakubicka, M. Barta.

Semen was collected by electro-ejaculation under a halothane anaesthesia from 5 intact males and 5 females from which the seminal vesicles had been removed. For the 2 groups of ejaculates (100 and 64 resp.), ejaculate volume averaged 1.18 and 0.87 ml resp. ($P<0.05$), sperm motility 76.9 and 79.1%, semen pH 6.89 and 6.81, and the percentage of thin ejaculates 33.0 and 32.7.

Veterinarni Medicina, 34;6, 355-360, 1989. 2 tables, 17 references. In SLOV, Su. RUSS, ENGL, GERM. Authors' summary.

Effect of dam body weight on whelping performance.

I. Pölönen.

Some recent work carried out in Finland on the effects of body weight of mink and blue fox females at mating on conception rate and litter size at birth and weaning is summarised and discussed. An account is also given of the importance of the energy content in the feed for reproductive performance.

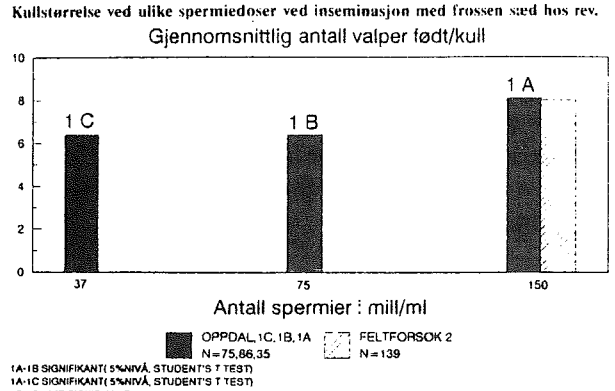
Finsk Pälstidskrift, 24;3, 68-72, 1990. 4 figs., 1 table. In SWED. CAB-abstract.

Frozen semen - merits more trials.

W. Farstad, J.A. Fougner.

In a field trial in Norway, 276 blue fox females were inseminated with frozen semen doses containing 150, 75 or 37. 5 million spermatozoa. In the 3 groups, 82, 77 and 68% resp. of females produced a litter, litter size at birth per inseminated female averaged 6.3, 4.7 and 4.3, and litter size per female whelping 8.1, 6.4 and 6.4. The differences between groups were significant for litter size, but not for CR. In a 2nd trial, 223 blue fox and 27 silver fox females were inseminated with frozen silver fox semen (150 million spermatozoa). Of 171 of the blue fox females, 81% conceived, and litter size at birth averaged 8.0 per female whelping and 6.5 per female inseminated; cub mortality to 3 wk of age was 24% of the silver fox females, approx. 60% conceived, and litter size at birth per female whelping averaged 4.5 cubs.

Kullstørrelse ved ulike spermiedoser ved inseminasjon med frossen sæd hos rev.



Tabellen viser gjennomsnittlig antall valper født pr. drektig tispe, der valpene er talt opp innen 2 dager etter fødsel, hos blårevtisper inseminert med frossen sølvrevsæd med ulikt spermieantall pr. inseminasjonsdose (1 ml.). De svarte søylene angir gjennomsnittlig valpetall hos tisper som deltok i Oppdalforsøkene:

Gruppe 1C (37,5 mill spermier/ml, 75 tisper med gjennomsnittlig kullstørrelse 6,4 valper).

Gruppe 1B (75 mill spermier/ml, 86 tisper med gjennomsnittlig kullstørrelse 6,4 valper.

Gruppe 1A (150 mill spermier/ml, 35 tisper med gjennomsnittlig kullstørrelse 8,1 valper).

Forskjellen i gjennomsnittlig kullstørrelse var statistisk signifikant mellom gruppen som ble inseminert med 150 mill spermier/ml og de to andre gruppene. Videre vises i skravert søyle den gjennomsnittlige kullstørrelsen pr. drektig tispe hos tisper fra områdene Kvål, Lensvik, Folldal og Bryne som ble inseminert med 150 mill spermier/ml. (Feltforsøk 2, 139 tisper med gjennomsnittlig kullstørrelse 8,0 valper). Alle tisper inseminert med frossen sæd blir inseminert 2 ganger med ca. 24 timers mellomrom.

Norsk Pelsdyrblad, 64;1, 14-15, 1990. 1 fig. In NORG. CAB-abstract.

Artificial insemination of foxes in 1989.

L. Jalkanen.

In 1989, in Finland, 155088 fox females, representing 30% of the total population, were inseminated. Of the inseminated females, 53% were blue fox females inseminated with silver fox semen, 17% were blue fox females inseminated with blue fox semen, and 30% were silver fox females inseminated with silver fox semen. For blue fox females inseminated with silver or blue fox semen, the CR was 82.3 and 79.5% resp., and litter size averaged 4.55 and 5.52 cubs vs. 78.4% and 2.61 for silver fox females inseminated with silver fox semen. Results are compared with those in previous years.

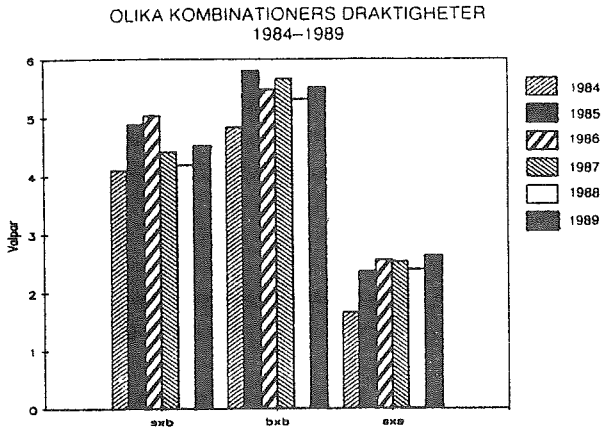
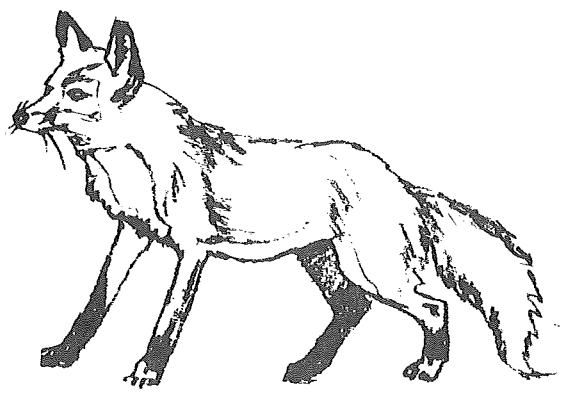


Bild 5. Valpresultatens utveckling 1984-1989 för de olika kombinationerna i de insemineringar som inrapporterats till FPF.

Finsk Pälstidskrift, 23;11, 346-348, 1989. 5 figs., 3 tables. In SWED. CAB-abstract.



The effect of dietary dl-alpha-tocopheryl acetate, sodium selenite and polyunsaturated fatty acids in mink (*Mustela vison*).

A. Brandt, Conny Wolstrup, T. Krogh Nielsen.

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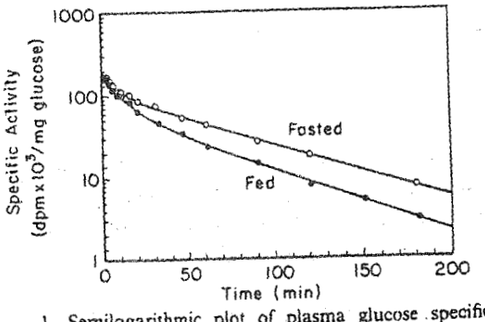
J. Anim. Physiol. a. Anim. Nutr. 64, 280-288, 1990. 4 tables, 21 references. Authors' summary.

Glucose turnover and defence of blood glucose levels in arctic fox (*Alopex lagopus*).

Peter G. Tallas, Robert G. White.



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1) Glucose utilization was assessed in fed and fasted arctic fox, maintained on a diet similar in composition to food available in the wild. 2) Fasted (24 hr) glucose concentration was not significantly different from the fed level (134 mg/dl). 3) Fasting was associated with a significant reduction in glucose space, pool size, total entry rate, and irreversible loss which suggests a decline in gluconeogenesis. 4) Glucose recycling was not significantly different between the fed and fasted states. 5) We suggest that, in the arctic fox, the mechanism for defending blood glucose levels during fasting is based on restricting blood glucose to tissues with a high glucose dependency.

Comp. Biochem. Physiol., Vol. 91A, No. 3, 491-498, 1988. 1 fig., 3 tables, 46 references. Authors' abstract.

Vitamin D metabolism in polar vertebrates.

Paul Griffiths, Angela Fairney.

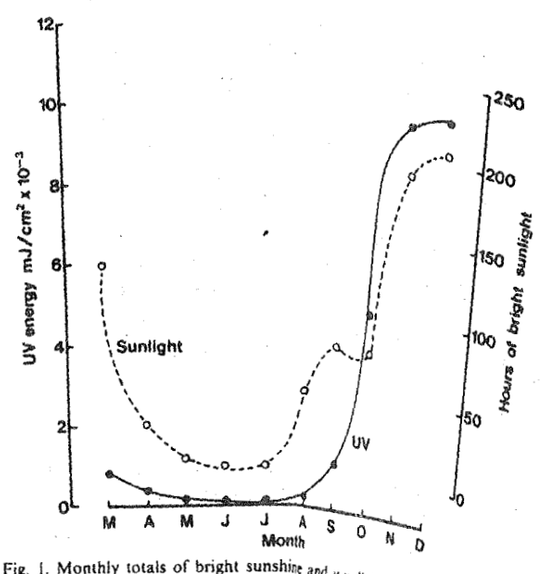

Fig. 1. Monthly totals of bright sunshine and u.v. light at Rothera Point.

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Comp. Biochem. Physiol. Vol. 91B, No. 3, 511-516, 1988. 5 figs., 3 tables, 25 references. Authors' abstract.

Hepatic and splenic content of iron, copper, zinc and manganese in anemic mink.

J.T. Työppönen, P.O. Lindberg.

Nutritional anemia in mink is usually a consequence of feeding the animals with a high content of raw fish of the Gadidae family. Anemia during the early growth period leads to the "cotton-fur" syndrome in dark minks (*Stout et al., 1960*). It is characterized by the lack of pigmentation in the underfur and causes great economical losses to fur farmers in the form of poor quality pelts. Imbalance in dietary trace element composition, especially copper deficiency, may underlie anemia and "cotton-fur" syndrome (*Underwood, 1977*). The present paper describes dietary and tissue concentrations of some trace elements in mink. The results indicate that Cu, Zn and Mn are normally or better absorbed during low-Fe absorption, and sligthly increased dietary Fe and Cu enhance absorption of Zn and Mn. According to the present study, anemia in minks on fish feed was due to strong and selective inhibition of iron absorption. Tissues seemed to respond normally to different dietary levels of the other trace elements evaluated.

Trace elements in man and animals, 6, 577-578, 1988. Plenum Press; New York. Available at: US (DNAL QP534.15 1987).; ISBN 03-064-30045. 2 tables, 3 references. Authors Introduction & Conclusion.

Ceruloplasmin and glutathione peroxidase as copper and selenium indicators in mink.

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Indirect analysis of a given trace element through its enzyme activity has some advantages over direct analysis: (i) smaller amount of sample is needed (ii) simpler analytical equipment is required and (iii) the enzyme assay determines the biologically active form of the element. Ceruloplasmin (Cp) has been successfully used as copper indicator in cattle and sheep (*Blakley and Hamilton, 1985*). Serum glutathione peroxidase (GSH-Px) has been shown to correlate with blood and dietary selenium in pigs (*Hakkarainen et al., 1978*). In the present study, the usefulness of plasma Cp and GSH-Px as Cu and Se indicators, respectively, in mink was studied. Plasma Cu did not correlate with hepatic or splenic content of this trace element. The Cu concentrations in these organs are given elsewhere (*Työppönen and Lindberg, 1987*). Plasma Se content did not correlate with liver Se content (0.71 ± 0.16 µg/g). Therefore, the use of Cp activity as Cu indicator is limited to plasma as it was also in cattle and sheep (*Blakley and Hamilton, 1985*). Plasma GSH-Px activity can be used as plasma or whole blood Se indicators in mink as previously demonstrated in pigs (*Hakkarainen et al., 1978*).

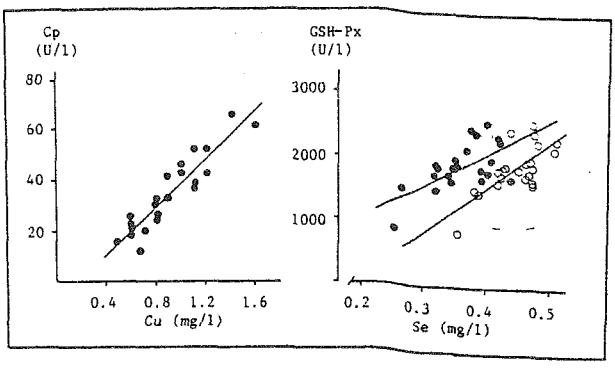

Fig. 1. Correlation between Cu content and Cp activity in mink (left). Correlation between plasma Se (●) or whole blood Se (○) and plasma GSH-Px activity in mink (right).

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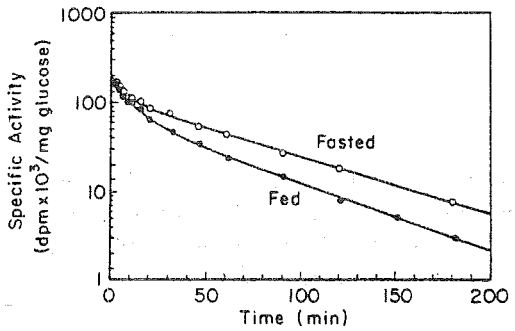

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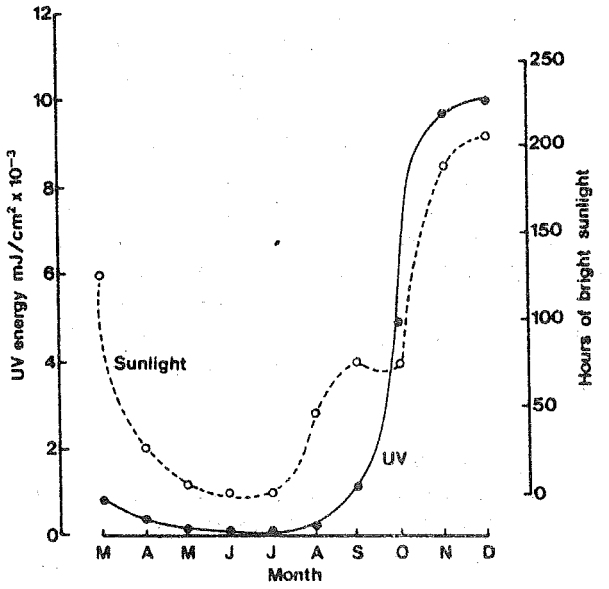

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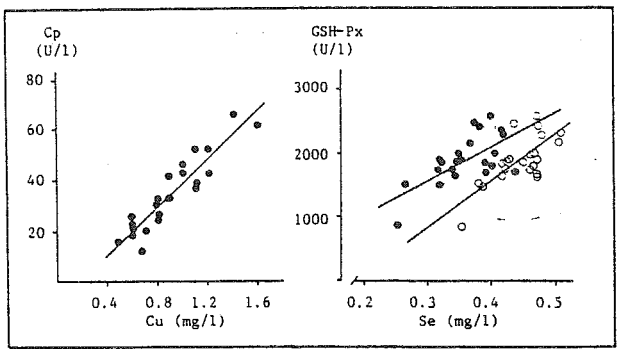

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Fat supplement to the diet (of mink).

G.S. Taranov, T.P. Gumnikova.

From June to the end of October, 2 groups of 40 male and female mink were given a diet supplemented with beef tallow or a 1:1 mixture of tallow and fox fat at 3.4 g/100 kcal ME. Average measured daily intake of the 2 groups was for air DM 75.1 and 75.6, crude protein 39.1 and 40.0, fat 16.4 and 16.3, and nitrogen-free extract 10.3 and 9.2 g and ME 374 and 369 kcal. Respectively, digestibility of DM was 67.4 and 69.1, crude protein 79.9 and 79.5, crude fat 83.4 and 89.7 and nitrogen-free extract 48.5 and 49.1%. Nitrogen retention was 28.3 and 35.3% of N digested. The average daily body weight gain of the second group was more than that for the first group.

Krolikovodstvo i Zverovodstvo, No. 3, 7-8, 1988. 5 tables. In RUSS. CAB-abstract.

Effects of dietary calcium concentration and calcium-phosphorus ratio on growth and selected plasma and bone measures in young european ferrets (*Mustela putorius furo*).

Catherine H. Edfors, Duane E. Ullrey, Richard J. Aulerich.

Wild mustelids have been observed devouring prey species in their entirety or selecting viscera, muscle, and brain and leaving the rest. In captivity, muscle may be a predominant item in mustelids diets. However, skeletal muscle is low in calcium (Ca) and moderately high in phosphorus (P), with a marked inverse Ca-P ratio. The effects of dietary Ca concentrations of 0.6, 0.7 or 0.8% and Ca-P ratios of 1.3:1 or 1:1.3 on growth and selected physical and chemical measures were investigated in 8-wk-old domestic European ferrets (*Mustela putorius furo*). Neither dietary Ca concentration nor Ca-P ratio affected body weight or length, and all ferrets grew normally. Dietary Ca-P ratios of 1.3:1 produced higher plasma Ca and lower plasma inorganic P concentrations than ratios of 1:1.3 ($P < 0.01$), but all values were within a normal range. There were no Ca-P ratio effects on plasma alkaline phosphatase activity or creatinine concentration nor on femur weight, length, diameter, maximum breaking force, or bending moment. Likewise, there were no differences among treatments in concentrations of Ca, P, magnesium, or sodium in femur ash. Potassium concentrations in femur ash were slightly higher ($P < 0.05$) when dietary Ca:P was 1:1.3. It is concluded that, for at least 42 days, an inverse Ca-P ration of 1:1.3 produces no adverse effects when young ferrets are fed Ca concentrations of 0.6, 0.7, or 0.8% in dietary dry matter.

Journal of Zoo and Wildlife Medicine 21(2), 185-191, 1990. Only abstract received. Authors' abstract.

Exposure to triphenyl phosphite results in widespread degeneration in the mammalian central nervous system.

Duke Tanaka Jr., Stevej J. Bursian, Ellen J. Lehning, Richard J. Aulerich.

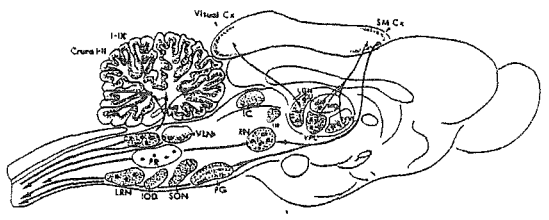

Fig. 3. Summary diagram illustrating the major regions in the CNS containing axonal and terminal (stipple) and somatic (filled circles) degeneration. Arrows indicate presumptive relationships between degenerating cell bodies and terminal fields.

Previous studies in mammals have found that exposure to triphenyl phosphite results in cellular and axonal degeneration in the spinal cord and medulla. However, the nature of concomitant clinical signs suggested that other areas of the central nervous system might also be affected. In this study, the brains of ferrets receiving single subcutaneous injections of triphenyl phosphite were examined 8-12 days after dosing. Widespread areas of axonal, terminal, and somatic degeneration were seen in medullary, pontine, and thalamic nuclei. Extensive axonal and terminal degeneration were also noted in the cerebellar granule cell layer and in the cerebral cortical primary visual and sensorimotor areas. These data indicate that triphenyl phosphite exerts a potent neurotoxic effect, not only in the medulla and

spinal cord, but also in the cerebellum, thalamus, and cerebral cortex.

Brain Research, 531, 294-298, 1990. 3 figs., 17 references. Authors' summary.

Subacute toxicity of dietary heptachlor to mink (*Mustela Vison*).

R.J. Aulerich, S.J. Bursian, A.C. Napolitano.

Mink were fed diets that contained 0, 12.5, 25, 50, or 100 mg/kg active ingredient heptachlor (as technical grade formulation) for 28 days followed by a 7-day observation period to determine the toxicity of this insecticide to mink. Diets that contained 25 mg/kg, or more, heptachlor resulted in a significant decrease in feed consumption, while 50 mg/kg, or more, heptachlor caused a significant reduction in body weights. Mortality (37.5%) occurred only in the group fed 100 mg/kg heptachlor. The dead mink showed neurological signs of toxicity prior to death. Animals fed 100 mg/kg heptachlor also had reduced relative weights of the spleen and kidney and increased relative weight of the adrenal glands when necropsied at the time of death or at the termination of the study.

Arch. Environ. Contam. Toxicol. 19, 913-916, 1990. 3 tables, 16 references. Authors' abstract.

Water is important, especially in the lactation period.

S. Møller, O. Lohi.

Contribution of diet, especially wet feed, and drinking water to fluid supply of mink is discussed. Water requirement of sucking females for milk supply of mink is discussed. Water requirement of sucking females for milk production, depending on litter size, and for cooling purposes in hot weather is examined. Fluid requirements of kits, which learn to drink at age 40 to 45 days, and how they are fulfilled and type of drinking water system are considered. The importance of supplying extra water in feed at this stage and helping kits to drink, e.g., from dripping water, with a view to increasing weight gain and discouraging licking of maternal saliva is stressed. Mink do not object to warm water.

Dansk Pelsdyravl, 52;5, 311, 313, 1989. 1 fig., 1 table. In DANH. CAB-abstract.

Feed for foxes can be produced more cheaply, but extra work is involved.

B. Lyngs, G. Hillemann.

From July to December, groups of growing blue and silver foxes or blue alone were given diets containing over 50% mink feed plus fish silage, bone meal, fat and barley or as alternative supplements dried greaves (cracklings) or bone meal or fish silage, each accompanied by fat and barley. Restricted feeding was tested with diet 1. Controls had mink feed alone. Amount and distribution of energy differed among treatments. Cost of feed and pelt size, were similar between treatments. Quality and purity of pelts were compared. The greaves diet was expensive and did not improve pelt characteristics. Bone meal and fish silage were considered excellent feeds. Restricted feeding had no adverse effect. A 30-50-20 energy pattern with 200 kcal/100 g diet appeared satisfactory.

Dansk Pelsdyravl, 52;7, 454-455. 2 figs., 3 tables. In DANH. CAB-abstract.

Results of feeding trials during the breeding season in 1989.

T. Dahlman.

For 102 mink females fed a standard diet from the end of January until weaning, the percentage of infertile females was 15.7, the number of kits born per mated female averaged 4.74, and kit body weight at weaning 462 g vs. 13.0%, 4.65 and 471 g for 108 females fed acid-treated offal, the differences between the groups being non-significant. In a 2nd trial, 94, 87 and 93 mink females were fed a standard diet, a diet with added vitamins or a diet containing 5% mink meat resp. In the 3 groups, the percentage of infertile

females was 11.7, 19.5 and 15.0 resp., litter size per mated female averaged 4.31, 4.09 and 4.40, and kit body weight on 13 June 218, 219 and 217 g for males and 203, 203 and 202 g for females. For 39, 39 and 41 blue fox females, fed a standard diet, a diet with a high content of carbohydrates or a diet with added vitamins, the percentage of infertile females was 20.5, 10.3 and 19.5 resp,, and litter size per mated female averaged 6.38, 7.59 and 6.76 cubs, the differences between the carbohydrate-fed group and the other 2 groups being highly significant.

Finsk Pälstidskrift, 23;11, 351-352, 1989. 6 tables. In SWED. CAB-abstract.

A unlform and slightly restricted feed supply in autumn has a beneficial effect on mink pelt quality.

J. Kjær, M. Sønderup.

A series of feeding trials to improve pelt quality of mink are reported. Different levels of protein, fat and carbohydrats were fed during the growth period of mink. Feed consumption patterns adopted by breeders producing high-quality pelts are also studied.

Dansk Pelsdyravl, 52;7, 425-428, 1989. 3 figs., 7 tables, 6 references. In DANH. CAB-abstract.

Utilization of feeds by two types of foxes.

B.A. Isupov, S.A. Yarmolenko.

Male and female silvery-black or red foxes 52 to 54 days old were fed to appetite from 23 til 28 June, 21 to 27 August and 23 to 30 October, on beef by-products, pork by-products, marine fish, fish meal, skim milk, cottage cheese, grain feeds, cabbage, feed yeast and melted fat. Feed intake was similar for both breeds. There were no significant differences in average body weight between breeds. At 2 months old, average weight was 1.61 and 1.70. Average weight gain throughout the feeding period was 3.58 and 3.63 kg. At 3 months old digestibility of organic matter was 85.7 and 87.9%, protein 87.2 and 89.2%, fat 92.8 and 94.1 and carbohydrate 79.1 and 82.0%. At 5 months old red cell count of blood was 9.54 and 9.64 x 106/ml and white blood cells 6.63 and 6.13 x 103/ml, haemoglobin 16.35 and 15.90 g/100 ml and total serum protein 6.71 and 6.62 g/100 ml. The findings indicated that standards for feeding silvery-black foxes are acceptable for feeding red foxes.

Krolikovodstvo i Zverovodstvo, No. 4, 6-7, 1989. 3 tables. In RUSS. CAB-abstract.

Fenozan in the diet of mink.

N.A. Balakirev.

For 60 to 72 days, groups of young male mink were fed on a basal diet with Fenozan 0, 50, 100 or 150 mg/head daily. The diet contained digestible protein 7.65 to 9.08, fat 3.85 to 4.54 and carbohydrate 3.0 to 5.0 g/100 kcal metabolizable energy. Average respective body weight by November 1 was 2026, 2059, 2065 and 2071 g. Fenozan had no significant effect on blood leukocytes, thrombocytes and red blood cells. With Fenozan at 100 mg/head, concentration of thyroxine in blood was 14.2%, and that of immunoreactive insulin 28.7% more than values without Fenozan. Pelt size was 983, 1036, 1025 and 1025 cm^2, respectively. In another trial, 284 to 305 female mink were given a basal diet without or with Fenozan 50 mg/head, citric acid 20 mg/head, or both together. Percentage of mink pregnant was 96.8, 96.7, 98.3 and 100, respectively. Litter size was 7.7, 7.0, 7.3 and 7.3.

Krolikovodstvo i Zverovodstvo, No. 4, 8-9, 1989. 2 tables. In RUSS. CAB-abstract.

ZhAK and MOSK in the diet for mink.

Kh. Z. Dilanyan, N.A. Ikryannikov.

A preparation (ZhAK) of lactic acid bacteria or streptococcus (MOSK), producing acids and antibiotic substances which, in turn, hinder the development of gram-negative bacteria and gas-forming anaerobes, was developed at the Yerevan Zootechnical Institute, Armenian SSR. ZhAK and MOSK are highly concentrated biomass. ZhAK includes 4 strains of acidophilic pure cultures

selected on the basis of antibiotic activity in relation to pathogenic strains of Escherichia coli and Strauras-209. MOSK contains Streptococcus bovis, S. faecalis, S. lactis and S. paramesentraides. Activity of cultures lasts for 6 months at 1°C to 18°C. In a feeding trial, 3 groups of 60 male mink, average age 20 days, were fed for 2 weeks on a basal diet plus 0.3 ml of ZhAK or MOSK given in the morning before feeding; controls were given no additive. At 34 days old all the mink were switched to their normal diet. Average body weight, was 173.8, 174.0 and 174.3 g, respectively, at 20 days old; 396, 361 and 325 g at 35 days; and 2133, 2023 and 1794 g at 180 days. Judged by size, degree of defects and quality, the pelts from mink given ZhAK and MOSK had higher scores than did those from the control mink.

Krolikovodstvo i Zverovodstvo; No. 4, 29, 1989. 2 tables. In RUSS. CAB-abstract.

"Quarks. Neutrinos. Mesons. All those damn particles you can't see. *That's* what drove me to drink. But *now* I *can* see them."

Dracunculus insignis in ferrets: Comparison of inoculation routes.

Floy H. Brandt, Mark L. Eberhard.

Three routes of inoculation were compared to determine the best method to infect ferrets with *Dracunculus insignis*. The traditional method of administering infected cyclops containing L_3s through gavage was compared to intraperitoneal (i.p.) and subcutaneous (s.c.) inoculation of L_3s. Ten of 18 (56%) gavaged ferrets became infected after receiving copepods containing approximately 100 L_3s each; 44 adult worms were recovered from these 10 animals. Twenty-one of 28 (75%) animals inoculated with 50 L_3s each became infected i.p.; 92 adult worms were recovered from the positive animals. Four of 5 (80%) ferrets given subcutaneous inoculations of 50 L_3s became infected: only 6 worms were recovered from these 4 animals. Inoculation of larvae via the i.p. or s.c. route greatly simplifies the infection procedure and produces more consistens results. A simple procedure is described, which permits rapid recovery of L_3s to be used in the i.p. or s.c. inoculations.

J. Parasitol, 76(1), p. 93-95, 1990. 1 table, 3 references. Authors' summary.

Failure to eliminate _Campylobacter mustelae_ colonization of the ferret stomach using oral antimicrobial therapy.

J.G. Fox, G. Otto, A. B. Cherry.

Campylobacter mustelae is commonly isolated from the gastric mucosa of the ferret. Similarities between *C. mustelae* and *C. pylori* suggest that the ferret may be of value as an animal model for human *C. pylori*-associated gastric disease. However, the high prevalence of infection in most colonies (near 100%) complicates the use of ferrets in comparative studies. Combined oral antimicrobial therapy consisting of metronidazole, tetracycline, and bismuth subsalicylate has been successful in eradicating *C. pylori* from humans. The efficacy of such a combination in the ferret was tested. Tetracyline (25 mg/kg TID) and bismuth subsalicylate (2 mg/kg TID) were each given orally for 4 weeks, while metronidazole (20 mg/kg TID) was given only for the first 10 days. Post-therapy cultures were performed on mucosal samples obtained via endoscopic or at necropsy. The ferrets were cultured post-therapy either at necropsy (one ferret) or via endoscopic biopsy (six ferrets). *C. mustelae* was isolated from five of seven treated ferrets (71%) 2 weeks post-therapy, and from all remaining ferrets (6/6) at 6 months. Results suggest that elimination of *C. mustela* from the ferret may require different or more intensive antimicrobial therapy than required for elimination of *C. pylori* in the human.

Laboratory Animal Science, Vol. 39, No. 5, 487-488, 1989. Only abstract received. Authors' abstract.

Eosinophilic gastroenteritis in the ferret.

J.G. Fox, L. Palley, J. Jenkins, J. C. Murphy.

Three adult ferrets (*Mustela putorius furo*) with weight loss, diarrhea, vomiting, and anorexia were studied. In two ferrets peripheral eosinophilia was observed. On abnominal palpation, the small intestine was thickened in two ferrets, and mesenteric lymph nodes in all three animals were enlarged. Two ferrets did not respond to steroid therapy;the third improved after surgical removal of an enlarged mesenteric lymph node, dietary alteration, and supportive therapy. Intestinal and systemic parasites were not found. Granulomatous lymphadenopathy with diffuse infiltration of eosinophils into the parenchyma of lymph nodes was observed in two ferrets; the third had eosinophilic infiltrate into the lymph nodes but no granuloma formation. The intestine, examined in two animals, had moderate to diffuse infiltration of eosinophils in the lamina propria and serosa, in addition to the presence of other inflammatory cells. This may be a new disease entity in the ferret. Similar conditions in man, dog, horse, and cat are named eosinophilic gastroenteritis and include involvement of the mesenteric nodes and intestine as well as peripheral eosinophilia.

Laboratory Animal Science, Vol. 39, No. 5, 499-500, 1989. Only abstract received, Authors' summary.

Chinchilla deaths due to *Clostridium perfringens* A enterotoxin.

M. Bartoszcze, M. Nowakawska, J. Roszkowski, J. Matras, S. Palec, E. Wystup.

An outbreak of sudden deaths in a chinchilla flock of 500 animals is described. Affected animals showed gastrointestinal disturbances, including rectal prolapse, flatulence and severe diarrhoea, leading to death within 24 to 48 hours. Total morbidity and mortality reached 20%. PM findings were inflammation of the gastrointestinal tract and enlargement of the liver and spleen. Histological changes were centrilobular necrosis of the liver, oedema congestion and necrosis of the large intestine mucosa and proliferation of white pulp of the spleen. *C. perfrigens* type A enterotoxin was detected in gastric contents and *C. perfrigens* type A strain were isolated from gastric contents and feed mixture.

Veterinary Record, 126;14, 341-343, 1990. 2 references. CAB-abstract.

Intracranial epidermoid cyst (*epidermoid cholesteatoma*) in a ferret.

R. Hofmeister, E. Breuer.

The first apperance of an intracranial epidermoid cyst in a ferret is reported; possible pathogenesis and differential diagnosis are described.

Kleintierpraxis, 34;10, 517-518, 520, 1989. 4 figs., 16 references. In GERM. Su. ENGL, FREN. Authors' summary.

Encephalitozoon disease in farmed *Alopex lagopus*.

M. Persin, J. Dousek.

The occurence of encephalitozoonosis in blue foxes kept on one farm is described. 50 young foxes from eight females used for reproduction were affected, the mortality being 88%. The main clinical symtoms included somnolency, ataxia, impaired vision, clonical spasms and in case of a longer duration of the disease retarded growth. Typical nonpurulent microgranulomas together with individual spores and cysts of Encephalitozoon cuniculi were demonstrated in the liver and in the central nervous system. Futhermore, diffusion interstitial nephritis and necrotizing angiotitis were found. In reproduction females chronic interstitial nephritis was found without isolation of the causal agent. The source of invasion was probably feeding of rabbit carcasses with subsequent transmission to the progeny.

Sbornik vedeckych Praci Ustredniho Statniho Veterinarniho Vstavu, 17, 32-36,1987. In CZEC. Su. ENGL, SPAN. Authors' abstract.

Occurrence of endoparasites in farmed foxes.

L. T. Berndtsson.

The prevalence of intestinal helminths and coccidia in foxes on 5 fur farms in Sweden was recorded.

Vara Palsdjur, 61, 3, 86-87, 1990. 2 tables. In SWED. CAB-abstract.

Cystic mucinous hyperplasia in the gallbladder of a ferret.

J.F. Reindel, M.G. Evans.

An 8-year-old male ferret had icterus, hepatomegaly and an enlarged gall bladder. Microscopically, the gall bladder had numerous mucinous cysts and papillary hyperplasia of the mucosa consistent with a diagnosis of cystic mucinous hyperplasia. No previous published reports of this condition in ferrets were found.

J. Comp. Path. Vol. 97 (5), p. 601-604, 1987. 1 fig., 6 references. Authors' summary.

Viral hepatitis in nutria.

N. Nankov, S. Enchev.

For six months, high morbidity and mortality rates have been observed at an industrial nutria breeding farm having 450 mothers and about 1000 young animals. The bacteriological tests of the dead animals were negative for pathogenic bacteria and parasites. Examinations of the feed for detecting organo-phosporic compounds - nitrites

and nitrates, as well as mycotoxins, were also negative. The following have been found after post-mortem of 63 nutria: enlarged yellow-brown tinted liver having friable consistency, differently enlarged cyanotic spleen, and intestines sometimes having hemorrahagic enteritis or entercolitis. Histological examinations show nuclear inclusions in the hepatocytes typical for adenoviral hepatitis in nutrias (described by Karstad, Dobos-Kovacs and Bergmann), as well as slight up to moderate lymphoid reaction and slightly activated RES. on the basis of epizootological, pathomorphological, and, particularly, the nuclear inclusions in the hepatocytes, it is accepted that adenovirus causes hepatitis.

Veterinarna Sbinka, 87, 2, 32-35, 1989. 3 figs. In BULG, Su. ENGL, RUSS. Authors' summary.

Observation of a distemper virus infection in a mink colony.

J. A. Nicolas, M. J. Cornuejols, A. M. Larry, C. Dufaure, C. Bosgiraud.

Morbillivirus, responsible for distemper in dogs can bring about minks' death. We thought that it would be useful to emphasize the interest of direct immunofluorescence in the biological diagnosis of this disease. This rapid technique has allowed us to reach an efficient prophylaxis for dog immunization using live vaccine.

Recueil de Medecine Veterinaire, 165;1, 27-30, 1989. 4 figs. 1 table, 3 references. In FREN, Su. ENGL, SPAN. Authors' summary.

Nitrofuratoin against urolithiasis in mink.

H. Zimmermann.

Urolithiasis caused by infection with Staphylococcus is the most important cause of losses among young mink males. Prevention by addition of Nitrofurantoin to the feed in June/July, dosage 10 mg/kg bodyweight daily is succesful.

Der Deutche Pelztierzüchter, 64, 27-28, 1990. In GERM, Su. ENGL. Author's abstract.

Vioxan® powder - A new dry preparation for use against ectoparasites of domestic animals.

G. Werner, T. Hiepe, P. Tschauschev, H. Hahn, H. Zimmermann, W. Siering, L. Hoffmann.

Vioxan®-powder (carbaryl) is a substance now being introduced to replace Pedix powder 67 (lindan). The spectrum of applications and effectiveness parameters preclinically tested under in vitro conditions was confirmed in vivo by investigations of young cattle, pigs, sheep, dogs, cats, mink and other fur animals as well as some other species. Vioxan®-powder was found to be highly effective against sucking and biting lice, fleas, louse flies, and ixodide ticks. A five per cent concentration of active ingredients in the powder proved to be sufficient for complete extermination of all ectoparasite populations tested. Action on mange mites was inadequate. Guidelines are proposed in this paper for modes of administration and dosage by species. Vioxan®-powder, as a matter of principle, was used against ectoparasites of domestic and farm animals by double treatment with an interval of 10 to 14 days in between. The preparation was properly tolerated, with no side-effects being recordable.

Monatshefte fur Veterinarmedizin, 44;17, 611-613, 1989. 23 references. In GERM, Su. ENGL, RUSS. Authors' summary.

Distemper vaccination in ferrets.

M. Oxenham.

In December 1989, 81 ferrets (30 males and 51 females) from 6 months to 6 years old were vaccinated against canine distemper using half the dog dose of Vaxitas D. Two weeks after vaccination all the ferrets remained in normal health. Vaxitas D is a live vaccine using the Rochborn strain distemper virus grown in the vero continuos line of African green monkey cells and although not licensed for use in ferrets in the UK a diluted version of the same vaccine is licensed for use in ferrets in New Zealand. Annual boosters should be given.

Veterinary Record, 126 (3), 67, 1990. CAB-abstract.

Dynamics of dermatophyte species among fur-bearing animals and rabbits.

L.I. Nikiforov, G.V. Chuchina.

Between 1964 and 1975, the agents of dermatophytosis in arctic and silver foxes, coypu and rabbits were found to be predominantly (83%) Trichophyton mentagrophytes, with some T. verrucosum and Microsporum canis; but between 1976 and 1987, 63% of M. canis were found , with only 37% of T. mentagrophytes. The change was attributed to the virtual elimination of trichophytosis from cattle, and the use of a vaccine for fur bearing animals.

Veterinariya, Moscow, No. 1, 38, 1989. 1 table. In RUSS. CAB-abstract.

A domestic ferret model of immunity to *Campylobacter jejuni*-induced enteric disease.

Judith A. Bell, Dean D. Manning.

Oral or intravenous inoculation of previously unexposed juvenile and adult ferrets with *Campylobacter jejuni* uniformly resulted in intestinal colonization lasting 2 to 12 days. Disease varied from mild to moderate diarrhea, which resolved in 2 to 3 days. Orally infected animals developed agglutinin titers of 8 to 256 within 3 weeks, while those infected intravenously developed titers of 256 to 2,048. Ferrets which had recovered from campylobacteriosis all developed high titers of agglutinating and bactericidal antibodies but were readily colonized by subsequent oral inoculation with the same strain of *C.jejuni*. Orally infected ferret kits 3 to 6 weeks of age exhibited the same general pattern of infection and disease as adults, but diarrhea was somewhat more severe. Kits resolved their diarrhea in 1 to 6 days and developed agglutinin titers in serum of 16 to 32 within 3 weeks. A series of five oral or rectal inoculations of kits during the 5- to 9-week age interval resulted in progressively shorter clearance times andeventual strain-specific resistance against infection, as well as disease. Gnotobiotic adults showed the same pattern of strain-specific accelerated clearance and resistance to disease. Kits born to immune dams with high levels of whey antibodies had passively acquired serum agglutinin titers of 256 to 2,048. These kits showed no resistance to colonization with the homologous strain of *C.jejuni* but were completely refractory to diarrhea. These observations suggest that (i) some form(s) of specific immunity, rather than factors relating solely to age or normal flora, is responsible for resistance to *C.jejuni* colonization and disease production and (ii) humoral immunity at a level that does not prevent colonization can project against enteric disease caused by this organism.

Infection and Immunity, Vol. 58, No. 6, 1848-1852, 1990. 5 tables, 12 references. Authors' summary.

Ecology of multilocular hydatidosis in Alsace. Parasitism in the red fox (*Vulpes vulpes*).

B. Pesson, R. Carbiener.

Human alveolar echinococcosis is still unusual in Alsace, whereas its incidence seemed to be regularly increasing during the last twenty years in border provinces. This survey had been carried out in order to collect new local epidemiological data to be compared with endemic areas. Red fox (*Vulpes vulpes*) was chosen to reveal zoonosis foci. 327 foxes were examined for intestinal helminths: 14 (4.3%) harboured *Echinococcus multilocularis*. Regional prevalence was low but, as in endemic regions, the distribution of the parasite was confined to some districts. Three areas located in the north (Alsace bossue, Basse-Alsace Hills) and in the south (Sundgau) of the province were seen to be more propitious to the parasite life cycle. Comparative landscape ecology confirmed parasitological data on a zonal scale as well as on a regional one.

Bull. Ecol, 20;4, 295-301, 1989. 3 figs., 25 references. In FREN, Su. ENGL. Authors' summary.

Cerebral nematodiasis caused by raccoon ascarid (*Baylisascaris procyonis*) in chinchillas.

S.E. Sanford.

During a 6-week period, commencing in May 1989, about 30 chinchillas from 3 ranches devel-

oped nervous symptoms including ataxia, tumbling and torticollis followed by death. Chinchillas 3 to 8 months old were affected primarily. PM examination revealed no gross lesions. Histological examination showed malacia tracts/areas of necrosis, swollen axons and infiltration of inflammatory cells in brainstem and cerebellum. A B. procyonis larva was seen adjacent to a necrotic focus in the brain in one animal.

Canadian Veterinary Journal, 30;11, 902, 1989. 1 reference. CAB-abstract.

Control measures against Microsporum.

L.I. Nikiforov, I.I. Zharkov, V.S. Slugin, T.V. Chuchina, V.K. Noginov, O.V. Bordasova, R.U. Mukhametshin.

The successful use of a vaccine against Microsporum infection in farmed rabbits and foxes, and also in farm dogs, over a 5-yr period, is briefly reported. The vaccine was used both prophylactically, in 1.5-2-month-old fox cubs, and also therapeutically in adult foxes with the infection. Regrowth of hair in affected areas was seen in treated animals.

Krolikovodstvo i Zverovodstvo, No. 2, 28, 1990. 1 table. In RUSS. CAB-abstract.

HAEMATOLOGY AND CLINICAL CHEMISTRY OF FUR ANIMALS

Editor
Asbjørn Brandt

This book is a result of many years of cooperation between the USSR Academy of Sciences, Karelian Branch, Petrozavodsk (Professor Vyacheslav Berestov and Dr. Lia Kozkevnikova), the College of veterinary Medicine, Helsinki and the Finnish Fur Breeders Association (Dr. Tapio Juokslahti and Dr. Maija Valtonen) and the National Institute of Animal Science, Dept. of Fur Animals, Denmark (Asbjørn Brandt and Gunnar Jørgensen).

The editor of the book, Asbjørn Brandt, is aknowledged for his large contribution to the final result – the first reference book in fur animal clinical chemistry and haematology.

The Production of the book is based on the cooperation between the College of veterinary Medicine, Helsinki and the Finnish Fur Breeders Association, Scientifur – Fur Animal Division of the Scandinavian Association of Agricultural Scientists, with economical support from Scientific – Technological Cooperation Committee between Finland and USSR, Ministry of Foreign Affairs, Finland and the Nordic Cultural Foundation. The present book which is the result of a fruitful international scientific coorporation, would not have been published without this support. Translation of the Russian contribution into English has been done by G.N. Sokolov, and the English text in the final manuscript has been revised by G. Brandt M. Sc.

We thank all contributors, the financing funds, the editor, and the printing house for their coorporation.

Helsinki, October 1989	Tjele, October 1989	Nikolaev, October 1989
Tapio Juokslahti	Gunnar Jørgensen	Vyacheslav A. Berestov
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With 159 pages, 20 chapters, 25 colour plates, 52 b/w illustrations, 43 tables and 371 references this remarkable book is the first attempt to generalize available data on clinical biochemistry of fur animals obtained in different countries, at the same times confirming the importance of international cooperation in fur animal science.

Price: DKK 250.- + postage.

For scientific libraries in the USSR and the Nordic Countries totally 500 copies are free of charge and can be obtained by payment of dispatch fee and postage DKK 50.- per copy.

The following copy of contents will show the **wide spectrum of recent knowledge** presented in the book and the list of authors the scientific authority put into the chapters.

Fur bearers production and breeding. Research papers.

PROCEEDINGS

LIII Zjad Naukowy Polskiego Towarzystwa Zootechnicznego w Olsztynie, 14- 16 IX 1988 roku.

Rocznik XXXV (1989), Zeszyt specjalny.

All reports: In POLH. Su. ENGL, RUSS. Authors' summary.

The intensity of selection for performance traits of Polar foxes in individual and family assortments.

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

The offspring of two groups of polar foxes were submitted to exterior evaluation and subsequently for all the animals an individual index was calculated, which apart from the individual assessment included three additional pieces of information about an animal, viz. the origin, litter size and the uniformity of the assessments of siblings of a given animal. The livestock was completed in group I on the basis of the calculated indices and in group II on the basis of individual assessment. The assortment of animals with regard to the way of assessment was in group I family-based. whereas in group II individual. In both groups real selection differences for the same traits were calculated as well as theoretical differences should the change of the selection be assumed. The authors were interested in how the selection differences would change having the same quota of completion, if the assortment in group I were made according to individual assessment and in group II on the basis of the index.
The results point that if the criterion of the assortment were changed, only 44.8 per cent of females in group I and 41.2 per cent in group II would be chosen regardless of the adopted criterion. The percentage of the same males chosen would be only 21.4 and 6.7 respectively. The obtained selection differences point out to the fact that both the methods of exterior evaluation of foxes being applied, and the construction of the index require some changes which would lead to stressing the most important traits for fur in selection, viz., the density and length of hair.

pp. 9-16. 3 tables, 7 references.

The results of cross-breeding of pastel and red foxes.

G. Jezewska, J. Maciejowski, A. Tarnawski.

As a result of cross-breeding of red and pastel foxes, in back-crossing, the cross-breds of red foxes with pastel ones, red pastel were obtained. Red pastels have red backs and sides, and their legs, ears and also the whole abdominal surfaces are brown. Obtaining pups of that kind proves that red and pastel colours are inherited independently from each other.

pp. 17-20. 1 table, 5 references.

Platinum pastel fox - new colour variety of fox.

J. Maciejowski, G. Jezewska, A. Tarnawski.

As a result of planned cross-breeding of pastel foxes with platinum ones a new colour variety - platinum pastel was obtained. F_1 cross-breds of the initial varieties were platinum, and did not exhibit any difference from platinum foxes coming from cross-breeding of silver foxes with platinum ones. In back-crossing of platinum cross-breds with a pastel variety, apart from platinum, silver and pastel, also platinum foxes were obtained with a characteristic platinum pattern against the brown background. Platinum pastel foxes possess in their genotype a recessive pair of genes determining the pastel colour, and they are heterozygous with regard to the gene of the platinum colour. As that gene is lethal when homozygous, platinum pastels are mated only with pastels. From such matings 50 per cent of platinum pastel and 50 per cent of pastel pups are expected. The new variety is very interesting for the industry.

pp. 21-25. 1 table; 3 references.

Genetic conditions of silver-cross colour in foxes.

G. Jezewska, J. Maciejowski.

The occurence of silver-cross foxes in the offspring of red as well as red-and-silver parents, and also the frequency of their appearance does not confirm the widely accepted assumption, put forward by Warvick and Hanson, about silver cross colour being conditioned by the double heterozygous genotype AaBb. Seven types of various matings of colour variaties in foxes were carried out and the obtained results of colour splittings in the offspring allowed the authors to verify the so far accepted hypothesis concerning the inheriting of red, black and silver-cross colour. The authors believe that two pairs of genes Aa and Bb take part in the determination of red, black and silver-cross colour and at the same time the homozygous composition aa affects epistatically the locus B which conditions the occurrence of black colour independently from the composition of the genes in locus B. The colour of silver-cross is conditioned by the heterozygous composition of the pair of genes Aa with the homozygous, recessive genotypes of the other pair bb. That claim having been made, the genotypes and phenotypes of the animals would be as follows: AABB, AABb, AAbb - red, Aabb - silver-cross; aaBB, aaBb, aabb - black(silver). The accepted model of inheritance complies with all obtained results of splittings.

pp. 26-32. 2 tables, 10 references.

Comparison of some performance traits in polar foxes from mating the Norweigen polar fox to Polish type.

S. Kubacki, H. Bernacka, B. Slubowska, J. Zawislak.

This study is a part of an investigation on the improvement in efficiency of breeding work on a polar fox farm. Studies were started in 1987 at State Fur Animal Farm Warlity and Farm Zalesie. For the studies Norwegian polar foxes mated to Polish type foxes were used. Thus, 3 groups of animals were formed. Group I of Polish type foxes (Polish females x Polish male), group II of Norwegain type (Norwegian females x Norweigen male), group III - Experimental (Polish females x Norwegian male). The results presented below refer to the pups of the first year group (F_1). The experiment was started on a total of appr. 100 mothers breeding stock from Warlity farm and 50 mothers from Zalesie farm. Comparative studies included fertility and prolificacy of mothers, body weight of kits at weaning and at slaugther and mean daily gains. Also, correlation coefficients between some traits of prolificacy of Polar vixens and body weight of kits were calculated. Based on the results obtained, it was found that the Norwegian type of Polar fox (group II) with respect to the studied traits, compared to Polish fox (group I) and cross group (group III) is inferior only regarding reproductive traits, which means that on the studied farms, it displayed a lower fertility (Warlity 69.49%, Zalesie 78.18%, respectively) and female prolificacy (Warlity 5.57 offspring, Zalisie 5.63 offspring, respectively), the differences being highly significant. Also, in the first year group a considerably delayed term of delivery was found. As concerns body weight (kg) depending on the studied farm, considerably higher indices in the offspring of

Norwegian fox or cross group (at weaning and at slaugther) were stated. The highest daily gain throughout the period of growth and maturation was found in the group of Norwegian foxes (Warlity - 36 g, Zalesie - 42 g). In second place was the cross group III, while the lowest gains were observed in group I (Polish type). In the studied animal groups no evident relationship was found between the date of whelping, number of pups born and weaned and body weight of animals after weaning and at slaughter. However, rather high correlation coefficients (r_{xy}) were recorded between body weight after weaning and final body weight of animals at slaughter (r_{xy} = 0.4-0.8).

pp. 34-44. 4 tables, 12 references.

Some qualitative indices of musk-rat coat.

R. Cholewa.

In order to develop methods of investigations on coat the author performed laboratory measurements of 68 pelts of wild musk-rats. The purpose was to find a point, one among 12 points on the pelt surface, which would best represent the mean value of the investigated feature of the whole pelt. The measurements concerned the coat colour, height of hair in both coat layers and the combined feature measured with apparatus SGM (elasticity, density and thickness) as well as pelt weight and length. It was found that for colour this point was situated in the middle of the right side, for hair it was on the front of the right side and for SGM it was on the rear of belly. The results obtained gave a possibility to characterize the coat quality in musk-rats shot in summer season.

pp. 46-53. 2 tables, 8 references.

The effect of dietary protein level on its digestibility and N-retention in pregnant farm fitch females.

B. Barabasz, S. Jarosz.

The aim of this study was to define protein digestibility and N-retention in pregnant fitch females fed diets with various levels of protein and energy. During the pregnancy period (10 April - 30 May) a feeding system was applied based on two levels of protein: 7.0 and 5.5 g digestible protein/100 kcal M.E., each group being fed diets with 4 different levels of energy: 110, 130, 145 and 170 kcal. These rations provided daily appr. 17.5-20.9 g of digestible protein per animal. Significant differences in the amount of ingested protein were found between groups I and III animals fed diets with protein level 7.0 g and groups II and IV fed diets with protein level 5.5 g. Protein digestibility in all diets was low, ranging from 70 to 75%, the lowest being found in groups III and IV, fed a high-energy ration (170 kcal). Nitrogen balance was positive in all studied groups, its peak being recorded at 24-27 days of pregnancy (1.04 -1.38 g of N-retained), with a subsequent gradual decrease, reaching a level 0.64 - 1.10 g. At 24-27 days of pregnancy N-retention in groups with higher levels of protein was 44, 42, 38 and 39%, respectively whereas in groups with lower levels the values were 39, 39, 44 and 44% respectively. Reproduction indices in females (fertility rate and mean litter size) were slightly higher in groups fed diets with a low level of protein (groups II and IV).

pp. 54-62. 4 tables, 5 references.

Analysis of feeding and production results of farm fitches on some selected farms in Poland.

B. Barabasz, Z. Klimczak, B. Gawlikowska.

This study contains a detailed analysis of annual feeding and production results obtained on two state fitch farms. One of them is situated in central Poland (Farm A) and the other in the north-eastern region (Farm B.) Indices of nutritive value of diets for farm A fitches were close to the standards recommended for mink. In the gestation and lactation diets (April-may) the protein/energy ratio was increasing up to 12.8 whereas in the kit growth period it gradually decreased, reaching in October a value of 7.4. During that time a percentage of energy from carbohydrates was found from 10 to 17.8 and that from fat from 40 to 50. In the late gestation (second half) and lactation diets of farm B female fitches the protein/energy ratio increased up to 10.5 and later was found to decrease to 7 (September - October). A participation of energy from carbohydrates was higher

than in farm A by ca. 40%, in the period June - September being 30% and in October 38%. Fertility rate in female fitches was: A - 91.6%, B-96%; prolificacy A - 7.3, B - 8.0 kits, and percentage of weaned kits: A - 84, B - 97.7 (being higher in Farm B); mean litter size: A - 9.5, B - 8.5 (being higher in Farm A). As concerns skin grading better results were obtained in Farm b where more skins of animals were estimated as perfect or very good (A - 82.6%, B - 95.7%) and fewer skins were removed (A - 17.1, B - 3.6). Particularly large differences in favor of Farm B were observed in animal size. Indices of nutritive value of diets applied in Farm B were closer to food requirements of the fitches. The results obtained indicate that feeding female fitches can be based on low-protein diets (5-6 g digestible protein/100 kcal M.E.) Energy value of diets should be calculated to ensure at "ad libitum" feeding a daily intake of ca. 18-20 g of digestible protein and 230-250 kcal which is enough to meet feed requirements of the animals and of the developing embryos.

pp. 63-72. 4 tables, 10 references.

The activity of proteolytic enzymes in farm fitches during the growth period.

B. Gawlikowska, B. Barabasz.

In the experiments on the physiological aspects of feeding farm fitches it was decided to study the relationship between the activity of pancreas and stomach proteolytic enzymes and the level of protein utilization by the system (digestibility, N-balance). Check slaughterings of young fitches, fed diets with various levels of protein and energy, were made at 25, 35, 90, 150 and 210 days of life. The pancreas and stomach mucosa samples were taken for determination by a modified Anson's method. The activity of proteolytic enzymes in the pancreatic juice in kits directly after weaning (age: 25 days) was low, being estimated at 4.4 - 5.8 μmol/min/g of protein. During the growth of animals it was found to increase gradually, reaching its peak at 150 days of animal life (21.3 - 23.2 μmol/min/g of protein. In extreme cases it was a 4-5 fold increase. The activity of proteolytic enzymes of the stomach mucosa reached its peak at 150 days of animal life, however, larger differences were orserved between animals fed diets higher in protein and those low levels of protein. The activity was considerably higher in groups fed diets low in protein. Coefficients of protein digestibility and N-balance were not indicative of the existing differences between groups. In case of their statistical confirmation this method could be accepted for determination of the protein conversion level.

pp. 73-79. 4 tables, 6 references.

The morphological and biochemical blood picture and indices of acid-base balance in polar foxes fed additionally preserved blood.

H. Bieguszewski, O. M. Lorek, B. Glowinska.

Physiological and biochemical blood tests were carried out on a total of 120 maturing polar foxes fed diets supplemented with various amounts of after-slaughter blood, preserved with sodium benzoate and sulfuric acid. In experimental group I - 20%, in group II - 40% and in group III - 60% of meat feeds were substituted by preserved feeds. A supplement of various amounts of preserved blood to fox had no effect on most studied morphological and biochemical blood indices. The resuls obtained for parameters of the acid-base balance in foxes indicate an incidence of a mild tempory acidosis in foxes in the initial period of being given feed supplemented with chemical preservatives.

pp. 80-87. 4 tables, 15 references.

Nutrients digestibility in polar foxes fed diets supplemented with preserved blood.

B. Glowinska, H. Bieguszewski, O. Lorek.

Studies were conducted on nutrients digestibility in diets for polar foxes fed additionally various levels of blood preserved by sodium benzoate and sulfuric acid. The control group was fed a standard diet. In group I animals 20%, in group II 40% and in group III 60% of the meat feed was substituted by preserved blood. In experimental foxes N-retention was also studied. A supplement of various amounts of preserved blood to feed for foxes had no significant effect on digestibility of dietary blood nutrients. A statistically significant

decrease in N-retention was found in the organism of foxes fed a diet in which 60% of the meat feed was substituted by preserved blood.

pp. 89-96. 4 tables, 10 references.

The effect of livex on some haematological and performance indices in fitches.

O. Lorek, H. Bieguszewski, B. Glowinska, R. Szymeczko.

One of the factors influencing an improvement in fitch (*Mustela putorius*) breeding is feeding. The need for introducing new feed components has stimulated trials aimed at elaboration of new technologies for their application. Livex is one of the latest feed components used in feeding carnivorous fur animals. As a product made of offal it constitutes a valuable supplement to high-protein feeds of animal origin. As a result of the studies the effect of livex was established on the selected haematological and performance traits in maturing fitches from weaning to slaughter. Animals were fed rations supplemented with livex accounting for 25% of the diet. In the studied haematological indices statistically significant differences were found in the count of erythrocytes in favour of the control group. As concerns performance indices, significant differences were found in weight gains, conformation estimates and pelt quality in favour of control group. Based on the results obtained it was found imperative to modify technology of utilizing livex in feeding fitches.

pp. 97-104. 6 tables, 5 references.

An estimate of indices of acid-base balance in fitches fed diets supplemented with livex, preserved meat-fish offal and oil waste.

R. Szymeczko, H. Bieguszewski, B. Glowinska, O. Lorek, J. Bodenszat.

The basic aim of this study was to estimate the indices of acid-base balance in a total of 40 fitches of either sex, after reaching somatic maturity. A feeding system based on a diet supplemented with 25% of slaughterhouse offal, preserved in formic acid and sodium benzoate (I experimental group), did not result in significant changes in the indices of acid-base balance compared to the control. In fitches fed a diet enriched with 25% livex (II experimental group) a highly significant increase in pCO_2 and HCO_3 was found. However, a 4% supplement of oil waste to the diet of III experimental group fitches caused a highly significant decrease in the blood pH and in pCO_2 compared to the control.

pp. 105-112. 4 tables, 20 references.

An attempt at determing the consumption of ration during nutria rearing.

R. Cholewa.

In the Institute of Small Animals Breeding in Celle (German Federal Republic) in the program out of Alexander von Humbolt-Stiftung grant the investigations were carried out in order to determine the influence of different protein contents (12 and 17%) in rations without animal protein on growth rate during nutria rearing. For this purpose 79 Grenland nutria of both sexes were fed "ad libitum" with the tested mixtures in pellets and meal forms given in separate feeders. The experiment started when the weaned nutria were 42 days old. The animals were marked individually at birth. They were reared in separate pens for males and females. Each animal was weighed at 4-week intervals and the amounts of feed used in both forms were calculated. The results obtained fully proved the utility of the diet given to nutria. The live weights of the periodically weighed experimental animals were not lower than those of the animals given traditional feed. The consumption of pellets was twice as great as that of meal. The general use of feed was non significantly higher in group II (17% protein) than in group I (12% protein). The growth rate in group II was slightly higher.

pp. 113-118. 3 tables, 6 references.

The effect of the term of weaning nutria offspring on their growth and slaughter value.

J. Kuzniewicz.

The aim of this work was to evaluate the influence of early weaning of coypus offspring from the

mother on their later growth; shortly after the separation of 4-week-old coypus offspring from their mothers a decrease in body weight was observed. Presumably, it was due to the stress connected with weaning; carcass examination has shown high slaughter value (52-54%). The time of offspring weaning has no influence on slaughter value if offspring were giver high-energy food.

pp. 119-125. 4 tables, 8 references.

Influence of body weight of new-born Grenland nutria on growth rate and exterior evaluation.

R. Cholewa.

The investigations were carried out on an experimental farm of the Institute of Small Animals Breeding in Celle (German Federal Republic) in the program of Alexander von Humboldt-Stiftung grant. The animal experimental material included 87 Grenland nutria (47 males and 40 females) marked and weighed on the day of birth. The animals were weighed at the ages of 6 and 8 weeks and later on at 4-week intervals up to 30 weeks when their exterior was also evaluated. The animals of different sexes were considered separately and qualified into 3 groups depending on their live weight at birth. The statistical calculations were carried out to determine the arithmetic mean, variation coefficients and correlations. The results obtained showed an increase in live weight with time in all groups of both sexes. In the groups of animals of lowest live weight at birth there was no significant difference between males and females. In the remaining groups from 20 weeks of age the females were lighter than males. There was significant differentiation among 3 groups of males in live weight during growth up to the age of 8 weeks, while in the later period it was found only between groups 1 and 3. It was also true for the exterior evaluation. The correlation coefficients between live weight of newborn nutria and their live weights in the individual periods up to 7 months were higher in males than in females and there was a high correlation of these traits.

pp. 126-134. 3 tables, 8 references.

The analysis of prenatal and neonatal growth in nutria.

J. Buleca.

The paper deals with the study of the growth of nutria in prenatal and neonatal periods. The average weights of the embryos recorded on the 30th, 60th, 90th, 120th and 125-135th days were as follows: 0.2, 6.8, 73.9, 216.1 and 218.6 g. The highest intensity of growth was reported between the 60th and 90th days of pregnancy. Later, the potential fertility, prenatal mortality and growth characteristics were investigated on the 10th, 20th and 30th days after birth.

pp. 135-138. 1 table, 5 references.

Preliminary observations on reproduction and growth of muskrats when kept in cages.

R. Cholewa.

Starting from the spring of 1987, specialists from the Department of Fur Animal Breeding at the Academy of Agriculture in Poznan have been carrying out research on the adaptation of muskrats to bathless maintenance in cages. The studies have initially been planned to last for a few years. They are to prove the ability of muskrats to propagate under farm conditions, to show the growth ability of the young muskrats as well as to determine quality of their pelts. The animals have usually been kept in cages in couples or there were three females kept with one male. Preliminary observations showed that only half of the females used for reproduction gave birth. However, the question of efficacy of muskrat harem maintanance is still inconclusive at this stage of investigations. The body weight of males was higher than that of females. The changes in this feature following aging proceeded in a different way depending on sex. Organoleptic evaluation of raw pelts of farm-reared muskrats proved their quality to be similar to those of wild animals.

pp. 139-143. 2 tables, 5 references.

The effect of the number and activity of teats in polar vixens on performance of pups.

M. Bednarz, A. Frindt, M. Brzozowski, T. Kaleta.

The aim of this study was to define a relationship between the total number of teats as well as that of the active and inactive ones in 1 year- and 2 year-old blue and white polar vixens and performance of pups up to weaning. In addition, a topography of teats was studied. In the 2 year-old vixens fewer inactive teats and also fewer dead pups were found than in the group of 1 year-old females. The significant correlation coefficients obtained, however low, indicate a correlation between the number of active teats in polar vixens and the number of weaned pups.

pp. 144-150. 2 tables, 7 references.

Comparative studies on various methods of collecting semen from common foxes.

M. Brzozowski, A. Frindt, M. Bednarz.

Three methods of collecting semen from silver foxes: masturbation of domesticated males, masturbation of non-domesticated males and masturbation preceeded by stimulation using an electroejaculator, were used. The best results were obtained in group 1: 66% of good quality ejaculates fit for insemination with only 5% negative trials. A set of parameters defining the semen quality used in this study can be considered reliable for estimating the characteristics of ejaculates in general. The results of the studies indicate that the value of a male as a semen donor can be estimated after 3-4 replications of semen sampling.

pp. 151-156. 5 tables, 7 references.

Hormonal stimulation of estrus in nutria.

O. Szeleszczuk, I. Jakubicka, M. Barta.

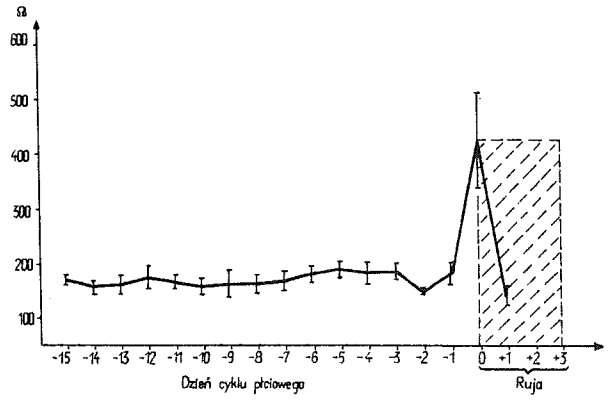
An experiment was carried out on a total of 25 1 year-old standard female nutria, housed in cages in sheds. Females were randomly divided into 5 groups of five each. Experimental females were given 200 i.u. of PMSG in three different ways. After 56 hours HCG was administered i.m. (80 i.u. per female). At 24 h after injection all experimental females were sacrificed. Throughout the experiment from all females vaginal smears were taken and measurements of electric resistance of vaginal mucus were made.
The levels of estradiol and LH were determined in blood serum by RAI methods. In the ovaries, the stages of oogenesis were defined histologically.
The results obtained indicate that the gonadotropic hormones used did not induce estrus and ovulation.

pp. 157-163. 4 tables, 5 references.

Studies on optimal time for mating female nutria.

O. Szeleszczuk, S. Jarosz, I. Jasionowska, B. Gawlikowska, M. Sucheta.

Experiments were carried out on a total of 32 2 year-old female nutria: 16 of Standard and 16 of Grenland varieties, under two systems of management: a) in cages with no access to bathing water, b) outdoor pens with bathing possibilities. In the period from August to December every 2-7 days (depending on the stage of sexual cycle) the measurements of vaginal mucus resistance were made in all females. At the same time intervals vaginal smears were collected. The length of estrus phase in Standard females was ave. 3.95 $\pm$ 2.59 days, and in Grenland females 4.02 $\pm$ 2.6 days. The length of sexual cycle was ave. 24.9 and 31.9 days, respectively. Both between varieties and management systems no statistical differences in the lengths of sexual cycle and estrus phase were found. Electric resistance of vaginal mucus in diestrus period was 176 $\pm$ 26| Ω while in estrus phase it increased gradually up to 360 $\pm$ 78| Ω.
In diestrus the cytogram of vaginal epithelium displayed the streaks of leucocytes and scarce cell elements which number was found to increase during proestrus. The estrus phase was characterized by an occurrence of a number of horny acidophilic cells from the superficial layers of epithelium, occurring in clusters, and by the lack of leucocytes.



Rys. 1. Elektryczna oporność śluzu pochwowego

pp. 164-169. 1 fig., 2 tables, 7 references.

Studies on the levels of triiodothyronine, thyroxine and insulin in foxes and raccoon dogs.

R. Rajs, H. Bieguszewski, J. Ornowski.

The levels of blood triiodothyronine (T_3), thyroxine (T_4) and insulin were determined in polar foxes and raccoon dogs during one year, considering the periods of copulation, pregnancy, lactation and dry period. Hormones were determined by radioimmunoessay. Significant changes in hormone concentrations were found in foxes and raccoon dogs within one year. During the pregnancy period a decrease in T_3 and T_4 levels was found whereas during the lactation period an increase in the levels of all hormones was found. During the process of fur-coat growing and in winter time the concentration of thyroid hormones in foxes and raccoon dogs was higher.

pp. 170-178. 4 tables, 18 references.

The composition of fatty acids in the subcutaneous fat in foxes.

J. Batura, I. Kosko, U. Bajarska.

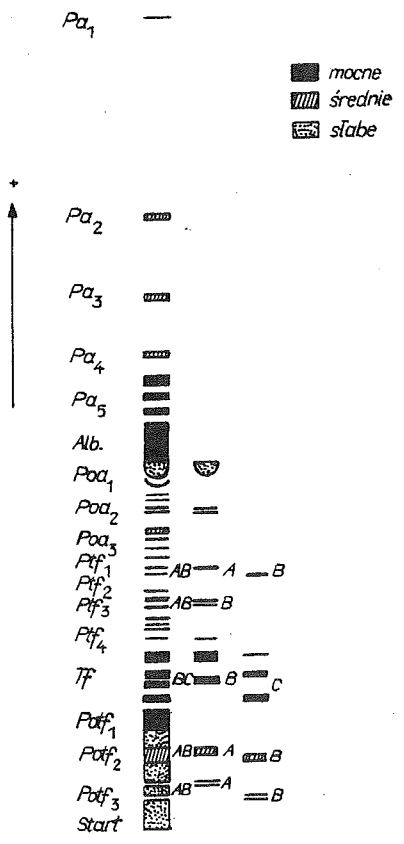
Gas chromatography was used to determine the composition of fatty acids in the fox subcutaneous fat collected in the period of mass slaughter of foxes for skins in the years 1982-1987. Ranges of occurrence were defined for individual fatty acids in the fat obtained as a domestic product.

pp. 178-183. 1 fig., 1 table, 15 references.

The variance of blood serum protein in blue foxes.

A. Brodacki, K. Kostro.

Serum proteins from 4 male foxes, 6 vixens and 33 offspring were separated using horizontal electrophoresis on polyacrylamide gel at pH 8.6 tris boratic buffer. The proteins were divided into 30 to 35 bands, classified in the following regions and sub-regions: prealbumins Pa_1, Pa_2, Pa_3, Pa_4, Pa_5, albumins, postalbumins Poa_1, Poa_2, Poa_3, pretransferrins ptf_1, Prf_2, Ptf_3, Ptf_4, transferrings Tf and posttransferrings $Potf_1$, $Potf_2$, $Potf_3$. The Poa_1, Poa_2, Ptf_2, Ptf_3, Tf, $Potf_2$ and $Potf_3$ regions differed with regard to number of band and rate of migration. The comparison of parents and offspring protein types shows that variation in transferrin and Ptf_2 region was genetically determined while that of Poa1 and Poa_2 region was under environmental influence. The other regions' variation can be affected by genetic background but that should be solved by further examination.



Rys. 1. Schematyczny rysunek białek surowicy krwi lisów niebieskich

pp. 184-189. 1 fig., 2 tables, 5 references.

The occurrence of dietary microflora in the organs and digestive tract in mink.

J. Zwierzchowski, B. Wojciechowska.

A daily introduction of large amounts of bacteria with feed into the digestive tract is not indifferent for the system, even if they are not strictly pathogenic. The aim of this study was to investigate the occurrence of microflora in the digestive tract and organs. The studies concerned an aerobic microflora. A total of 241 mink were studied in 2 groups, including 78 sick or dead animals and 163 seemingly healthy ones. In the internal organs the presence of bacteria was found in 50.0% and 70.0% of the sick mink, and in 41.0% and 55.2% of the healthy ones. In 5 consecutive sections of intestines of the sick mink, bacteria were found in 86.2% and 93.1% while in the healthy ones in 47.2% and 57.6%. In 18 mink no bacteria were found in the intestines, in 36 animals only in 1 section and in 19 in 2 sections. Intensity of occurrence of aerobic microflora (mass emergence) both in the cultures from the organs and intestines was many times higher in the sick mink. The isolated bacteria belonged to 8 genera.

pp. 190-196. 4 tables, 6 references.

Frequency of bacterial infections from the digestive tract in foxes and mink.

J. Zwierzchowski, L. Jablonski.

Based on cusaistic material from the Clinic of Infections Diseases Agricultural University in Wroclaw, coming from the western regions of Poland, analytical studies were conducted on a total of 1524 cases of diseased foxes and mink which died in the years 1981-1986. The diagnosis revealed 57.08% cases with infections from the digestive tract, 7.54% other infectious diseases, 33.18% affections of various internal organs and 2.2% dermatoses.
Among the isolated microorganisms the digestive tract infections salmonellae accounted for 57.08%, Escherichia coli 47.61%, staphylococci 10.41%. Bacillus proteus 18.42%, streptococci 7.42%, blue-pus b. 2.63% and others 3.23%.
A performed antibiogram for the above microorganisms indicated a high efficiency of chloramphenicol and neomycin. Our findings indicate a significant problem in the pathology of fur animals concerning infections from the digestive tract as a result of feed at an unsatisfactory sanitary level.

pp. 197-202. 3 tables, 6 references.

The presence of bacteria in feed for carnivorous fur animals.

J. Zwierzchowski.

Bacterial infections of the digestive tract, due to the presence of dietary microflora, constitute the most important problem of health in carni-vours fur bearers and affect productivity of farms. It is expressed not only by morbidity and mortality rate of animals but also by a reduced number of weaned kits due to infections, embryo mortality, fetus mortality, abortions, mortality of sucklings and lesions of internal organs.
A total of 54 series of peformed bacteriological studies have shown the presence of bacteria in 1 g of diet for mink in the range from 9.3×10^7 to 9.3×10^8 and for foxes from 4.3×10^7 to 2.4×10^9. The presence of bacteria in individual components of diet was as follows: raw meat 1.5×10^4 - 9.3×10^9, frozen meat 1.6×10^6 - 9.3×10^7, cooked meat 7.3×10^3 - 4.3×10^6, frozen fish 9.3×10^4 - 4.3×10^5, raw giblets 4.3×10^7, cooked giblets 1.5×10^4 - 9.3×10^8, liver 2.4×10^6, gelatinized blood (livex) 2.4×10^4 - 2.4×10^9, cooked meal 2.4×10^5 - 2.1×10^8, dry yeasts $4.3\text{-}9.3 \times 10^3$. A total of 29 species of bacteria were isolated, including 30% salmonella.

pp. 203-210. 3 tables, 16 references.

Results of bacteriological studies of smears from the vagina and preputal sac in polar foxes in 1985-1987.

A. Kopczewski, T. Zdunkiewicx, M. Wroblewska.

Studies were conducted on farm polar foxes in the years 1985-1987. Material for the studies consisted of vaginal smears collected from females in March, September and October as well as smears from the preputal sacs of males, collected at monthly intervals from March to October. A total

of 2,544 tests were performed in males and 1705 in females. The following microorganisms were isolated: blue pus bacteria, staphylococci M(+) and M(-), streptococci (beta-hemolytic and anhemolytic), cocci and diplococci.

pp. 211-217. 5 figs., 2 tables.

Determination of the contents of polychloric pesticides, polychlorinated diphenyls and the metals lead, cadmium, copper and zink in the tissues of mink, foxes and fitches.

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

Studies were conducted on the presence and levels of polychloric and polychlorinated diphenyls and the metals lead, cadmium, copper and zink in the tissues of mink, fitches and polar foxes. In the animals coming from polluted farmes, health and reproduction processes were found impaired. The presence of the abovementioned compounds and metals was confirmed in the tissues of the studied animals. This might be responsible for the disturbances, particularly as this was supported by the negative results of microbiological studies and of iodine test (mink).

pp. 218-223. 1 table, 7 references.

Studies on the behaviour of nutria.

T. Kaleta.

This is an attempt to establish an ethogram of nutria and to define a relationship between their behaviour and animal density in cages. Studies were conducted in the years 1985-1987, in the spring period, on two private farms. Observations were performed in two stages: 1) observations of behaviour of growing nutria maintained in cages in groups; 2) observations of behaviour of mature specimens kept in harem groups.
A total of ca. 130 animals were under observation. Following types of behaviour were most frequently recorded: exploration, comfort behaviour and various forms of agonistic behaviour with vocalization. In cages with young stock the effect of density of animals on their agonistic behaviour is to be viewed upon in various aspects and should be estimated according to fights occurring at feeding time and outside feeding time. Both in growing and mature animals a border density outside which the number of fights between nutria has increased significantly, can be estimated at appr. 0,2 m^2 per animal.

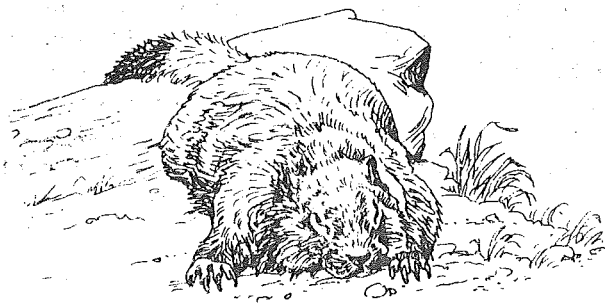
pp. 224-230. 4 tables, 7 references.

The effect of electroacupuncture on the changes in the blood leucocyte picture in polar foxes.

K. Sciesinski, A. Frindt.

The aim of this study was to attempt to define possibilities of increasing cell immunity in weaned polar foxes.
The experimental material comprised a total of 24 polar fox pups aged 7 weeks, from three litters.
In the studied groups electroacupuncture was applied in a specific point QUCHI (LI-11). The immunity point was located by means of a device ACUPUNKTUR Expert System, produced by SOFT Electronic, Szczecin.
A stimulation time for point QUCHI was 10 minutes. A white cells count was made and their qualitative picture was estimated (after Arnett Schilling), at 56 days after treatment.
A significant increase in leucocyte level was found in maturing polar foxes after applying electroacupuncture in the point QUCHI, which was maintained up to 42 days after treatment.
An application of electroacupuncture resulted in the changes in leucocyte composition in fox pups. At first an increase in the number of neutrophils and a decrease in that of lymphocytes was found. However, after 6 days following the treatment, a slow decrease in the number of neutrophils and an increase in that of lymphocytes was found.

pp. 238-246. 5 figs., 2 tables, 15 references.



New Books

MAMMALS AS PESTS

EDITED BY

R. J. Putman

A pest may be defined simply as something that is noxious, destructive or troublesome but most biological definitions include some consideration of the economic significance of the damage caused. A number of mammals are in this sense significant agricultural pests, while others might be health hazards or a hazard to conservation and the environment.

The book is an edited and revised selection of papers presented at a symposium organized by the Mammal Society in London in November 1987. In its coverage, it offers consideration to most of the British and European mammal species widely considered as pests, including, amongst others, deer, foxes and various rodents. Judgement of any animal as a pest, however, is often somewhat subjective; for each species treated, a more objective evaluation is thus offered of its pest status in economic terms. The actual biology of the animal – and in particular of those relationships which bring it into conflict with man – is also considered in detail. Recent advances in our knowledge of the biology of these various species are reviewed and their implications for strategies of management of the pest problem are explored. The book should therefore attract a wide audience in mammalogy, applied ecology and pest control.

Rory Putman is a lecturer in biology at the Department of Biology, Southampton University.

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1989 Vitamin E Abstracts

Abstracts prepared by: Max K. Horwitt, Ph.D.
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Division of Geriatric Medicine
Department of Internal Medicine
St. Louis University School of Medicine

VERIS, the Vitamin E Research & Information Service
LaGrange, Illinois

Preface

This issue of Vitamin E Abstracts is a compilation of significant vitamin E research articles published throughout the world in 1989. The abstracts are grouped into these classifications:

- Occurrence & distribution
- Chemistry & assay
- Physiology & pathology
- Pharmacology
- Nutrition & metabolism
- Medical & therapeutic use

Numbering is serial in each section and continues from the previous year. Thus, beginning numbers under each heading in this volume indicate the number of abstracts that appeared between 1980 and 1988.

Articles for inclusion in the 1989 Vitamin E Abstracts were reviewed and selected by Max K. Horwitt, Ph.D., Professor Emeritus of Biochemistry, Division of Geriatric Medicine/Department of Internal Medicine, St. Louis University School of Medicine. Dr. Horwitt has been working with vitamin E since the first study sponsored by the National Research Council—a study that focused on whether or not man needs vitamin E. Dr. Horwitt's interest and involvement with vitamin E has continued since that time, a period of more than 30 years.

We at VERIS are grateful to Dr. Horwitt for his contribution to the endeavor.

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Biotechnology and Veterinary Science
OIE Scientific and Technical Review,
Vol. 9 (3), September 1990

In the introduction of the present issue of Scientific and Technical Review is given a definition of biotechnological procedures as applied to veterinary science. In the paper the term covers all procedures which result in "the practical application of our knowledge of biology, microbiology, and molecular biology to enhancing the potential of animals or strengthening their resistance to adverse factors in their environment".

The biotechnological procedures currently employed in veterinary science can be classified into three major groups:

Group 1: Procedures which make use of existing genotypes.

Group 2: Procedures which modify existing genotypes or which create new combinations of genes.

Group 3: Procedures which create new genotypes by DNA manipulation (genetic engineering).

In veterinary science, biotechnology is utilized in four major fields: health, genetics, reproduction, and animal nutrition.

The issue contains 12 articles written by leading world specialists in the field of biotechnology. All articles are written in English with summaries in French and Spanish. Some articles are written in the three languages mentioned in their full length.

The first four articles cover the utilization and control of biotechnological procedures in veterinary practice and national and international regulatory aspects of biotechnological procedures throughout the world.

The other articles cover the following areas in particular:

- diagnosis of viral, bacterial, and parasitic diseases and nutritional disorders by means of molecular biology,
- prevention and treatment of these diseases using, in particular, products of genetic engineering,
- genetic improvement of animal populations, most often by artificial insemination or embryo transfer,
- animal nutrition through enhanced plant growth and the metabolism of nutrients.

Each article deals with a limited area and contains a survey of the methods used within the area in question. Furthermore, examples are given of areas where biotechnological procedures have been profitable to veterinary science.

The issue gives a good survey of the extent of biotechnological procedures in veterinary science. Furthermore, it gives a good impression of the areas in which biotechnology is used today as well as examples of possible application of the new technologies.

Each article is built up as a review and contains a comprehensive list of references. Actual method descriptions are not included, however.

Reviewed by Birthe M. Damgaard, DVM, Natl. Inst. of Animal Science, Denmark.

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REVIEW

Biotechnologie et science vétérinaire
Biotechnology and veterinary science
Biotecnología y ciencia veterinaria

Coordinated by:
Coordonné par: J. Blancou
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