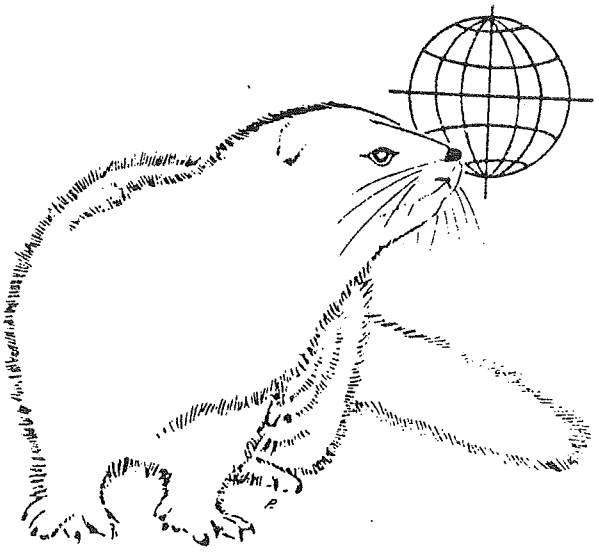


Published by **IFASA**

INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

SCIENTIFUR
ISSN 0105-2403
Vol. 16, No. 1
February 1992

Titles of other puplications - not abstracted

The roots of the splanchnic nerves of the coypu. *Marian Langenfeld. Polskie Archiwum Weterynaryjne 30; 1-2, 1990. In ENGL, Su. POLH, RUSS. Code 2-O.*

Autoradiography localisation of melatonin receptors in mink pars tuberalis. *L. Agasse Boissin, C. Barberis, G. Roch, J. Boissin. Anales d'Endocrinologie, Vol. 52 (2), p. 21, 1991. In FREN. Code 2-3-M.*

Blood collection from the transverse sinus in the chinchilla. *Flint A. Boettcher, Brian R. Bancroft, Richard J. Salvi. Laboratory Animal Science, Vol. 40, No. 2, 223-224, 1990. Code 3-14-9-O.*

Improvement of the course of operations and open-air enclosure systems in fox breeding. *L.L. Jeppesen, V. Pedersen. Deutsche Pelztierzuechter, Vol. 64 (5), p. 84-88, 1990. 2 figs., 4 tables, 4 refs. In GERM. Code 10-11-12-F.*

Rearing of raccoons in big boxes. *H. Korhonen, J. Mononen, M. Harri, A. Maekinen, S. Alasuutari. Finsk Pälstidskrift, Vol. 24 (12), p. 271-274, 1990. 3 tables, 3 figs., 2 refs. Code 10-11-12-O.*

Balls and bite cups can reduce skin biting. *Michael Sønderup. Dansk Pelsdyravl, Vol. 53 (9), p. 396-398, 1990. 6 tables. In DANH. Code 2-10-11-12-M.*

USU Researchers help mink producers. *J. Carpenter. Utah Science - Utah Agricultural Experiment Station, Vol. 51 (4), p 130-132, 1990. Code 14-M.*

Mortality in Danish mink farms - causes and relationship to animal welfare. *P. Henriksen, H.H. Dietz. 7 Arbeitstagung über Haltung und Krankheiten der Kaninchen, Pelztiere und Heimtiere, 31 May bis 1 Juni 1990 in Celle, 222-229. In ENGL. Code 9-14-M-F-O.*

Danish mink statistics and development. *J. Groot. Dansk Pelsdyravl, Vol. 53 (6), 274-277, 1990. 11 tables. In Danh. Code 13-M-F-O.*

Furs produced in Finland compared with international furs production. *Finsk Pälstidskrift, Vol. 24 (12), p. 263-265, 1990. 1 table, 9 figs. In SWED. Code 13-2-M-F-O.*

Anaesthesia and sedation of ferrets. *E. Engh, A. Smith. Norsk Veterinaertidsskrift, 101; 8-9; 693-694, 1989. In NORG. Code 14-O.*

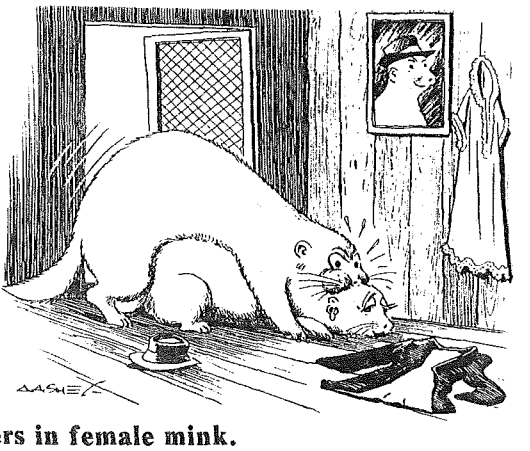
GENETICS

4. Genetics

Titles of other publications - not abstracted

Structure of cDNA and chromosomal localization of gene of immunoglobulin lambda light chains in the mink. *T.M. Khlebodarova, G.I. Karasik, N.M. Matveeva, S.E. Lapteva, O.L. Serov. Doklady: biological sciences - Akademiia nauk SSSR (USA), vol. 311 (1/6), p. 200-204. Translated from: Doklady Akademii Nauk SSSR, Vol. 311 (2), p. 487-491, 1990. (511 P444A). Available at: US (DNAL 511 P444AEB). In ENGL. Code 4-3-M.*

Genetic inheritance of colour and quality in silver fox. *H. Kenttaemies. Finsk Pälstidskrift, vol. 24 (12), p. 268-270, 1990. 4 tables, 2 figs., 8 refs. In SWED. Code 4-F.*



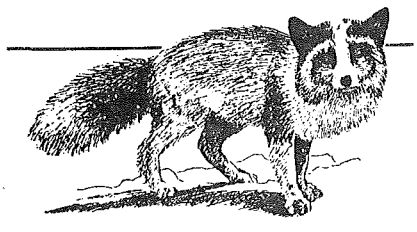
5. Reproduction

Titles of other puplications - not abstracted

Potential and actual female fox fertility (fertility as affected by fox fattiness on the farm "Vyatka" of the Kirov region). *I.P. Petrova, R.D. Mamaeva, L.A. Skobelkina. Krolikovodstvo i zverovodstvo, No. 6, p. 10, 1990. In RUSS. Code 6-5-F.*

Crezacyn effect on silver fox reproductive ability. *L.A. Burdel, P.P. Orlov. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p 103-107, 1989. In RUSS. Code 6-5-F.*

Crezacyn biostimulator and reproductive ability of minks. *P.P. Orlov, M.G. voronkov, V.M. D'yakov. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p. 48-52, 1989. In RUSS. Code 6-5-M.*



Effect of chorionic gonadotropin on reproductive functions of American mink. *R.T. Shajkhov. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p 62-66, 1989. In RUSS. Code 3-5-M.*

Effect of chorionic gonadotropine on the pituitary-ovary system and reproduction of nutria in the fall. *R.T. Shajkhov. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, vol. 36, p. 66-71, 1989. In RUSS. Code 3-5-O.*

The effect of insemination terms on reproductive ability of Arctic foxes. *V.B. Fokin, V.A. Tsvetkov. Joshkar-Ola (USSR), p. 72-77, 1988. In RUSS. Code 5-F.*

Breeding results 1985-1990. *Dansk Pelsdyravl, Vol. 53 (10), p. 484-485, 1990. In DANH. Code 5-13-M-F-O.*

6. Nutrition

Titles of other publications - not abstracted

Results of commercial trials of los and norizin preparations (biologically active substances) in fox breeding. *V.S. Snytko, O.L. Rapoport, A.N. Dobrynin, T.A. Putrushina. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p. 29-31, 1989. In RUSS. Code 3-F.*

Weight changes and feed utilization in silver fox pups and blue fox pups. *Bente Lyngs. Dansk Pelsdyravl, Vol. 53 (8), p. 296-298, 1990. 5 ill., 3 tables. In DANH. Code 2-6-F.*

Protein-vitamin preparation of micromicets, Fusamin used in mink rations. *I.V. Vyazovkina, L.A. Zakordonets. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodsta imeni Afanas'eva, Vol. 36, p. 108-115, 1989. In RUSS. Code 6-M.*

Physiologically justified use of biostimulators promoting mink productivity (Sodium copperfluorphilin). *A.V. Rubis, V.S. Kostina, T.I. Kazakova, M.P. Sheptalova, A.S. Fedotova. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p. 41-47, 1989. In RUSS. Code 3-6-M.*

Effect of crezacyn biostimulator on young, mink growth and pelt quality. *P.P. Orlov, L.A. Burdel, B.F. Duzhko, M.G Voronkov, V.M. D'yakov. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanas'eva, Vol. 36, p. 52-61, 1989. In RUSS. Code 6-2-M.*

Use of Panax ginseng "sludge" in mink rations. *B.A. Isupov, E.V. Vershinina, Yu. A. Vasenin. Sbornik nauchnykh trudov - NII pushnogo zverovodstva i krolikovodstva imeni Afanaseva, vol. 36, p. 95-99, 1989. In RUSS. Code 6-7-M.*

Effect of paraaminobenzoic acid on polar fox kits showing growth retardation (effect on growth and development). *Yu. K. Svechin, A.G. Egorova. Doklady VASKhNIL, No. 12, p. 32-34, 1989. In RUSS. Code 7-8-6-F.*

Chinchilla feedstuff control in Denmark. *Jørgen Nordholm. Deutsche Pelztierzüchter, Vol. 64 (5), p. 88-89, 1990. 1 table. In GERM. Code 6-O.*

The nutrition of the mink. *M.G. Stuart Jones. Journal of the science of food and agriculture, Vol 53 (1), p. 130-131, 1990. Code 6-M.*

7. Veterinary

Titles of other publications - not abstracted

Molecular pathobiology, 3: Further gene technological research of Aleutian mink disease parvovirus infection (review). *S. Alexandersen, T. Storgaard, E. Gottschalck, B. Aasted, A. Cohn, M.E. Bloom. Dansk Veterinærtidskrift, Vol. 73 (22), p. 1194-1200. In DANH. Code 9-M.*

Infectious mink encephalopathy. *G. Albert, U.D. Wenzel. Deutsche Pelztierzüchter, 65 (1), p. 4-5, 1991. In GERM. Code 9-M.*

Distribution, aetiology and control of ascending infections of the urinary tract of farmed mink. *G. Luhrs, H.C. Löliger. 7 Arbeitstagung über Haltung und Krankheiten der Kaninchen, Pelztiere und Heimtiere, 31 Mai bis 1 Juni 1990 in Celle, p. 230-240. In GERM. Code 9-M.*

Aujeszky's disease and offal from slaughter pigs fed to mink. *T. Mejerland. Vara Pälsdjur; 61 (6), 168, 1990. 4 refs. In SWED. Code 9-7-M.*

Splenic lymphosarcoma in a ferret. *David L. Hammond. Journal of the American Animal Hospital Association, 26 (1), 101-103, 1990. 10 refs. Code 9-O.*

Leiomyosarcoma in a domestic ferret: Morphologic and immunocytochemical diagnosis. *Steven R. Brunners, Alan J. Herron, Norman H. Altman. Laboratory Animal Science, 40 (2), 208-210, 1990. Code 9-2-3-O.*

A retrospective study of periparturient diseases in the ferret: pregnancy toximia, mastitis, and agalactia. *S.E. Erdman, J.G. Fox, R. Rose. Laboratory Animal Science, 40 (5), 564-565, 1990. Code 9-5-O.*

Transitional cell carcinoma of the renal pelvis in a ferret. *Ronald C. Bell, Robert B. Møller. Laboratory Animal Science, 40 (5), 537-538, 1990. Code 9-O.*

The health status of Norwegian fur bearing animals in 1989. *G. Loftsgaard. Norsk Veterinärtidsskrift, 102 (2), 117-118, 1990. In NORG. Code 9-13-M-F-O.*

8. New books

Notes

SCIENTIFUR

Vol. 16, No. 1

February 1992

After a very green winter, the main world population of mink is going to be in a springtime mood. It had been the hope of everybody involved in the fur industry that the springtime for the skin market had been much more pronounced than we can see today. After the international fur auctions held until now in the 1991/92 season it must be realised that the long economic winter will last even longer. Even though many have had to go out of business, everybody still believes in the future of fur animal production.

Looking at the problems from the sideline, your editor feels very sorry for the people who have to base their living on fur production, but at the same time we feel glad because of the readiness of the Fur Breeders Associations to go on supporting the scientific side of the production. This clearly tells us that their confidence in the future is very strong. Without this understanding SCIENTIFUR would have been history today.

This is not the case, however, and as regards contributions in the form of original reports and abstracts there is still a lot of pressure on the space we have available to publish the material. We have already received more than 50% of the material we are able to bring in the next issue of SCIENTIFUR, so nobody needs to worry about the flow of scientific information regarding fur animal production in the nearest future.

SCIENTIFUR INDEX. All our spare time is used for preparation of SCIENTIFUR INDEX II, covering Vol. 11-15 as mentioned in No. 4, 1991. We can inform you that besides the printed version there will also be an electronic version of the SCIENTIFUR INDEX covering all volumes (1-15).

It is our hope that both versions will be ready for distribution in April/May 1992. The intention is to distribute the printed version free of charge to those of our subscribers who want to receive it.

But due to the costs of printing and postage the SCIENTIFUR INDEX II will only be sent according to order from the individual subscriber.

In this issue of SCIENTIFUR you will therefore find a reply card where you can order your free copy of SCIENTIFUR INDEX II, and the electronic version + other services from SCIENTIFUR.

The electronic version of the SCIENTIFUR INDEX will be distributed on 3½" diskettes (1.4 MB), and the price will be DKK 800.- because of the costs of programming, copyrights, copying etc.

VTH INTERNATIONAL SCIENTIFIC CONGRESS IN FUR ANIMAL PRODUCTION.
With the former issue of SCIENTIFUR you received the second announcement of the congress just as it has been mentioned in all issues of SCIENTIFUR Vol. 15. Until now only 90 participants are preregistered, but 80 abstracts of scientific reports from 16 different countries were sent to the arrangement committee.

At the beginning of March the final announcement and registration forms will be sent from the committee to:

1. All who have preregistered for the congress.
2. All who have sent abstracts.
3. All members of IFASA.

If you do not appear among these groups and wish to participate in the congress, we recommend you to send an application for the final announcement to the Congress secretariat at the following address:

Vth IFASA Congress
c/o Terje Smith
Norwegian Fur Breeders' Association
P.O.Box 145 Økern
N-0509 Oslo
Norway

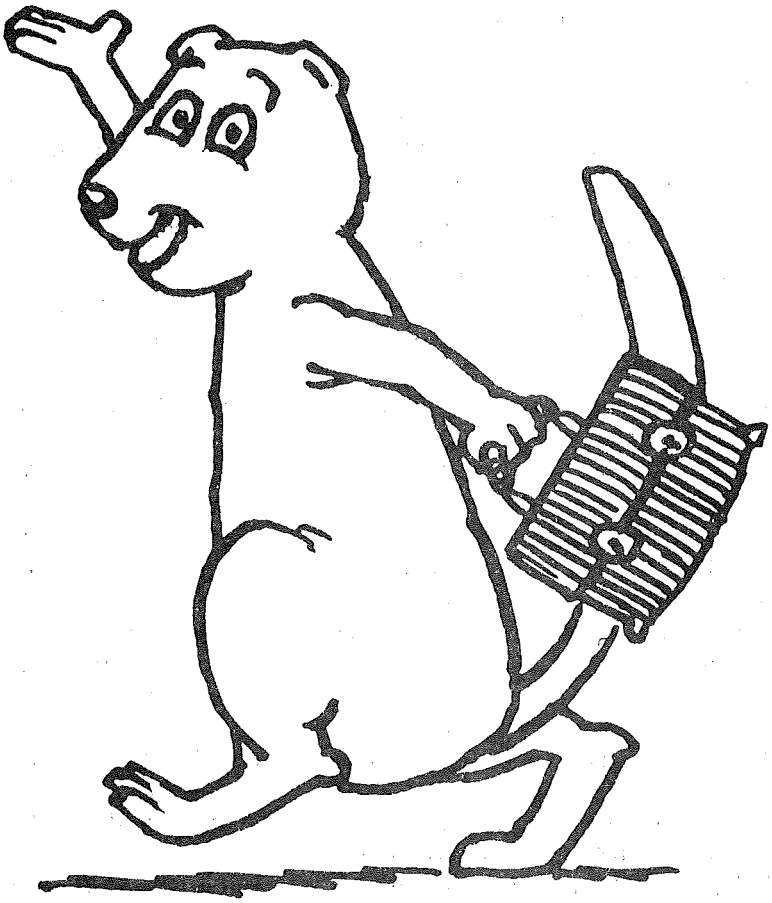
Phone: +47 2 644150
Fax: +47 2 643591

Do not miss this unique opportunity of meeting colleagues from the international fur animal world and, through the activities in the Council of IFASA, of influencing the future of IFASA and hereby also the future of the international cooperation regarding fur animal science.

We look very much forward to seeing you in Oslo, August 13-16, 1992.

Best regards,
Your editor,

Gunnar Jørgensen



SEE YOU IN OSLO, AUGUST 13-16, 1992

Original Report

Hierarchical development in captive arctic blue fox pack

Hannu Korhonen and Sakari Alasuutari***

**Agricultural Research Centre of Finland,*

Fur Farming Research Station, SF-69100 Kannus, Finland

***University of Helsinki, Muddusjärvi Exp. Farm,*

SF-99910 Kaamanen, Finland

Summary

Six arctic blue foxes (*Alopex lagopus L.*) were housed in a large ground floor enclosure in an attempt to study the development of their social hierarchies, scent-marking behaviour and reproductive success. Social dominances and hierarchies were evident and were found to develop as early as 1-4 days after the animals were placed into the experimental enclosure. Hierarchies stayed constant until February, after which dramatic changes were observed. Males normally dominated females, and showed rather linear hierarchical structure. In females, the hierarchy was more ambiguous. No marked correlation between the social status and body sizes were found. Social interactions and aggressions between the individuals increased significantly during the breeding season. Finally only one female whelped. During that time the entire social hierarchy was broken down. Urination reactions to familiar and unfamiliar odor samples were pronounced, being released primarily by animals of higher social status. Saturation of the enclosure with the animals' own scent markes was observed. It can be concluded that social hierarchies and dominances are evident in the arctic blue fox under captive conditions. However, the results support the conclusion that the arctic blue fox originally is not adapted to group living but can be considered to be relatively solitary.

Introduction

Factors such as adaptation to a cursorial life, tendency toward omnivorous food habits, and large litter size can permit and promote the development of tolerance among animals of same species (*Kleiman and Eisenberg, 1973*). During the course of evolution, such factors have led to the formation of social grouping with various alterations. In Carnivora, such as the canids, the basic social unit is often a seasonal or more permanent pair bond supported by dispersal of the young and/or the pair after the pups have reached adult size (*Kleiman and Brody, 1978; Ikeda, 1982*). Solitary living, either temporary or permanent, also belongs to the social strategies of canids (*Messier, 1985*). The formation of large groups or packs among carnivores, on the other hand, has been considered to be an adaptive response to the presence of large prey (*c.f. Mech, 1970; Kleiman and Eisenberg, 1973; Fox, 1975*). Large groups are probably formed through the continued association of a family after the pups are weaned and not through the association of unrelated individuals (*Kleiman and Eisenberg, 1973*). Additionally, group living operates within a framework of cost-benefit constraints determined mainly by such factors as the abundance of food resources, competition for living space, assistance needed for the optimal care of offspring and reasonable reproductive performance (*Lamprecht, 1981; MacDonald, 1983; Messier, 1985*).

The arctic fox (*Alopex lagopus L.*) is a medium-sized canid which normally has been considered to be relatively solitary (*Fox, 1969; Banfield, 1977*), although some evidence of its group living in the wild state is also available (*Hersteinsson and MacDonald, 1982; Eberhardt et al., 1983; Garrott et al., 1984*). Studies made with captive-reared arctic foxes additionally support the conclusion that, if housed in groups, this species can form a social organization and hierarchies (*Wakely and Mallory, 1988; Korhonen and Alasuutari, 1991*). In captive conditions, however, the group sizes studied have been small, i.e. only 3-4 individuals each. Thus, more data are needed, especially concerning social behaviour of arctic foxes that live in larger packs.

The main objectives of this investigation were (i) to describe the social hierarchies and interactions of an arctic blue fox pack, (ii) to investigate their scent-marking behaviour, and (iii) to clarify their breeding success and reproductive performance under controlled conditions in captivity.

Materials and methods

Animals and management

The experiments were carried out at the Muddusjärvi Experimental Farm of the University of Helsinki, In Finnish Lapland (in Kaamanen village located in Inari commune; 69 N, 27 E). The subjects were arctic blue foxes (3 males, 3 females) born between May 24th and June 3rd, 1990 (table 1), at the experimental farm. They were randomly selected from the animal material available, and all came from different litters of large litter sizes (table 1). After weaning (at age of 7-8 weeks) they were housed individually in conventional farm cages measuring 105 cm long x 120 cm wide x 60 cm high. By mid-October they were transferred into a large ground floor enclosure (measuring 17 m long x 8 m wide x 2 m high) and allocated to the experimental treatments. The experimental enclosure contained four wooden nest boxes measuring 70 cm long x 40 cm wide x 40 cm high (fig. 1).

Table 1. Body weights (kg) and social status of the experimental animals. Social status = 1; most dominant, social status = 6; least dominant.

Variable	Female-1	Female-2	Female-3	Male-4	Male-5	Male-6
Day of birth	May 28	May 31	May 31	May 23	May 24	June 3
Litter size	13	12	12	12	8	10
Body weight, kg						
Nov 16	7.7	8.2	7.8	7.9	7.7	9.1
Jan 24	7.5	7.8	7.5	7.4	7.6	7.5
Feb 28	7.2	7.2	7.3	6.9	7.0	6.2
Mar 19	6.5	6.4	6.9	6.4	6.1	-
Apr 16	6.0	5.2	6.4	-	5.9	-
May 15	-	4.8	5.5	-	5.4	-
Social status						
Oct 20	6	5	4	3	1	2
Nov 16	6	5	4	3	1	2
Jan 24	6	5	4	3	1	2
Feb 28	6	5	4	2	1	3
Mar 10	3	2	5	4	1	dead
Mar 19	2	3	5	4	1	-
Mar 21	2	3	4	removed	1	-
Apr 1	2	removed	3	-	1	-
Apr 16	2	put back, 4	3	-	1	-
May 14	whelped	?	?	-	?	-
May 15	?	escaped	escaped	-	escaped	-

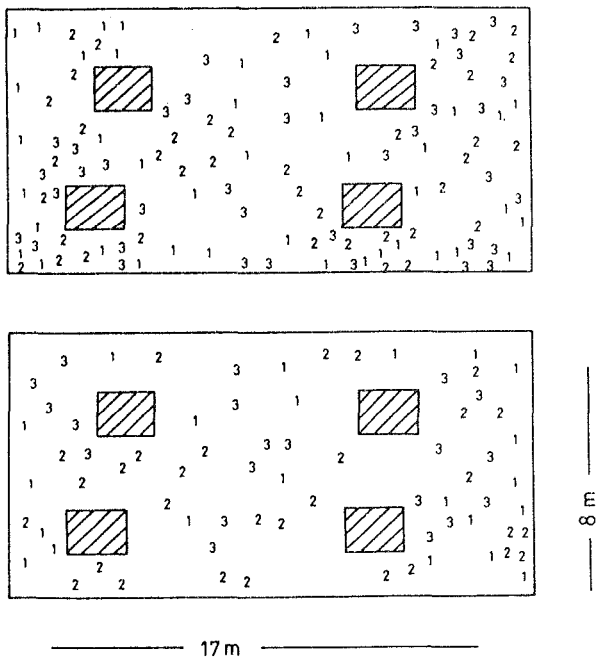


Fig. 1. Sites of urination (upper figure) and faeces (lower figure) during the first 3 days (numbers 1-3 are the days) after arctic blue foxes (3 males, 3 females) were placed into the experimental enclosure (mid-October). Shaded areas are the nest boxes. Note that in figs. 1-4 the sites of nest boxes are somewhat different because the boxes were transferred.

Monitoring of social behaviour
The visual status signals and agonistic interactions of the animals were recorded several days weekly during the course of the experiments. Visual monitoring was carried out daily by the same person for about a 30-minute period. The social contacts and signals displayed by the foxes ranged from aggression to appeasement, and made it possible to determine the hierarchical position of each animal.

The animals were additionally monitored during several days for 15 minutes before feeding, at feeding time, and for 15 minutes after feeding to estimate their feeding hierachies. Each animal studied received its feed on a wooden tray (measuring 30 cm long x 25 cm wide x 2 cm thick). Each tray was placed about 1 m away from the others. The order in which the individuals ate, as well as the number and outcome of challenges made by the other foxes, was recorded as carefully as possible. The behaviour of both the challenger and the defender was noted. Foxes were considered to feed and succesfully defend their feed if they remained in control of the tray for 1 minute. Feeding dominance was determined on the basis of aggressive encounters and visual status over feed items. In addition, to make it possible to gather more accurate data, visual observations lasting 24 consecutive hours were performed during the winter period.

Testing of familiar and unfamiliar odors
Samples of urine and faeces originated from the animals produced by the Muddusjärvi Experimental Farm. They were promptly gathered into the plastic bottles, labelled, and frozen until required. Local tap water represented the control sample.

Experiment 1 was carried out between January 9th and 11th. To initiate a trial, a sample was placed inside the enclosure on a wooden plate (measuring 30 cm long x 25 cm wide x 2 cm thick). The duration of a trial was 5 minutes, starting from the time the test plate was put into the enclosure. A visit was recorded when a fox's nose came within about 5 cm of the plate. A marking response was recorded when the subject urinated or defecated within 30 cm of the stimulus plate after a visit. The order of testing was randomized.

Three samples (control, urine taken before breeding season, and urine taken during breeding season) were tested at the same time in experiment 2 (made between March 20th and 22th). To initiate a trial, the samples were placed inside the enclosure on individual wooden places each. The duration of a trial was 5 minutes. A record was kept of the latency and frequency of visits made to each plate and the marking responses during the trial period.

Detection of oestrus
Development of oestrus cycle was carefully monitored in females by evaluation of vulval swelling and the change in electrical resistance in the vaginal tract. Electrical resistance was measured with a modified ohmmeter (SiLi3 digital heat detector, LIMA AS, Sandnes, Norway).

Results

Hierarchical changes and dominances

Hierarchical positions of the animals developed very quickly (1-4 days after the start of the experiments) and stayed stable until February (see table 1); the males normally were dominant to females, and one of the males (MALE-5) became the leader of the group. The hierarchies were most pronounced during the feeding times. Body weighings from November 16th revealed that the biggest male was not the leader but the situation was quite reversed. According to our observations, this was the fact from the very beginning. At the beginning of February, body weights of all the experimental animals were about the same order of magnitude, i.e. they weighed about 7.5 kg.

Hierarchical positions of the animals were reflected to their sleeping distances and groupings, also. Before the mating season, MALE-6, MALE-4, FEMALE-3 and FEMALE-2 most often slept close to eachother in a group (fig. 2). FEMALE-1 was lowest in the rank order and she normally slept alone outside the basic group. Although the dominant male, MALE-5, often slept together with the basic group, he was also found to sleep alone outside the group.

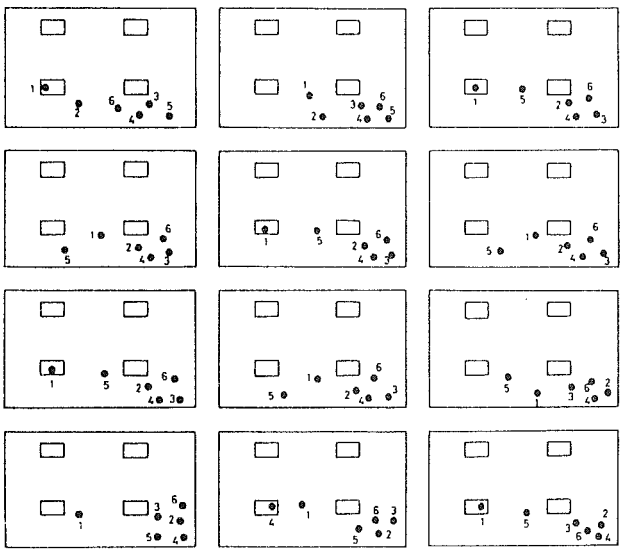


Fig. 2. Representative examples of sleeping sites of the individual. Numbers are the animals (see table 1). The data were gathered between January 7th and 11th.

In February, the competition for leadership between the dominant (MALE-5) and subdominant (MALE-6) male become more pronounced; they not only showed their hierarchical positions by visual signals or intent but also by pure aggression and fights. Some bites were also observed and were delivered to the rump, upper back, shoulder and neck regions. Loud growls associated with an open gape was also observed. Finally it happened that MALE-5 bit MALE-6 several times during several days on the hind leg which hurt very badly. After this, MALE-6 became very passive and shy. His ranking position declined first by one step, but since the leg bothered him more and more he become so sick that he lost his touch with the group. In this situation, we took him away from the enclosure and placed him in a smaller farm cage. Unfortunately, however, he died soon after the removal. This all happened during February, before any of the females was in heat.

FEMALE-3 was the dominant female from the start of the experiments in October until the breeding season. Her position as the leading female was quite clear during this time, whereas FEMALE-1 was absolutely the lowest female in the rank. In the beginning of March, however, many things changed quite unexpectedly. The first signs of heat were observed in FEMALE-2 in March 10th (table 2). The dominant male (MALE-5) then significantly increased his contacts and interest to FEMALE-2. We noticed that her position in the rank then rose to leading female. No marked aggression or fights were observed between the females. The position of FEMALE-1 also increased whereas MALE-4 dropped to the second lowest position. Some aggressions between MALE-4 and MALE-5 were evident, although not so violently as previously between MALE-5 and MALE-6.

The heat cycle continued in FEMALE-2 (see table 2), and on March 17th MALE-5 probably mated her (we didn't see it, and are therefore not quite sure). First signs of heat were observed in FEMALE-1 March 12th. March 18th-19th we made an accurate 24-hour observation, and noticed that dominances were changed again; now FEMALE-1 was highest in the rank and just secondly came FEMALE-2. MALE-5 was not interested in FEMALE-2 but preferred FEMALE-1. FEMALE-2 tried to gain the attention of MALE-5 but normally MALE-5 rejected her,

keeping contact only with FEMALE-1. FEMALE-3 was totally out of the group, mainly staying alone. Table 3 provides a good general description of social relationships between March 18th-19th. FEMALE-1 had 88 social contacts with MALE-5 during a 24-hour period, and normally the direction of contact was from MALE-5 to FEMALE-1. FEMALE-2 and MALE-5, on the other hand, provided 42 mutual contacts, and now the direction generally was from FEMALE-2 to MALE-5. FEMALE-3 had only few interactions with any of the animals in the group. MALE-4 seemed to willingly contact FEMALE-2, but normally such a contact or contact effort led to attack coming from the direction of MALE-5. As table 3 additionally shows, numbers of social contacts very significantly correlates with the social status of the animals (table 1) at this time.

Table 2. Changes in vulval swelling and electrical resistance (ohm) of the vaginal tract. X, XX and XXX are the increasing amounts of vulval swelling.

Date	FEMALE-1	FEMALE-2	FEMALE-3
Mar 10	-	XX	-
Mar 12	X	XXX	-
Mar 14	XX	360	-
Mar 15	110	530	-
Mar 16		390	
Mar 17	100	425	-
Mar 19	200	135	-
Mar 20	265		-
Mar 22	220		-
Mar 29	115		X
Apr 4	110		X
Apr 8			XX
Apr 16			XXX
Apr 17			105
Apr 18			170
Apr 22			140
Apr 29			160

Changes in sleeping distances and grouping were observed at this time. FEMALE-1 and MALE-5 were now together all the time, even when sleeping (fig. 3). Often FEMALE-2 was found to sleep with them. FEMALE-3 now normally slept outside the group of dominant individuals. Also MALE-4 was nothing but an outsider during this time.

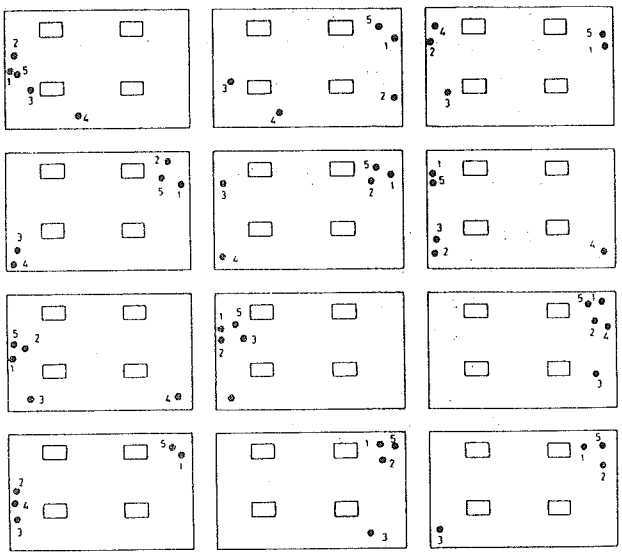


Fig. 3. Representative examples of sleeping sites of the individuals during March 18th and 22nd. The two last figures represent the situation after the removal of MALE-4.

On March 20th aggressions and fights between MALE-5 and MALE-4 became more dramatic, and finally MALE-4 was so badly hurt that we had to remove him from the enclosure to an individual farm cage. As in the case of MALE-6, here again the hind leg was most injured. We noticed that this occured in the hierarchical position in which the lower animal (MALE-4) turned his back towards the dominant (MALE-5). In such a position the dominant individual can easily bite the hind leg. After having taken MALE-4 away, hierarchical orders of the remainder animals did not change (table 1). Relations in their daily social contacts also remained rather constant. As previously observed (table 3), here again numbers of social contacts showed highly positive correlations with the hierarchical status (table 1).

After the removal of MALE-4 from the enclosure, sleeping distances and grouping did not change markedly (fig. 1). FEMALE-1 and MALE-5 always slept together, having FEMALE-2 with them often, too. FEMALE-3 was an outsider all the time.

Table 3. Circadian numbers of social contacts between the individuals. Each social contact represents the situation when an encounter of two individuals is supported by clear visual status signals and/or physical interaction. In each period the data were carefully collected during 24 consecutive hours.

	FEMALE-1	FEMALE-2	FEMALE-3	MALE-4	MALE-5	MALE-6
January 8-9						
FEMALE-1	-	1	3	35	6	6
FEMALE-2	1	-	4	8	3	8
FEMALE-3	3	4	-	5	7	6
MALE-4	35	8	5	-	10	6
MALE-5	6	3	7	10	-	13
MALE-6	6	8	6	6	13	-
Total	51	24	25	64	39	39
March 18-19						
FEMALE-1	-	0	7	0	88	dead
FEMALE-2	0	-	5	19	42	
FEMALE-3	7	5	-	2	5	
MALE-4	0	19	2	-	21	
MALE-5	88	42	5	21	-	
Total	95	66	19	42	156	
March 21-22						
FEMALE-1	-	5	2	removed	66	dead
FEMALE-2	5	-	16		34	
FEMALE-3	2	16	-		4	
FEMALE-5	66	34	4		-	
Total	73	55	22		104	

Scent-marking

The locations of urine and faeces were monitored as carefully as possible during the first 3 days after the animals had been put into the enclosure (fig. 1). Already after the first day of the experiments, both urine and faeces were surprisingly evenly scattered throughout the enclosure, although a somewhat increased tendency to concentrate them into the corners of the enclosure could be seen, too. Five days after the start of the experiment, the entire ground surface of the enclosure was covered with smaller or larger pieces of faeces and urine.

As time progressed, we observed that there were fixed places inside the enclosure where the animals released their urine. In January there were altogether 14 fixed sites in which urine markings were concentrated. Five of them were beneath the poles, 3 were close to the corners of nest boxes and the rest were on the clumps of snow or on the ground. During the breeding season these sites became larger because of more extensive urine markings. It was observed that in January these fixed marking sites were employed by the dominant (MALE-5) and subdominant (MALE-6) male. Since MALE-6 died MALE-4 also started to release its urine on fixed sites. The other animals seldom marked these sites but were otherwise interested in them, rubbing their neck, head or other body parts on them.

Table 4 summarizes circadian urine markings of the individuals gathered during 3 winter periods. In January, the most common markers were the dominant and subdominant male, which urinated 84 and 75 times, respectively. Their defecation activity was also higher than that of the other

foxes. The other individuals did not seem to significantly employ urine or faeces for marking because their frequencies were so low. In March, urination again was the most common marking mode and mainly released by the males. Particularly the dominant male showed high marking frequency. FEMALE-1 and FEMALE-3 urinated only a few times circadially, but the frequency of FEMALE-2 was a little bit higher. After removal of MALE-4, the marking frequency of MALE-5 also decreased. In males, furthermore, circadian numbers of urinations were rather evenly distributed throughout the 24-hour period. We also located the sites of urine and faeces of each individual as carefully as possible. During each observation period, the most favorite sites were parts A and D.

Table 4. Locations and numbers of urine and faeces (in parenthesis) within the enclosure during 24 consecutive hours.

	FEMALE-1	FEMALE-2	FEMALE-3	MALE-4	MALE-5	MALE-5
January 8-9						
Cage area A	2 (3)	4 (1)	1 (1)	3 (1)	62 (4)	51 (5)
B	0 (0)	0 (1)	1 (1)	0 (1)	5 (2)	3 (2)
C	0 (1)	0 (1)	0 (0)	1 (0)	4 (1)	6 (1)
D	0 (0)	1 (1)	1 (1)	0 (1)	13 (1)	15 (1)
Total	2 (4)	5 (4)	3 (3)	4 (3)	84 (8)	75 (9)
March 18-19						
Cage area A	1 (0)	6 (0)	0 (0)	15 (0)	98 (1)	dead
B	0 (0)	0 (1)	0 (0)	1 (1)	10 (0)	
C	0 (0)	0 (0)	1 (1)	0 (0)	15 (0)	
D	1 (19	1 (0)	0 (0)	1 (0)	16 (1)	
Total	2 (1)	7 (1)	1 (1)	17 (1)	139 (2)	
March 21-22						
Cage area A	1 (0)	5 (0)	0 (0)	removed	23 (1)	dead
B	0 (0)	1 (0)	1 (0)		1 (10)	
C	1 (1)	1 (1)	0 (2)		14 (0)	
D	0 (0)	0 (0)	1 (0)		10 (0)	
Total	2 (1)	7 (1)	2 (2)		48 (1)	

Reactions to selected samples

Typical reactions of the foxes to the odor samples studied can be described as follows: during the first minute after setting a sample into the test area, most of the animals came over to sniff the sample or showed other positive interest in it. Then, they normally scattered away from the plate, but soon after one or two of the animals approached and marked it mainly by urinating on it or close to it. After the first 5 minutes of the trial, the animals typically lost their interest in any of the samples studied.

None of the trials elicited a zero approach to a tested sample. Therefore, the foxes were interested in the samples and odors placed into their living area. Each of the odors tested, excluding the controls, were also marked.

In January, the dominant and subdominant males were significant markers. The former produced 6 urine markings and the latter 8 of the total 12 urine samples. As to the females, only the subdominant one (FEMALE-2) showed any marking reactions; surprisingly she marked by urination 10 of the total 12 test urines.

Responses to selected urine samples during breeding season are given in table 5. Unfortunately, the tests were not performed before the removal of MALE-4, and thus we have reaction data of 4 animals only. The trend, however, was here again similar to that observed previously; the dominant male (MALE-5) marked most intensively and frequently; we noticed that he marked 9 of the total 12 samples tested. Only a blue fox male sample (taken outside the breeding season) and two controls were left out of the markings. FEMALE-1 and FEMALE-3 did not mark at all, but FEMALE-2 marked 6 of the total 12 samples. Latency to first visit was longest in control samples and, correspondingly, shortest for samples taken during oestrus cycle. MALE-5 was more interested in female than male samples. As concerns reactions of females, on the other hand, no differences in relation to the sexes of samples tested were found.

Table 5. Latency (sec) to 1st response during mating season (tested between March 20th and 22nd). S=sniffing, U=urination. *sample gathered before breeding season, **sample gathered during breeding season, ***sample gathered from the female who was in heat.

SAMPLE	FEMALE-1		FEMALE-2		FEMALE-3		MALE5	
	S	U	S	U	S	U	S	U
Exp 1; control	20	-	25	-	40	-	35	45
blue fox, M*	10	-	15	-	70	-	10	-
blue fox, M**	1	-	2	150	20	-	2	30
Exp 2; control	7	-	15	-	30	-	10	-
blue fox, F*	5	-	11	-	20	-	5	6
blue fox, F***	1	-	2	10	10	-	2	3
Exp 3; control	10	-	10	-	15	-	15	-
silver fox, M*	5	-	5	6	12	-	7	15
silver fox, M**	1	-	2	-	10	-	1	12
Exp 4; control	5	-	5	10	10	-	4	5
silver fox, F*	3	-	3	4	5	-	3	7
silver fox, F***	1	-	2	8	3	-	1	10

Mating activities and aggressions

We also tried to observe mating activities of the animals. Any accurate figures of sexual contacts when FEMALE-2 was in heat we unfortunately did not manage to obtain, but such figures for FEMALE-1 we successfully counted. No mating effort was observed before March 21st, i.e. before the electrical resistanc value of the vaginal tract was clearly over 200 Ohm (see table 2). Mating efforts at this time, however, can be described more as mating play than true mating effort aimed at sexual contact. FEMALE-1 thus allowed MALE-5 to jump on her back, but prevented all efforts aimed at coitus. The only thing that FEMALE-1 at this position additionally allowed, was neck licking by MALE-5. We counted these play-like matings, and received a huge number; about 140 times per 24 hours. Its circadian distribution was rather even, except between 10 and 13 a.m., when only a few efforts were observed. Finally, MALE-5 mated FEMALE-1 on March 24th. This led to increasing aggressions between FEMALE-1 and FEMALE-2. Two days after copulation, on March 26th, we noticed that the right foreleg of FEMALE-2 was badly hurt. Nevertheless, aggressions between both females continued, and MALE-5 also attacked FEMALE-2, trying to bite her wounded leg. On March 29th we observed that both FEMALE-1 and FEMALE-2 had a wounded foreleg. They additionally continued to fight aggressively. Finally we were forced to take FEMALE-2 (badly hurt) out of the enclosure.

FEMALE-3 came least into heat (table 2). First signs of vulval swelling were observed on March 29th. Increase of swelling was rather slow. Highest values of electrical resistance in the vulva were observed in the late part of April. Despite the fact that FEMALE-3 was in heat, we did not observe that MALE-5 was markedly interested in her. Thus, no mating efforts or copulation were

seen. At the beginning of April, MALE-5 lost all interest in FEMALE-1.

On April 16th, FEMALE-2 was transferred back to the enclosure. At first, there were fights between FEMALE-2 and FEMALE-1 but, finally, the situation became calm. After that, until the end of the experiments, FEMALE-2 stayed outsider and lowest in the social rank.

Discussion

The present results agree with the previous findings (*Hersteinsson and MacDonald, 1982; Garrott et al., 1984; Wakely and Mallory, 1988; Korhonen and Alasuutari, 1991*) that males are dominant to females in the arctic fox. However, the results are in contrast to the assumption that dominant individuals are the heaviest (*Wakely and Mallory, 1988*); both our dominant male and dominant female were either lightest or second lightest in the weight scaling. A similar conclusion was drawn from our previous work (*Korhonen and Alasuutari, 1991*) in which we studied a group of four arctic blue foxes. In the work of Wakely and Mallory (1988), there were two groups of only three individuals which are not large enough to make any definite conclusions.

During the autumn and early winter periods, i.e. outside the breeding season, the social hierarchies were found to be stable, which is also supported by the observations of Wakely and Mallory (1988). Just before and during the breeding season, however, significant changes were seen in the social rank orders of our fox group. In females, the ability to be in heat at the right moment seems to be very essential for their social status and maternal future. FEMALE-3, who was the leading female throughout the autumn and early winter, suddenly dropped lowest in the rank because of late oestrus. Our previous work (*Korhonen and Alasuutari, 1991*) supports the relationship between dominance and sexual state in arctic blue fox females.

The arctic blue fox has a rich repertoire of visual signals to denote social status and intent (*Fox, 1969; Wakely and Mallory, 1988*). Its ability to form social organization and dominances, if housed in a group, is therefore evident as has been shown by the present and previous studies (*Wakely and Mallory, 1988; Korhonen and Alasuutari, 1991*). On the other hand, numerous aggressions and fights during the breeding season, which led to bad injuries and death, showed that solitarity and co-operation between individuals was small. Thus, it is tempting to conclude that, originally, arctic blue fox is not adapted to group living but can be considered to be relatively solitary (*c.f. Banfield, 1977*). Its hierarchical behaviour and visual status signals evidently have evolved in an environment where the abundance of living resources such as food and reproductive success are variable and unpredictable (*Wakely and Mallory, 1988; Korhonen and Alasuutari, 1991*).

Literature cited

Banfield, A.W. 1977. The Mammals of Canada. University of Toronto Press, Toronto.

Eberhardt, L.E., Garrott, R.A., and Hanson, W.C. 1983. Winter movements of arctic fox, Alopex lagopus, in a petroleum development area. Can.Field.-Nat. 97: 66-70.

Fox, M.W. 1969. The anatomy of aggression and its ritualization in Canidae: a developmental and comparative study. Behaviour 35: 242-258.

Fox, M.W. 1975. Evolution of social behaviour in canids. In M.W. Fox (Ed.). The Wild Canids. Van Nostrand Reinhold Co., New York.

Garrott, R.A., Eberhardt, L.E., and Hanson, W.C. 1984. Arctic fox denning behaviour in North Alaska. Can. J. Zoll. 62: 1636-1640.

Hersteinsson, P. and MacDonald, D.W. 1982. Some comparisons between red and arctic foxes Vulpes vulpes and Alopex lagopus, as revealed by radio tracking. Symp. Zool. Soc. London 49: 259-289.

Ikeda, H. 1982. Socio-ecological study on the raccoon dog, Nyctereutes procyonoides viverrinus, with reference to the habitat utilization pattern. Ph.D. thesis, Kyushu University, Fukuoka, Japan.

Kleiman, D.G. and Eisenberg, J.F. 1973. Com parison of canid and felid social systems from an evolutionary perspective. Anim. Behav. 21: 637-659.

Kleiman, D.G. and Brady, C.A. 1978. Coyote behaviour in the context of recent canid research: problems and perspectives. In M. Bekoff (Ed.) Coyotes, biology, behaviour, and management. Academic Press, New York.

Korhonen, H. and Alasuutari, S. 1991. Induced changes in social relationships of arctic blue foxes. Applied Animal Behaviour Science (submitted for publication).

Lamprecht, J. 1981. The function of social hunting in larger terrestrial carnivores. Mammal Rev. 11:. 169-179.

MacDonald, D.W. 1983. The ecology of carnivore social behaviour. Nature (London) 301: 379-384.

Mech, L.D. 1970. The Wolf, Nat. Hist. Press, New York.

Messier, F. 1985. Solitary living and extraterritorial movements of wolves in relation to social status and prey abundance. Can. J. Zool. 63: 239-245.

Wakely, L.G. and Mallory, F.F. 1988. Hierarchical development, agonistic behaviours, and growth rates in captive arctic fox. Can. J. Zool. 66: 1672-1678.

The structure anchoring underfur in outer root sheath cells of telogen mink hair follicles.

Fumio Nakamura, Kunihiro Kaji, Shigeharu Fukunaga, Kaoru Kohno, Keiji Kondo.

The purpose of this study was to explore the ultrastructural features of the underfur of mink. The outer root sheath (ORS) cells in telogen (resting) hair follicles was compared with hair follicles in anagen (growing phase).
A transmission electron microscope (TEM) was used. It was observed that the outer root sheath cells in the telogen hair follicle and their nuclei, in the level of the sebaceous gland, were oval or spherical in shape and filled with tonofibrils. Numerous desmosomes were present along the cell membranes. The most prominent feature was many altered desmosomes adjacent to the cuticle of the underhair and trichohyalin granule-like structures near the desmosomes.
In anagen hair follicles the shape of ORS cells and their nuclei was ellipsoidal and the tonofibrils, trichohyalin granules and desmosomes were scarce. Further, no ultrastructural interaction between the ORS cells and the cuticle of the underhair in anagen phase was seen.
It was concluded that the existence of numerous tonofibrils, desmosomes and trichohyalin granules of ORS cells in telogen may be related to the anchoring of the underhair to the hair-follicle-an "anchoring structure".

Reprint from Animal Science and Technology, vol. 62, No. 8, 1991. 1 fig. 9 references. Abstract: Palle V. Rasmussen.

Concentration of some mineral elements in hair of crossbred foxes (*Vulpes vulpes L.*) in the period of hair maturity.

D. Mertin, J. Rafay, V. Stepanek.

Dispersion-röntgen-fluorescent spectrometry was used in analyzing the content of K, Ca, Mn, Fe, Cu, Zn, Br, Sr and Pb in the hair samples of crossbred foxes (*Vulpes vulpes L.*) in the period of hair maturity from three topological body areas (centre of the back, centre of the tail, apical part of the tail).
Based on statistical evaluation of the selected concentration there was found a significant effect of sex and significant or highly significant effect of collection site upon the concentration of major elements investigated. Subsequent t-test has confirmed statistical significant differences between concentrations in the apical part of the tail and further sites.

Scientific works of the Research Institute of Animal Production, Nitra, XXIV, 153-158, 1991. 5 tables, 8 refs. In CHEC, Su. ENGL, RUSS. Authors' summary.

Does melatonin affect the quality of fox pelts?

L. Blomstedt, E. Mäntysalo, P. Mustonen, S. Tuominen.

Pelt length, quality, strength and shrinkage were compared in pelts from blue fox males implanted with melatonin approx. 4 months before pelting and from untreated controls (approx. 50 pelts per group). There were no significant differences between the groups in any of the above traits, although treated males tended to have thinner pelts than controls.

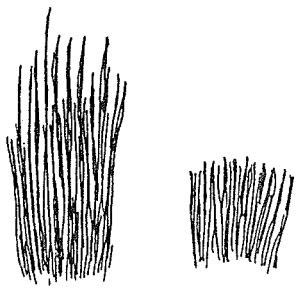
Finsk Pälstidskrift 23;10, 299-300, 1989. 4 tables, 2 photos, 2 refs. In SWED. CAB-abstract.

Skin production based on Castor Rex rabbits. Fur characteristics, fur maturity/pelting time and skin treatment.

Bettina C. Jørgensen.

The relevant literature concerning Castor Rex rabbits has been examined and made up-to-date, with special reference to the following traits: prime, pelting time, fur characteristics and fur dimensions (length, width, total area).
The suitable pelting time was examined for the following three ages: 6, 7 and 8 months. Moreover the changes in fur dimensions for the raw pelt, dried pelt and dressed pelt, and the best dimension for a commercial production of Castor Rex, was examined.
The trait prime can be expressed by a subjective evaluation of the mature area on the leather side of the pelt, and by a subjective evaluation of the live rabbits in November and December (live animal evaluation). The pelts were graded out in

the traits: quality, size, purity and colour.
The pelting time around 7 - 8 months gave the best reults regarding primeness and fur characteristics.
Concerning the examination of the fur dimensions, the results showed that the dimension: length, measured on the dried pelt gives an appropiate measure for the total pelt area.



(mod.e. Brems, 1931).

Fig. 2.1. Schematic presentation of relation between guard hair and underfur in rabbits with normal hair (A) and Castor Rex (B).

M.Sc.-report, Royal Veterinary and Agricultural University, Copenhagen, Denmark, 1991. In DANH. 81 pages, 14 figs, 32 tables, 82 refs. Author's summary.

The "flat hips" pelt defect.

Henrik Falkenberg.

The "flat hips" defect is characterised by a poor development of guard and undercoat hairs on the hips of mink, resulting in unsatisfactory pelt quality. Evaluation of 620 live males and 488 pelts from male mink revealed that the defect was present in 10% of the males. The h^2 of flat hips was estimated to be 0.59 from live animal evaluations and 0.16 from pelt evaluations, the corresponding h^2's for overall pelt quality being 0.19 and 0.21. The correlations of body condition at 27, 33 and 36 weeks of age and prior to pelting in November with the incidence of flat hips were -0.07, 0.07, 0.10 and 0.19 resp., the corresponding correlations of body condition with overall pelt quality being 0.19, 0.31, 0.39 and 0.44.

Dansk Pelsdyravl, 52;10, p. 599, 1989. In DANH. CAB-abstract.

Is it possible to reduce the incidence of fur biting?

Henrik Falkenberg.

Factors affecting the incidence of fur biting in mink, including nutrition, housing and management, air temp., age, sex, age at sexual maturity and genetic effects, are discussed. The incidence of fur biting was slightly higher for mink kept with their littermates until pelting than for those separated from their littermates, but sorting animals according to pelt colour or quality after weaning had no significant effect on the incidence of fur biting.

Dansk Pelsdyravl, 53;5, p. 232, 1990. 1 ref., 3 tables. In DANH. CAB-abstract.

Pelt quality is not adversely affected in mink born late in the season.

Ejner Børsting.

Data on 384 mink of 2 lines, born before 29 April, 29 April - 1 May or after 1 May, were analysed. Females giving birth after 1 May had smaller litters at birth and at weaning than those giving birth before 29 April or from 29 April to 1 May and a higher percentage of stillbirths, but there were no significant differences between the groups in pelt colour or quality. Kit results were confirmed in a trial with a further 1082 mink.

Dansk Pelsdyravl, 53;5, 223-224, 1990. 3 tables. In DANH. CAB-abstract.

Properties of leathers produced from blue-fox pelts taken from animals treated *in vivo* with melatonin.

E. Mäntysalo, L. Blomstedt.

Melatonin is a natural hormone that initiates autumn moult and the growth of winter fur. It is possible to induce an early moult of winter coat, several weeks earlier, with one 12-mg implant of synthetic melatonin. In this work, possible melatonin-induced effects on skin and leather properties of blue fox were investigated. The samples formed two groups: one control group and one melatonin group. Physical properties such as tensile strength, breaking energy, percentage elonga-

tion at break, tearing strength and tearing energy were determined for the leather samples in aluminum-tanned state. The results showed good quality for both groups. The figures obtained for the chemical characteristics of (i) shrinkage temperature and (ii) fixing of tannin were also comparable with those typical of normal production. All the figures give new useful information on the properties of blue-fox skin and leather and are sufficiently useful to justify their inclusion in a database.

The Journal of the American Leather Chemists Association 1990, v. 85 (12), p. 465-473. 4 tables, 5 figs., 13 references. Authors' abstract.

Stress physiological, haematological and clinical-chemical status of farm mink placed in groups or singly.

Steffen W. Hansen, Birthe M. Damgaard.

The effect of social environment on the number of eosinophil leucocytes, total plasma cortisol, and the ratio between per cent occurrence of heterophil leucocytes and lymphocytes was measured on 168 farm mink. Furthermore, haematological and clinical-chemical variables, the frequences of bite damages, and weight of body and organs at pelting were included in the investigation. The mink kits were placed either individually or in groups consisting of 3 males and 3 females. Differences in social environment had no effect on the number of eosinophil leucocytes, on the ratio between heterophil leucocytes and lymphocytes, nor on the haematological variables. For females in groups, the concentration of cortisol increased in comparison with females kept individually which shows that females in groups have a higher social stress level than females kept individually. Generally, females are more sensitive to stress than males measured by the concentration of cortisol. The activity of the enzymes ASAT and CK and the frequency of bite damages were higher for females in groups than for females kept individually. These results may indicate a higher level of social stress.

Acta Agric. Scand. 41: 355-366, 1991. 7 tables, 32 refs. Authors' summary.

Analysis of dyeing by using fiber-optic spectroscopy with partial least-squares techniques.

E. Mäntysalo, M. Marjoniemi, E. Walsh.

Dyeing processes in the fur, leather and textile industries generally deal with multi-component systems presenting multi-collinearity and interferent problems. In these cases the traditional Multiple Linear-Regression (MLR) analysis fails. At TUT in the Laboratory of Fur and Leather Technology (LFLT) fiber-optic spectroscopy with the Partial Least-Squares (PLS) technique is used to analyse multi-component systems with interferent components and multi-collinearity problems and with noisy signals. In order to predict chemical compositions of a multi-component system from spectroscopic information it is necessary to create concentration and absorption matrices which are used to create a calibration model. Using the model and applying PLS data-manipulation techniques, it is possible to predict unknown concentrations. In this research, the PLS technique is applied in the analysis of acid dyeing processes using a number of dye solutions. The results are promising and possible further applications of this technique are being investigated.

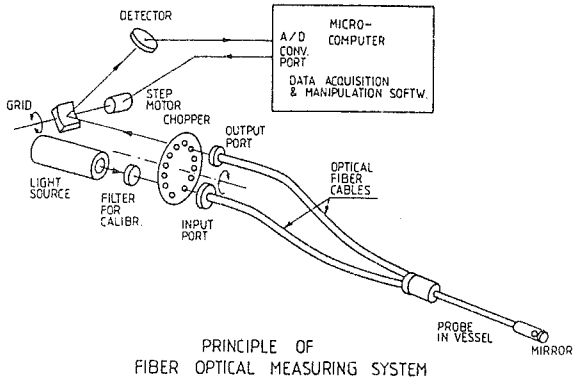


Fig. 1. Principle of measuring system.

The Journal of the American Leather Chemists Association, 1990, Vol. 85 (10), p. 383-392. Authors' summary.

Blood analysis of 20 raccoons, *Procyon*.

Takashi Makita, Tetsuya Ishida, Eiji Sagara, Miho Ohoue, Satoshi Kagabu, Koichi Manba.

A total of twenty captive born raccoons were obtained from a local zoo and their blood was analysed for reference data. The body and organs were used for comparative anatomy.

Yamaguchi J. of Vet. Med., No. 16, 97-100, 1989. 1 table. In ENGL, Su. JAPN. Authors' summary.

Progesterone concentration in peripheral blood of nutria (*Myocastor coypus*) during ontogenesis, sexual cycle, gravidity and lactation.

Milan Barta, Ivor Jakubicka.

The authors observed the variance of progesterone level in peripheral nutria blood during ontogenesis, expected sexual cycle, gravidity and lactation. They found that progesterone concentration during ontogenesis is highest in the first month of age (4.3 10.33 ng.ml^{-1}, $\bar{x}$ = 7.01 ng.ml^{-1}) with a tendency of successive decrease until sexual maturity.The absolute quantity of progesterone in a 33-day cycle of sampling is low and moves below a value of 1 ng.ml^{-1}. The progesterone level of gravid females tops between the 14th and 15th weeks of gravidity (12.50 - 20.72 ng.ml^{-1}) and decreases close before delivery, while in intact females is low in the observed period and achieves only 0.09 - 3.18 ng.ml^{-1}.

Polnohospodarstvo 37;4, 371-389, 1991. 4 tables, 5 figs., 31 refs. Authors' summary.

Optimal conditions for in vitro mitogen-induced proliferation of peripheral blood lymphocytes in breeding foxes.

Krzysztof Kostro, Krzysztof Wiktorowicz.

The proliferative response of fox peripheral blood lymphocytes to nonspecific mitogens: leucoagglutinin (LA), concanavalin A (Con A) and pokeweed mitogen (PWM) was studied. Microcultures were kept at 39°C in a humidified atmosphere containing 5% CO_2. The highest ^{3}H-thymidine incorporation was observed, when Con A was used, while LA and PWM showed weaker but significant stimulatory action. Optimal doses of mitogens were: 5μg/ml for Con A, 5μg/ml for LA and a dilution of 1:100 for PWM. The maximal stimulation index for Con A was about 240 and up to 100 for LA or PWM. The maximal lymphocyte proliferation was observed when culture media were supplemented with 10% serum. When proliferation kinetics were studied, the peak response was observed on Day 2.

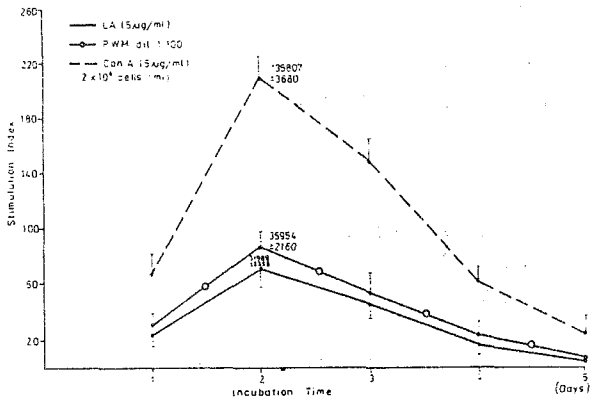


Fig. 2. Kinetics of proliferation of fox peripheral blood lymphocytes stimulated with optimal doses of LA, PWM or Con A. Each point represents mean values of stimulation indices (SI) ± standard deviation from five experiments.

Veterinary Immunology and Immunopathology, 29, 183-188, 1991. 2 figs., 12 refs. Authors' summary.

Cloning and sequence analysis of the mink growth hormone cDNA.

Yasuhiro Harada, Hiroki Tatsumi, Eiichi Nakano, Motoaki Umezu.

A cDNA clone for mink growth hormone (GH) was isolated from a mink pituitary cDNA library, employing a part of a rat growth hormone cDNA sequence as a probe. According to the nucleotide sequence, mature mink GH consists of 190 amino acids with a calculated molecular weight of 21.720. The amino acid sequence homology between the mature region of mink GH and those of pig GH, rat GH, bovine GH and human GH was 98.4%, 93.7%, 89.0% and 66.7%, respectively.

Biochemical and biophysical research communications, Vol. 173, No. 3, 1200-1204, 1990. 3 figs., 11 refs. Authors' summary.

Cytological effects of bromadiolone on some organs or tissues (liver, kidney, spleen, blood) of coypu (*Myocastor coypus*).

Anne-Yvonne Jeantet, Michel Truchet, Guy Naulleau, Roger Martoja.

Bromadiolone damaged the erythrocytes, resulting in a probable saturation of transferrin, a deposit of iron in the connective tissue and in a few cells of the proximal tubules of the kidneys and an increased storage of ferritin in the spleen. In the hepacocytes, mitochondria were distorted, their lipid inclusions being granular; a large depletion of glycogen may be considered a reflection of an elevated phosphorylase ascribable to the proliferation of the smooth endoplasmic reticulum. In the kidneys, pyelonephritis may be irrelevant to the poisoning of the animals. Bromine could not be detected using microanalytical methods.

C.R. Acad. Sci. Paris, t. 312, Serie III, p. 149-156, 1991. 1 table, 6 figs., 11 refs. In FREN, Su. FREN, ENGL. Authors' abstract.

Evolution of the raccoon dog - chance or adaptation?

H. Korhonen, J. Mononen, M. Harri, J. Aho.

Raccoon dogs first appeared in Finland in 1935, having travelled from the USSR, where East Asian raccoon dogs were introduced in 1929. In 1985-86, the production of wild and farmed raccoon dog pelts in Finland was 61.000 and 70.000, resp. The chromosome number of raccoon dogs in Finland is 2n = 56 vs. 42 for raccoon dogs in Japan, and it has been suggested that the difference between the 2 populations is due to centric fusion in the Japanese population. Comparative trials in Finland revealed that body weight in winter averaged 6.0 kg for Japanese raccoon dogs vs. 7.7 kg for Finnish animals, although body weight in summer averaged 4.9 kg in both populations. Food consumption was similar in the 2 populations in winter, but higher in the Finnish population in summer. Japanese raccoon dogs had a smaller stomach than Finnish animals, but there were no differences in intestine length, and heat insulation capacity of the coat was 35-40% higher in the Finnish animals.

Finsk Pälstidskrift 24;11, 244-245, 1990. 1 table, 2 figs., 2 refs. In SWED. CAB-abstract.

Comparison of early oogenesis and meiosis in postnatal development in mink of different genotypes.

N.G. Bakhtadze, E.V. Zybina, G.K. Isakova, T.G. Zybina, I.I. Kiknadze.

The fertility of females of many colour varieties of mink, including Sapphire and Shadow, is known to be low. In the present work, ovaries were removed from 18 Standard, Sapphire and Shadow females within 24 h of birth. The oocytes from Sapphire and Shadow females were at a more advanced stage of prophase of meiosis I than those from Standard females. It is suggested that acceleration of the late oogonial divisions in Sapphire and Shadow females leads to gamete death or to the production of oocytes that cannot be fertilized.

Tsitologiya, 32;8, 811-815, 1990. 1 table, 13 refs. In RUSS, Su. ENGL. CAB-abstract.

Postnatal changes in hypothermic response in farmborn blue foxes and raccoon dogs.

M. Harri, J. Mononen, K. Haapanen, H. Korhonen.

1. Farm raised raccoon dogs weighed significantly more at birth (89.4 g) than blue foxes (72.9 g). Both species gained weight at the same rate retaining the initial difference.

2. For both species, weight specific and age specific cooling rates followed an exponential decay curve.
3. Both weight specific and age specific cooling rates were greater for raccoon dogs than for blue foxes.
4. Solitary newborn pups cooled down about twice as fast as pups in a huddle.
5. Live blue fox and raccoon dog pups weighing less than 65 and 90 g, respectively, cooled down faster than dead pups of the same size.
6. The times within which rectal temperatures of the pups would fall to 30 and 20°C were calculated for typical, practical farm situations.

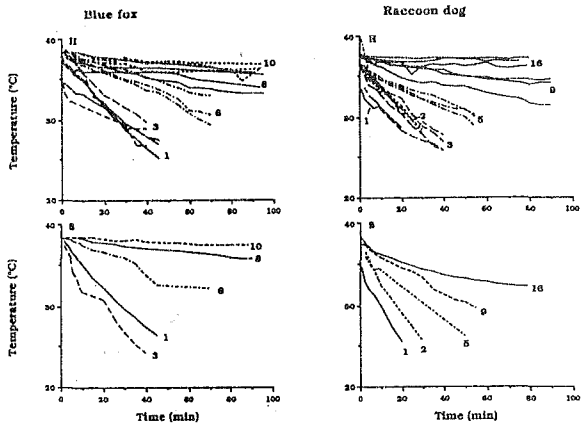


Fig. 1. Actual cooling rates for live newborn blue foxes and raccoon dogs when measured at about +10°C for solitary animals (S) and for animals in a huddle of at least five animals (H). Each line depicts the cooling rate of an individual pup, the ages of which in days are marked at each line.

Journal of Thermal Biology, 16;2, 71-76, 1991. 1 table, 6 figs., 19 refs. Authors' abstract.

The effect of housing management upon the growth and haematological parameters of standard nutria.

V. Parkanyi, J. Rafay, I. Jakubicka, M. Barta.

20 heads of standard nutria (10 males and 10 females) at 60 to 240 days of age were tested. 10 animals (5 males and 5 females) were reared in pens with basin and 10 animals (5 males and 5 females) in cages with drinkers. The objective of our work was to evaluate both housing systems from the standpoint of growth and haematological parameters.

Growth was equal in both systems and during the investigated period did not differ in terms of rearing system. At 240 days of age, nutria live weight was 5661 ± 537.06 g in the pens with basin and 5923 ± 678.54 g in the cages with drinkers. Acid-base balance values (pH.pCO_2) and haematological parameters (leucocytes, erythrocytes, hemoglobin, hematocrit) did not differ in the two systems. Significant differences were recorded only in pO_2 values, mean erythrocyte volume and colour index. It may be stated, however, that nutrias adapted to the rearing systems and maintained their internal homeostatis in both types of housing. The above-mentioned knowledge may be used as an objective criterion of suitability of cage systems for nutria rearing.

Scientific works of the Research Institute of Animal Production, Nitra, XXIV, 159-165, 1991. 3 tables, 13 refs. In CHEC, Su. ENGL, RUSS. Authors' summary.

Can feeding in nesting boxes be avoided?

Jørgen Kjær.

In a trial with 73 female wild mink, and their litters totalling about 360 kits, the control group were fed in the nesting box and the experimental group were not. Kit mortality was not reduced by the experimental treatment. Subsequent pelt length and quality were about the same for both groups.

Dansk Pelsdyravl, 53;5, 225-226, 1990. 2 tables. In DANH. CAB-abstract.

Euthanasia of mink (*Mustela vison*) by means of carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen (N_2).

N. Enggaard Hansen, Annette Creutzberg, H.B. Simonsen.

The time periods and the behavioural pattern of mink euthanized with carbon dioxide (CO_2), 100% and 70%, carbon monoxide (CO), 4%, and nitrogen (N_2), 100%, are described. The time between the placement of the animal in a glass box and the first symptoms of incoordination (phase I), the period to loss of consciousness (phase II), and,

finally, the coma phase until cessation of respiration (phase III) using three groups of 10 pastel male mink each were recorded.
Phase I times ranged from 14 s for CO_2, 31 s for N_2, and 49 s for CO. In phase II, the difference was even more pronounced, being 5 s for CO_2, 15 s for CO, and 45 for N_2. In phase III, the time was 58 s for N_2, 134 s and 151 s for CO_2 and CO, respectively.
Hence, this critical period from the time when the animals were placed in the glass box till unconsciousness occurred (phase I and II) was 19 s for CO_2, 64 s for CO, and 76 s for N_2. The total course of euthanasia was 153 s for CO_2, 215 s for CO, and 134 s for N_2.
The following minimum times will be required before it can be judged to be safe to remove the animals: CO_2 and N_2: 5 min, and for CO: 6.5 min.
In a supplementary experiment, involving a mixture of 70% CO_2 and 30% atmospheric air, it was not possible within the allotted time to kill adult male mink.
Convulsions, in phase III only, occurred to a varying degree in all the animals euthanized with CO_2 and N_2 and in 6 out of the 10 animals killed with CO.

Br. Vet. J. 147, 140-146, 1991. 2 tables, 9 refs. Authors' summary.

Yohimbine reversal of ketamine-zylazine immobilization of raccoons (*Procyon lotor*).

Diane T. Deresienski, Charles E. Rupprecht.

Six adult raccoons (*Procyon lotor*) were sedated with a combination of ketamine hydrochloride (KH) at 10 mg/kg body weight and xylazine hydrochloride (XH) at 2 mg/kg body weight intramuscularly (i.m.). Twenty min after the KH-XH combination was given, yohimbine hydrochloride (YH) at either 0.1 mg/kg (Trial 1) or 0.2 mg/kg (Trial 2) body weight or a saline control (Trial 3) was administered intravenously (i.v.). The time to arousal, time to sternal recumbency and time to walking were recorded. These times were significantly shortened after YH administration (e.g. mean time to walking (MTW) at 0.2 mg/kg YH = 23.7 min) as compared to the saline controls (MTW = 108.8 min). Heart and respiratory rates both increased after YH administration, while body temperature remained constant. A fourth trial was performed using a higher ratio of KH to XH (45:1 rather than 5:1) to mimic sedation as performed in the field.
The mean time to arousal (MTA) and MTW in this trial (1.3 and 23.7 min, respectively) were significantly shorter than controls and similar to YH trials performed after immobilization with 5:1 KH-XH. Yohimbine hydrochloride may be useful in field studies that require sedation of raccoons using KH-XH combinations.

Journal of Wildlife Diseases, 25(2), 169-174, 1989. 1 table, 34 refs. Authors' abstract.

Effects of yohimbine on bradycardia and duration of recumbency in ketamine/xylazine anesthetized ferrets.

Teresa J. Sylvina, Nancy G. Berman, James G. Fox.

Eleven adult ferrets (*Mustela putorius furo*) were anesthetized with ketamine hydrochloride (25 mg/kg, IM) and xylazine hydrochloride (2 mg/kg, IM). Fifteen minutes post-ketamine/xylazine injection, ferrets were treated with yohimbine hydrochloride at a dose of 0.5 mg/kg, or an equal volume of physiologic saline, intramuscularly. Each ferret served as its own control by randomly receiving both treatments with a minimum interval of 2 weeks between treatments on any one ferret. At 15 minutes post-ketamine/xylazine injection, mean heart rate measurements for both treatment groups were 27% less than the mean heart rate measurement reported for unanesthetized ferrets. Intramuscular administration of yohimbine antagonized the ketamine/xylazine induced bradycardia in 10 of the 11 ferrets, ($p = 0.0001$). In yohimbine treated ferrets, an increase in mean heart rate measurement was noted 5 minutes after the intramuscular administration of yohimbine, and followed, over the next 15 minutes, by a progressive increase in mean heart rate. However, a corresponding decrease in mean heart rate measurement was observed in saline treated controls. Fifteen minutes after the injection of yohimbine, the mean heart rate measurement of yohimbine treated animals had increased to 194 beats per minute. This mean heart rate measurement is nearly 30% greater than the mean heart rat of 150 beats per minute measured at 15 minutes post-saline injection in saline treated controls. Also, yohimbine treatment significantly reduced duration of recumbency in 10 of 11 ferrets ($p = 0.0001$). Mean duration of recumbency for yohimine treated ferrets was 41 ± 9.7 minutes, where

as mean duration of recumbency for saline treated ferrets was determined to be 80 ± 11.4 minutes. Intramuscular administration of yohimbine effectively reverses ketamine/xylazine induced bradycardia and significantly reduces duration of recumbency in ketamine/xylazine anesthetized ferrets.

Laboratory Animal Science, Vol. 40, No. 2, 178-182, 1990. 2 tables, 1 fig., 21 refs. Authors' summary.

Derivation of gnotobiotic ferrets: perinatal diet and hand-rearing requirements.

Dean D. Manning, Judith A. Bell.

A procedure is described which has resulted in successful gnotobiotic derivation of the domestic ferret. The most critical element of this hand-rearing procedure was found to be diet, with ferret milk being required for at least the first 7 days. Puppy milk replacer was phased in during the next 10 days, and enriched cow's milk sufficed thereafter. Around-the-clock sip-feeding with fire-polished Pasteur pipettes was necessary at intervals gradually increasing from 1 to 1.5 hours at birth to 3 hours by day 21. Temperature regulation was accomplished with an electric heating pad placed eccentrically under towel bedding to provide a 30°-40°C gradient, along which the kits positioned themselves to their own comfort. Techniques are described for minimizing fatalities due to dehydration, milk-aspiration pneumonia, underfeeding, overfeeding, gut stasis and obstipation. Internal hemorrhage, the greatest single cause of mortality in this study, manifested at day 13 and involved all kits by day 17. Despite immediate vitamin K1 dietary supplementation, five of the seven remaining kits died of hemorrhage by day 19. Around day 50, the two surviving kits were weaned from milk to dry commercial cat and ferret supplemented with vitamins K, C, A, D, E and B-complex and were reared to adulthood on this diet.

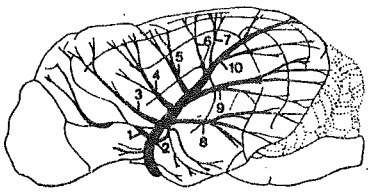
Laboratory Animal Science, Vol. 40, No. 1, 51-53, 1990. 1 table, 2 figs., 10 refs. Authors' summary.

Comparative investigation of cortical branches of middle cerebral artery in some species of carnivores.

Cezariusz Wiland.

The aim of our research was the systematisation of description, structure and arrangement of cortical branches of middle cerebral artery as well as estimating the range of their changeability. The research on the structure of the middle cerebral artery was carried on 358 brain hemispheres. Out of the weasel-like family, 32 brains of mink and polecat were analysed and out of the dog-like family, 21 brains of polar fox, 34 of red fox, 32 of raccoon dog and 28 dog brains. The arteries were filled with synthetic latex. First, small central branches deviate from the main trunk of middle cerebral artery and then the trunk parts into a great number of cortical branches. In the case of the investigated species of predatory animals this artery splits into anterior and posterior olfactoral arteries, into 3 frontal branches, and into 2 parietal and 3 temporal branches which supply the given areas of the cortex with blood. The anterior and posterior olfactoral artery and particular frontal, parietal, temporal branches may depart from the main trunk of the middle cerebral artery as individual vessels. This way of separation of particular branches is found most often in mink (78.1%), polecat (90.6%) and red fox (81.2%). Particular rami may first form trunks connecting two or several neighbouring branches. Frontal, parietal and temporal branches may also form three rami at the beginning. In this case, the main trunk of the middle cerebral artery parts into rostral, upper and caudal middle cerebral arteries. This form of division was observed most often in partition of these arteries of common red fox (8.4%) and dog (23.2%). The middle cerebral artery may also split into two trunks where, from one trunk most often depart frontal and parietal branches - while the other one is the mutual trunk for temporal branches. This form of division is noted in all examined species in a small percentage of cases. In the case of the jenot it is the dominating form of division, noted in 70.3% instances. Another form of changeability was, in particular species, vascular modifications. It was

found that in polar fox on one hemisphere (2.7%), and in jenot on four hemispheres (6.2%) a double middle cerebral artery parts from the rostral artery. In one individual polecat was found a modification consisting of ramification of the middle cerebral artery from the caudal artery. In three mink (4.7%) were found oblong vascular loops in the structure of the middle cerebral artery. The above mentioned vascular modifications found in predatory animals were also described in other species of mammals including man.
From comparison of changeability of cortical branches variation it appears that the greatest variation reveals frontal branches of the middle cerebral artery, up to appearance of vascular modifications. The three ways of middle cerebral artery parting we examined were found in each of the investigated species, but they appeared in different percentages. Such a result points to some limitations in the ways the middle cerebral artery ramifies on the area of hemisphere.



Rys.5. Schemat rozgałęzień tętnicy środkowej mózgu u badanych drapieżnych, przedstawiony na przykładzie mózgowia u lisa rudego

Akademia Techniczno-Rolnicza im. Jana i Jedrzeja Sniadeckich w Bydgoszczy, Rozprawy nr. 46, 52 pp, 1991. 38 figs., 66 refs. In POLH, Su. RUSS, ENGL. Author's summary.

Studies on the microvasculature of the large intestine of the chinchilla.

Cleo Chen-Pan.

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

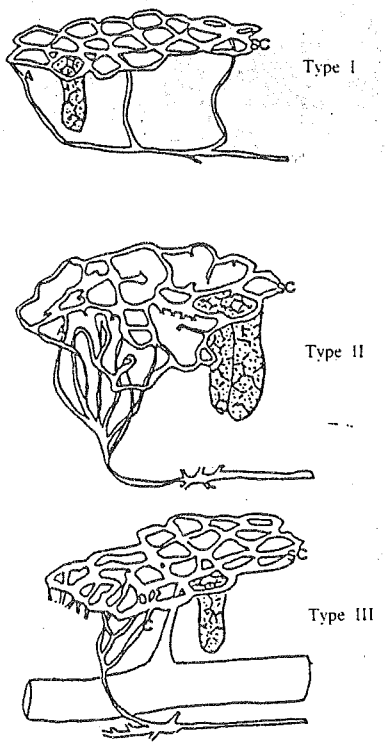


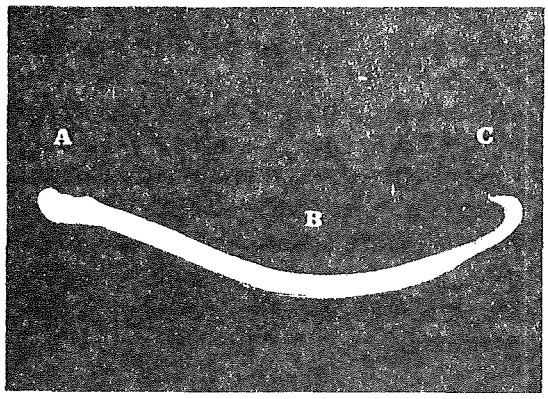
Fig. 3. Three types of the microvasculature in the large intestine of the chinchilla. Type I: a fishing net-like structure of uniform capillary meshes in the subepithelial area. Type II: numerous arterioles ascending along the crypts and irregularly formed capillary meshes in the subepithelial area.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

Japanese Journal of Veterinary Science, Vol. 50 (6), 1215-1221, 1988. 9 figs. 27 refs. Author's summary.

Penis bone in mink (*Mustela vison* Brisson, 1756).

D. Goscicka, J. Gielecki.

30 male mink were examined anatomically, histologically, and radiologically. It was found that the penis bone constituted the always-present part of the penis. It was shown, on the grounds of both the X-ray and histological examinations, that the connective tissue is the basis for osteogenesis of the penis bone closer ending.



Ryc. 2. Kość prąciowa: A – część bliższa; B – trzon; C – część dalsza
Fig. 2. Penis bone: A – proximal part; B – corpus; C – distal part

Polskie Archiwum Weterynaryjne, 30;1-2, 143-151, 1990. 1 table, 6 figs., 22 refs. Authors' summary.

High performance liquid chromatographic analysis of amoxicillin in microliter volumes of chinchilla middle ear effusion and plasma.

Gary R. Erdmann, Karla Walker, G. Scott Giebink, Daniel M. Canafax.

A reversed-phase high-performance liquid chromatographic procedure was developed to analyze 75 µl volumes of chinchilla middle ear effusion and plasma for amoxicillin. The small sample volumes were dictated by the chinchilla model we use to study otitis media and our need to collect multiple samples over an 8-h dosing interval. Amoxicillin was separated on an octylsilane column using methanol-10 mM sodium dihydrogen phosphate-acetonitrile, (88:10:2, v/v), pH 3. Amoxicillin and the internal standard were detected at 230 nm. Middle ear effusion and plasma samples were precipitated with perchloric acid and neutralized prior to injecting 6 µl onto the column. The limit of quantitation in plasma and middle ear effusion was 0.5 µg/ml (coefficient of variation 14.8% and 18.2%, respectively), and 99% of amoxicillin was recovered.

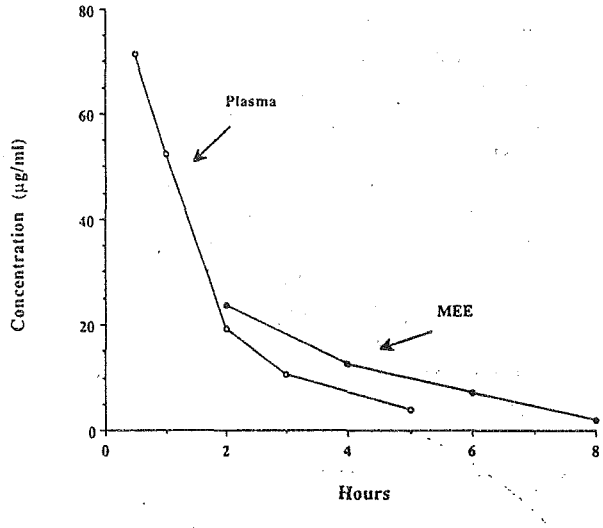


Figure 3. Concentration-time profile of AMX levels in chinchilla middle ear effusion and plasma.

Journal of Liquid Chromatography, 13;16, 3339-3350, 1990. 3 tables, 3 figs., 12 refs. Authors' abstract.

Performance recording of fur bearers in 1990.

Norsk Pelsdyrblad.

In 1990, in Norway, the performance was recorded of 10.444 mink and 16.410 silver fox females, and of 9238 and 1960 blue fox females mated with blue fox and silver fox males, resp. In the 4 groups resp., 10.0, 13.1, 13.4, and 10.5 % of females failed to give birth to a litter, litter size averaged 5.9, 4.3, 8.3 and 7.7 at birth and 5.5, 4.2, 7.3 and 6.4 at 3 weeks of age, and the average mortality from birth to 3 weeks was 10.5, 15.0, 20.5 and 31.5 %.

Norsk Pelsdyrblad, 64;10-11, 25-26, 1990. 4 tables. In NORG. CAB-abstract.

Original Report

Genetic and phenotypic parameters for fur and growth traits in nutria (Myocastor coypus)

C. Mezzadra[1], C. Milano[2], J. Nicolini[3] and C. Faverin[4]

[1] *INTA; Balcarce Experimental Station, Argentina*

[2] *Nat. Univ. of Mar del Plata, Faculty of Biology, Argentina*

[3] *Nat. Univ. of Mar del Plata, Faculty of Agronomy, Argentina*

[4] *National Council of Scientific Research, Argentina*

Abstract

With the aim of estimating heritabilities (h^2) and genetic and phenotypic correlations (r_G and r_P respectively) tending to characterize populations of nutria, information on fur and growth traits were analysed. Records came from the progeny of 43 sires of Silver and Greenland mutations. The evaluated fur traits were color (C), "snow" (Sn), underfur density (D), brightness (B), silkiness (S) and general appearance (G) through scores of 9 points. The kits were graded at the age of 6 months by a panel of 3 judges. The growth trait included in the analysis was average daily weight gain from weaning to 6 months (ADG). The model included fixed effects of sex, and the random effects of mutation, farm, sire within farm and mutation and order of rearing within farm and sex. The estimations of the h^2 were realized through paternal half sibs, using the REML (Restricted Maximum Likelihood) method for the calculation of the components of variance. The mean number of progeny per sire was 7.14. The r_G were estimated by paternal half sibs covariance. The h^2 found for C, Sn, D, B, S and ADG were .55±.21, .49±.21, 46±.20, .01±.11, .21±.17 and .17±.17 respectively. For G, the sire effects were non-significant. The r_G between fur traits were in general positive, varying from 0.00 to 0.58. The r_G between fur and growth traits were all positive with the exception of density, ranging from 0.05 to 0.29. The r_P followed a similar trend to r_G although with levels somewhat higher. The results suggest that selection programmes for these traits can proceed with good possibilities.

Introduction

Fur production in Argentina is an important activity which is mainly directed towards exportation market. Nutria (*Myocastor coypus*) is ranked in second order after mink in relation to the number of pelts exported from farms.

Although some minor importations of breeding animals from countries of East Europe have taken place, the populations of nutria utilized by farms at present, came from a narrow genetic base, and there were not sustained selection programmes to produce genetically superior animals.

One of the main difficulties arising when starting a selection process is the estimation of genetic and phenotypic parameters for fur traits. Although in other species, such as mink, much work has been done, and there are estimations of heritabilities for growth and fur traits (*Kenttämies and Vilva, 1988*), as well as for fertility and litter size (*Einarsson, 1981*), in nutria there are no estimates of such parameters.

The objective of this study was to estimate, at least in a preliminary way, the genetic variation in fur and growth traits, and the genetic and phenotypic relation among them.

Materials and methods

Records from 302 kits produced by 43 sires from Silver and Greenland mutations and from two private farms were utilized, the information being collected during 1989. The breeding system used consisted in families of 6 females by male, with natural service kept in pens, under indoor conditions. The animals were weaned at the age of 30 ± 10 days, and then separated by sexes and allocated in cages or pens depending on the farms, up to the age of 6 months when they were slaughtered or were used as breeding animals.

At the age of 9 months the kits were graded for fur traits by a panel of 3 judges. The evaluated traits were: general appearance, color intensity, underfur density, brightness, silkiness and "snow". This last character consists in the white tips of the guard hair, and the evaluation indicates the spatial distribution of this trait across the body. For all the traits scores of 5 points with intermediate scoring (v.g. 1.5, 2.5, etc.) were used (1=scarce, 5=excellent), in the case of color intensity being darker as scoring increased. Hence, the number of total points in each score was 9.

All animals were weighed monthly from weaning to 6 months of age, and the average daily gain in that period (ADG) was calculated as the regression of weight on age.

The information obtained was analysed by least-squares using the following mixed model:

$$Y_{ijkmp} = \mu + \alpha_i + \beta_j + \tau_{ijk} + \delta_m + \phi_{mp} + e_{ijkmp}$$

where: μ = general mean
α_i = random effect of farm; i=1,2.
β_j = random effect of mutation; j=1,2.
τ_{ijk} = random effect of kth sire within the ith farm and jth mutation; k=1,...,51.
δ_m = fixed effect of sex; m=1,2.
ϕ_{mp} = random effect of pth order of rearing within sex; p=1,...16.
e_{ijkmp} = random error ≈ NID

In order to estimate the variance components, the same model was fitted using REML (Restriced Maximum Likelihood) proecedure from SAS (SAS, 1988).

The estimation of heritabilities (h^2) were performed through paternal half sibs, while the genetic correlations were estimated by paternal half sibs covariance. For the phenotypic correlations the Person method was utilized. The standard errors for the heritabilities were calculated according to Cunningham (1969) as:

$$\sigma h^2 = 16 \{2[1+(n-1)t)^2 (1-t)^2] / n(n-1) (N-1)\}$$

where: n = number of offspring by sire
N = number of sires
t = correlation between paternal half sibs.

Before estimating genetic parameters the information was prepared to include only sires with at least 3 kits, and the mean number of progeny per sire was 7.14.

Results and discussion

The mean squares from the ANOVA for the traits involved in this study are shown in table 1. It is worth noting that for all traits, except general appearance, sire was a significant source of variation ($P<0.001$ to $P<0.05$). The situation was more variable for the other sources of variation such as farm, which was important for color, snow, brightness, silkiness and ADG, but not for general appearance or fur density. In the same way, the order of rearing had significant effects ($P<0.001$ or $P<0.01$) for all the traits with the exception of general appearance. The latter might be explained by the different conditions from one group to the other, basically in the nutritional apects, because the composition of the ration can change according to the price of each ingredient and this could affect the different groups in some extent. The model adjusted well to the data, as indicated by the R^2 obtained in the different ANOVAs, which varied from 0.46 to 0.83.

Table 1. Mean square for fur traits and average daily gain[a].

Source of variation[a]	gl	General appear.	color	snow	density	brightness	silkiness	ADG
Farm	1	.5371	3.3136***	5.7296***	.3560	35.0099***	26.5003***	949.39***
Mutation	1	8.1766***	7.1090***	.9171***	.0953	.0335	.0301	.02
Sire (F,M)[b]	51	.3889	.5879***	.3227***	.3687***	.5041***	.9159***	22.35*
Sex	1	.0008	.2406	.4098	.4225	.0322	.0871	1129.57***
Order (F,S)[b]	16	.3626	.5639***	.8130***	.3705**	2.4180***	2.3180***	71.57***
Error	229	.3658	.2645	.1205	.1539	.2762	.3483	.14.29
R^2		.46	.67	.77	.53	.83	.69	.78

[a] * P<0.05
** P<0.01
*** P<0.001

[b] F=Farm, M=Mutation, S=Sex

Table 2 shows the least squares means and the standard errors for the evaluated characteristics by mutation. It is evident that for all traits Greenland nutrias were superior to Silver, although just for general appearance, color and "snow" the differences were significant. In the specific case of general appearance, the decoloration found in Silver nutria in the white tips of guard hairs, turning to yellow, affected negatively the grading. This effect was not observed in Greenland kits.

In table 3 can be seen the estimation of heritabilities for the traits. In the case of color and "snow" there were important effects of mutation (P<0.001), so the h^2 were estimated separately. A pooled estimation is also shown.

Table 2. Least squares ± standard errors for fur and growth traits by mutation.

Trait	Mutation		Diff.
	Silver	Greenland	
- General appearance (points)	2.02 ± 0.06	2.73 ± 0.04	***
- Color (points)	2.94 ± 0.06	3.65 ± 0.05	***
- Snow (points)	2.15 ± 0.05	2.62 ± 0.04	***
- Density (points)	2.55 ± 0.04	2.66 ± 0.04	NS
- Brightness (points)	3.67 ± 1.00	4.03 ± 0.08	NS
- Silkiness (points)	3.20 ± 0.08	3.36 ± 0.07	NS
- ADG ($g.day^{-1}$)	22.12 ± 0.58	24.06 ± 0.57	NS

*** P<0.001
NS Non significant

Table 3. Heritabilities (h^2) and standard errors of the estimates for fur and growth traits.

Trait	h^2	(pooled)
- General appearance	-	
Silver	0.73 ± 0.24*	
- Color		0.55 ± 0.21*
Greenland	0.52 ± 0.20*	
Silver	0.13 ±0.14	
- Snow		0.49 ± 0.21*
Greenland	0.59 ± 0.22*	
- Underfur density	0.46 ± 0.20*	
- Brightness	0.01 ± 0.14	
- Silkiness	0.21 ± 0.17	
- ADG	0.17 ± 0.17	

* $P<0.05$

It is very difficult to compare these figures with the estimations from other studies, because no references in the literature were found for nutria. However, there are many published data for mink which will be used. In general terms, it can be said that the heritabilities found were moderate to high. The exception was brightness, where the environmental variation (farm and order of rearing) was much greater than the genetic one, resulting in a h^2 as small as 0.01. For general appearance, there is no estimate of h^2 due to the lack of significance of sire effects. Kenttämies and Vilva (1988), working with black and pastel minks graded in two different seasons of the year, reported estimates of h^2 for general pelt quality of 0.43 and 0.20 in August and November for black minks, but the levels decreased to 0.07 and 0.05 for pastel mink in the same seasons, respectively. This heterogenous result is not surprising, since this trait is a composite of others and, as such, of difficult subjective evaluation. Nevertheless, more efforts are needed for better adjusting the grading of this trait in nutria.

To the other traits exhibited moderate to high estimates of h^2 ranging from 0.17 for ADG to 0.73 for color in Greenland. Underfur density, a very important trait, had a h^2 of 0.46. Reiten (1977a) found, in black mink, estimates of heritabilities for underfur density, calculated in summer and winter, of 0.34 for males and 0.18 for females and 0.28 for males and 0.23 for females, respectively. These results are lower than our estimates for nutria, but the levels of h^2 reported by Reiten (1977a) 0.45 for males and 0.50 for females in summer and 0.42 for males and 0.38 for females in winter, are very close to the results from this experiment.

In general terms, it can be suggested that with the genetic variation exhibited by fur and growth traits, there are good possibilities of achieving moderate to high rates of progress if a selection programme is started in nutria.

In table 4 can be seen the genetic (r_G, above diagonal) and phenotypic correlations (r_P below diagonal) between the traits.

Table 4. Genetic (above diagonal) and phenotypic correlations (below diagonal) between fur traits and average daily gain (ADG).

	Color	Snow	Density	Brightness	Silkiness	ADG
Color		-0.02	0.39	0.30	0.26	0.13
Snow	0.38		0.09	0.20	0.10	0.29
Density	0.12	0.07		0.47	0.58	-0.01
Brightness	0.55	0.58	0.02		0.45	0.05
Silkiness	0.43	0.49	0.17	0.70		0.08
ADG	0.27	0.46	0.00	0.47	0.35	

The first point to take into account is the fact that almost all correlations, both genetic and phenotypic were positive, which is an indication that there are no antagonisms between fur traits or between fur and growth traits and therefore selection can proceed for these traits simultaneously. In general, r_P were higher than the r_G. There were high levels of r_G such as between underfur density and brightness and silkiness (0.47 and 0.58 respectively), or between the two last characters inter se (0.45); some others were intermediate such as between color and density, brightness or silkiness (0.39, 0.30 and 0.26 respectively), and there were low correlations as, for example, snow and density (0.09) or snow and silkiness (0.10). In the case of color and snow and density and ADG, the values were close to zero. The trend for the r_P is similar to the r_G but having higher values.

Reiten (1977b) calculated only phenotypic correlations in dark mink, and found negative r_P between fur color and both underfur and guard densities. This was not the case in our study. In Reiten's report, as both densities increased so also did the general pelt quality as indicated by their association (r_P=0.35 and 0.33 in males and 0.38 and 0.25 in females, respectively). In our case, general quality was not present in the correlation analysis, but density showed a strong genetic association with brightness and silkiness which are in fact constituent traits of the general appearance of the pelt.

Based on experiment results, analysis and experience from mink breeding, Einarsson (1987) concluded that no correlated responses can be expected in fur characteristics, the reverse being true in traits connected with body size. In our case, we can suggest that if these results are confirmed from larger scaled experiments, it could be possible to expect correlated responses in both fur and growth traits. In this regard, a selection programme based on a selection index can be an efficient way to select for an aggregate genotype.

Acknowledgements

The authors with to thank Mr. and Mrs. Pons, owners of the farm "Papinou", who kindly provided the information from their farm. Thanks are also extended to Rafael and Carlos Garcia-Mata, owners of the farm "las Charitas", who permitted us to carry on evaluations on their animals.

References

Cunningham, E.P. 1969. Animal Breeding Theory. Landbruksbokhandelen/Universitetsforlaget Vollebeck, Oslo. 272 pp.

Einarsson, E. 1981. Heritability for litter size in mink, with special reference to methods of estimation and influence of maternal effects. Acta Agr. Scand. 31: 219-228.

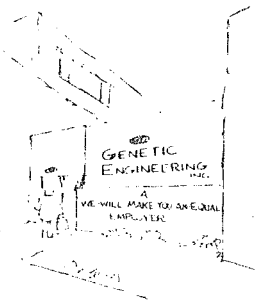
Einarsson, E. 1987. Selection for litter size in mink. I. Background, analyses of the base population and design of the experiment. Norw. J. Agr. Sci. 1: 131-153.

Kenttämies, H. and Vilva,V. 1988. Phenotypic and genetic parameters for body size and fur characteristics in mink. Acta Agric. Scand. 38: 243-252.

Reiten, J. 1977a. Arvbarhetsestimater for størrelse og pelsegenskaper hos mørk mink. Meld. Norg. Lanbr. Høgsk. 56, no. 16, 12 pp.

Reiten, J. 1977b. Korrelasjoner mellom størrelse og pelsegenskaper hos mørk mink. Meld. Norg. Landbr. Høgsk. 56, no. 15, 15 pp.

SAS. 1988. SAS Institute Inc. SAS/STAT User's Guide. Release 6.03 Edition, Gary, NC:SAS Inst. Inc. 1028 pp.



IFASA

IFASA/SCIENTIFUR

Scientifur

SCIENTIFUR
P.O.Box 13
DK-8830 Tjele

Phone (+45) 86 65 25 00
Fax (+45) 86 65 29 12

WHY NOT USE THE INTERNATIONAL CLASSICS TO PROMOTE YOU!!!

PRICE LIST 1992

1. **SUBSCRIPTION TO SCIENTIFUR**, Price DKK 550.- incl. postage
   Air mail delivery, add DKK 60.-

2. **PREVIOUS VOLUMES OF SCIENTIFUR**, Vol. 1-15, incl. postage
   Price DKK 150.-/vol. (All volumes: Index free).

3. **SCIENTIFUR INDEX** covering all titles and authors from Vol. 1-10,
   Vol. 1-10, DKK 100.- + postage.

4. **MINK PRODUCTION, ISBN 87-981959-0-5**, 399 pages, richly
   illustrated, Price DKK 300.- + postage. (Also available in Danish)

5. **BEAUTIFUL FUR ANIMALS - and their colour genetics,**
   ISBN 87-981959-5-6, 271 pages incl. more than 300 colour photos,
   Price DKK 320.- + postage. (Also available in Danish, Norwegian, Swedish,
   and Japanese).

6. **HAEMATOLOGY AND CLINICAL CHEMISTRY OF FUR ANIMALS**
   ISBN 87-981959-8-0, Price DKK 150.- + postage.

ITEMS NO. 3-6 UP TO 40 PERCENT DISCOUNT WITH 100 COPIES OR MORE. ASK FOR SPECIAL OFFER.

Genetic polymorphism of immunoglobulin G in the mink. VI. A regulatory gene controlling the expression of the gamma-chain constant region allotype of mink immunoglobulin.

Irina I. Fomicheva, Olga Yu. Volkova.

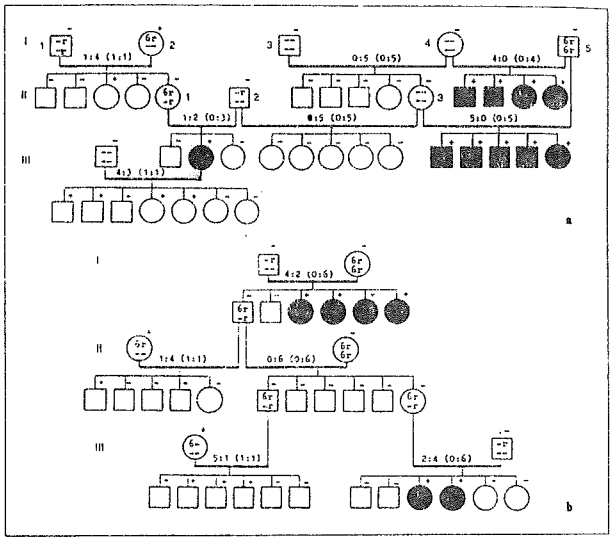


Fig. 1. Fragments of pedigrees showing the appearance of an unexpected phenotype (H6+) in all (a) or some (a,b) members of families in the case of acceptance of the single-locus hypothesis. Black symbols indicate offspring with (H6+) phenotype whose appearance is not permissive under the single-locus hypothesis. The genotype is indicated for parents with known pedigree and tested for offspring in different crosses. 6 = the structural gene for H6 allotype; r = the r_{H6} gene, when homozygous, it suppressed the expression of H6 in serum. Sign + or - above the symbols indicates H6-positive or H6-negative phenotypes, respectively. The ratios indicate the number of phenotypes observed and expected (parentheses) segregation ratios (H6+):(H6-) on the basis of the single-locus hypothesis.

We describe here the inheritance of H6, one of the six known allotypes of the γ-chain constant region of mink immunoglobulin (IgG). H6 is not present in minor concentrations in the serum, and its phenotypic expression is stable. However, in offspring of some (H6-)X(H6-) crosses, H6 appeared unexpectedly and, by contrast, it disappeared in some H6+/H6+ homozygote offspring.

Based on pedigree analysis, a transregulation of H6 expression in the serum by an autosomal recessive gene not linked to the structural allotype gene is postulated.

Experimental and Clinical Immunogenetics, 7;4, 213-220, 1990. 2 tables, 1 fig. Authors' summary.

B2-like repeated sequence in genome of the American mink.

M.V. Lavrent'eva, M.I. Rivkin, A.G. Shilov, M.L. Kobets, I.B. Rogozin, O.L. Serov.

Repeat sequences of 195 bp were identified in DNA from an X-chromosome library of mink. These had flanking sequences of 14 bp. The repeat sequences had an internal, split promoter, an adenine-rich 3' region, and a poly (A) tail. The repeats contained a polypyrimidine trait of 22 bp, not found in Alu-like sequences. The number of repeats in the genome was 1 x 105 to 2 x 105. Homology between the repeat sequences in mink and mice was 55%.

Molekul mekhanizmy genet protsessov 7 Vses simp, Moskva, 27-30 mara, 1990, Tez dokl 87-88. 4 figs., 14 refs. CAB-abstract.

Mink IgG-allotypes and Aleutian disease.

I.I. Fomicheva, N.A. Popova, D.K. Tsertsvadze, O.Yu. Volkova, T.I. Kochlashvili, O.K. Baranov.

IgG polymorphism (allotypes H3, H4, H6 and H8 of constant region of the γ-chain) was investigated in healthy and Aleutian disease-affected (AD) mink from two Siberian and one Danish populations. In all three populations, the expression of H3 and H4 allotypes was strongly associated with AD. Among the AD minks the frequency of H6, H8 phenotype was found to decrease, whereas the frequency of H3, H4, H6, H8 phenotype significantly increased. At the same time, the population distribution of the rest of the phenotypes was similar among healthy and AD mink. The H3, H4, H6, H8 mink showed the highest pathomorphological characteristics of AD. Based on the data concerning mink H3 and H4, and human Gm allotypes, their role as possible genetic markers for hereditary susceptibility to distinct disease is discussed.

Genetika 26 (1), 109-113, 1990. 4 tables, 9 refs. In RUSS, Su. ENGL. Authors' summary.

Comparative evolutionary study of the alpha-macroglobulin immunogenetic system in mink and pigs.

V.I. Ermolaev, E.G. Mirtsukhlava, M.A. Savina.

Allotypic polymorphism was demonstrated for lipoprotein (Lpm) allotypes in mink and alpha2-MF microglobulins in pigs. There were 14 Lpm allotypes, which exhibited complex inheritance. In pigs, there were 4 alpha2-MF allotypes, but only 1 alpha2-MS allotype. The alpha2-MF and alpha2-MS genes were closely linked in pigs.

Molekul mekhanizmy genet protsessov 7 Vses simp. Moskva, 27-30 marta, 1990, Tez dokl 47. In RUSS. CAB-abstract.

Chromosome study of yellow-throated marten (*Martes flavigula*).

Chen Zhiping, Liu Ruiging, Wang Yingxiang.

The karyotype of *Martes flavigula*, captured from the west of Yunnan, has been studied from chromosome preparations of culture fibroblastes and bone narrow cells. The number of diploid chromosomes is 40. Autosomes consist of 5 pairs of metacentries, 7 pairs of submetacentries, 4 pairs of subtelocentries and 3 pairs of telocentrics. X is a metacentric chromosome. The G-banded, C-banded and silver-stained karyotypes have been observed. The results show that the centromere distribution of heterochromatin is demonstrated in all chromosomes except one chromosome of No. 14, No. 19 and the long arms of No. 8 are completely C-band positive. The terminal of No. 11 and No. 13 chromosomes is with heterochromatin, Ag-NORs are located at the secondary constriction of No. 15. By means of comparing *M. flavigula* with *M. foina, M. martes* and *Mustela sibirica* in G-banded, C-banded and silver-strained karyotypes, we think that *M. flarigula* should be a subgenus of *Martes*, moreover, *M. flavigula* is a specialized species.

Acta Theriologica Sinica (China), vol. 10(1), 19-22, 1990. In ZH, Su. ENGL, ZH. Authors' summary.

Effect of colour type of parents on pelt colour and quality in silver foxes.

H. Kenttamies.

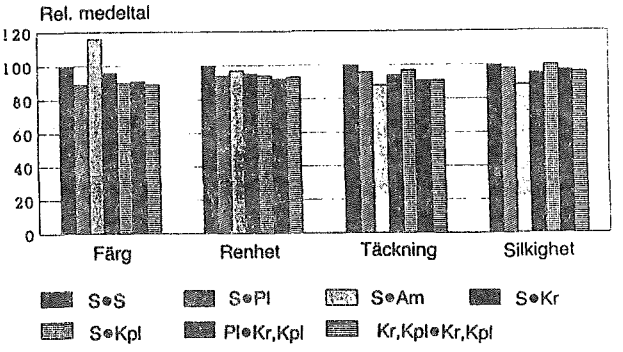


Fig. 1. The influence of parents on the color, purity, coverage and silkiness (LS-mean). Silver (S), Platinagroup (PI), Amer.recess. (Am), Cross fox (Kr) and Crossplatina (Kpl).

Data on 4000 silver foxes evaluated live for pelt quality in 1984-86, and on 1500 pelts evaluated in the same year after processing, were analysed. The foxes were sired by silver males mated with silver, Platinum, American recessive, silver crossbred (Golden Cross or Silver Cross) or Platinum crossbred females, by Platinum males mated with silver or Platinum crossbred females, or silver and crossbred Platinum males mated with silver or Platinum crossbred females. Matings involving crossbreds resulted in a higher than average incidence of undesirable brown offspring (64% of the total number), and Silver X Golden or Silver Cross matings produced a higher percentage of brown progeny than other crosses (37.4% of the total number). Based on evaluation of live animals pelted in 1984 and 1985 (7.3 progeny per sire), the h2s of pelt size, pelt colur and purity of colour were 0.40 plus or minus 0.15, 0.13 plus or minus 0.12 and 0.08 plus or minus 0.11, resp. vs. 0.28 plus or minus 0.13, 0.31 plus or minus 0.14 and 0.07 plus or minus 0.11 when based on pelts. The overall h2s, based on live animal and pelt evaluations in 1984, 1985 and 1986, (8.1-12.2 progeny per sire), were 0.22 for pelt size, 0.31 for pelt colour, 0.13 for purity of colour, 0.30 for pelt quality, 0.19 for fur density and 0.15 for silkiness.

Finsk Pälstidskrift, 24;12, 268-270, 1990. 4 tables, 2 figs., 8 refs. IN SWED. CAB-abstract.

Chinchilla colour types and their inheritance.

R. Scheelje.

Nine recessive, 3 dominant and 9 combination chinchilla colour mutations are described. The gene symbols are given.

Deutsche Pelztierzuchter, 65;1, 9-10, 1991. 1 table. In GERM. CAB-abstract.

Inbreeding and linebreeding in chinchillas. Dangers and possibilities.

Anonymous.

The effects of inbreeding and linebreeding on pelt colour and production in chinchillas are discussed.

Deutsche Pelztierzuchter, 64;6, 106-108, 1990. In GERM. CAB-abstract.

Ultrastructural findings in spongy degeneration of white matter in silver foxes (*Vulpes vulpes*).

G. Hagen, W.F. Blakemore, I. Bjerkås.

Spongy degeneration of white matter in silver foxes is a naturally occuring, hereditary disorder. We report ultrastructural findings in the upper cervical cord of five perfusion-fixed foxes that were examined between 5 weeks and 2 ½ years after the onset of clinical signs. Large cytoplasmic vacuoles in oligodendrocytes were present in the foxes examined 5, 12 and 20 weeks after the onset. Other early features of the disease were severe vacuolation of myelin sheaths, demyelination, expansion of extracellular spaces and hypertrophy of astrocytes. Evidence of partial demyelination as well as demyelination of entire internodes was found. In the later stages of the disease, the vacuolation was largely resolved but a marked astrogliosis persisted and numerous remyelinated axons were present in the gliotic areas.

Vacuolation of oligodendrocytes and partial demyelination has not previously been seen together in a single process. The relationship between oligodendrocyte vacuolation, myelin sheath vacuolation and demyelination is discussed. It is concluded that the present condition is due to a primary damage to oligodendrocytes; however, the underlying biochemical lesion is not known.

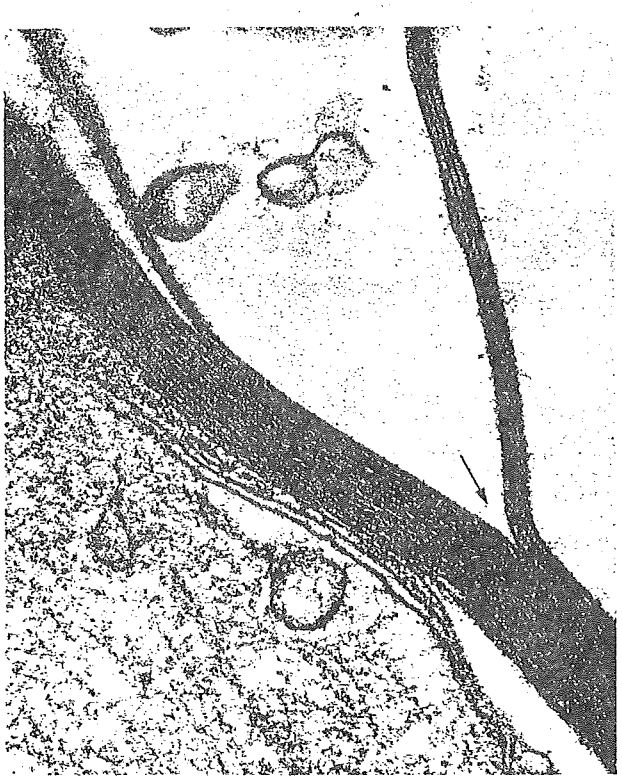


Fig. 1. Fox 2. Vacuolation of a myelin sheath. Note the splitting of lamellae at intraperiod line (arrow) x 65.000.

Acta Neuropathologica, 80;6, 590-596, 1990. 8 figs. 21 refs. Authors' summary.

Impaired phagocytosis by the mononuclear phagocytic system in sapphire mink affected with Aleutian disease.

Donald L. Lodmell, Robert K. Bergman, Marshall E. Bloom, Larry C. Ewalt, William J. Hadlow, Richard E. Race.

The phagocytic function of the mononuclear phagocytic system (MPS) in normal sapphire mink and in sapphire mink affected with experimental Aleutian disease was compared.
Clearance from blood of carbon particles or ^{125}I-labeled micro aggregated human serum albumin, and subsequent measurement of radioactivity in phagocytic organs indicated profound MPS blockade in mink affected with advanced Aleutian disease. In contrast, MPS activity in mink in the

early stage of the disease was comparable to that of normal mink. It is suggested that the MPS blockade may be responsible for some pathologic changes in Aleutian disease.

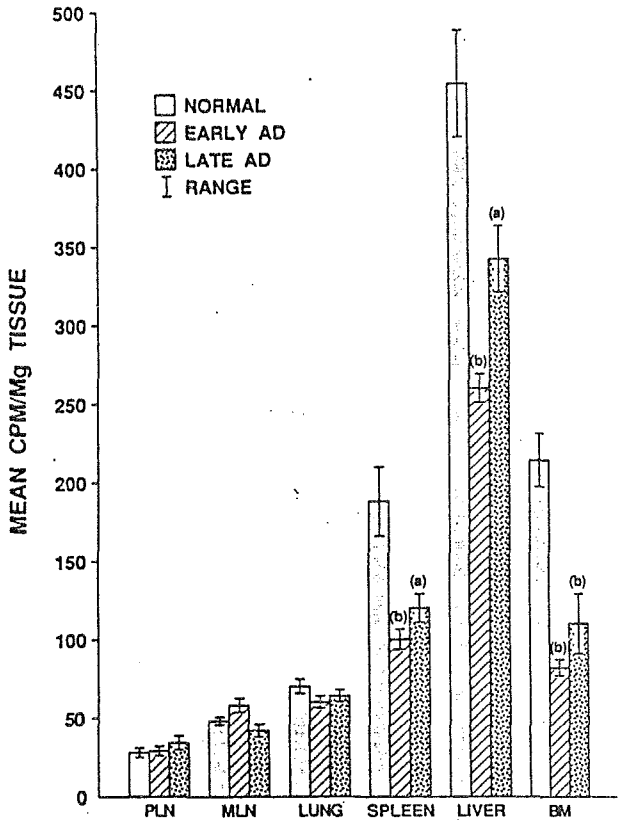


Fig. 1. Mean counts per minute of ^{125}I-HSA colloid per mg of tissue in normal and AD-affected mink. (a) significantly different from normal mink, $P \leq 0.05$. (b) significantly different from normal mink, $P \leq 0.01$. PLN, popliteal lymph nodes; MLN, mesenteric lymph node; BM, bone marrow.

Proceedings of the Society for Experimental Biology and Medicine, 195;1, 75-78, 1990. 2 tables, 1 fig., 23 refs. Authors abstract.

Breeding trials with Standard mink. Results of selection for fertility, body size and fur density.

G. Lagerkvist.

Work carried out in Sweden in 1988 and 1989 on the selection of mink females over 4-5 generations for litter size, body weight, fur density, or body weight plus litter size is summarised, and data are presented in 5 tables. Selection for litter size or fur density had no significant effect on other traits, although intensive selection for litter size had a slightly adverse effect on pelt size. Selection for body weight had a negative effect on fertility and pelt quality, and selection for fur density resulted in an overall improvement in pelt quality.

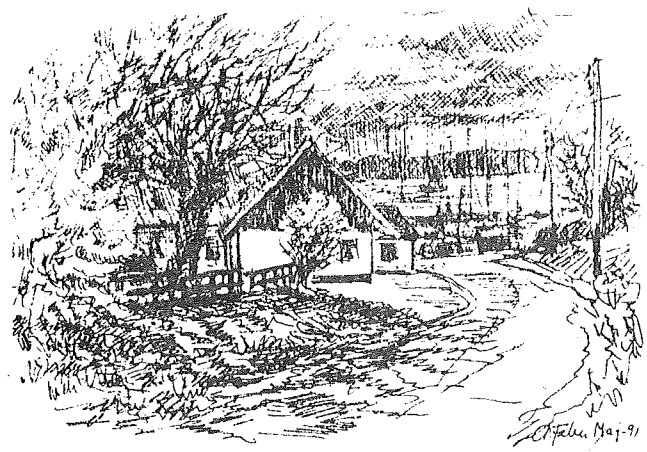
Vara Pälsdjur, 62;1, 68, 1991. 5 tables, 1 figs. In SWED. CAB-abstract.

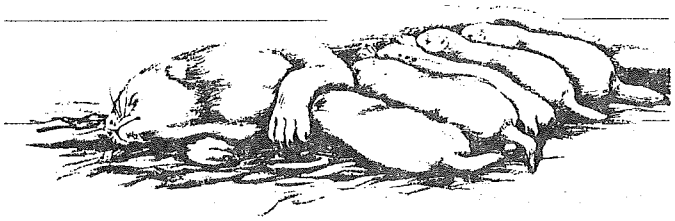
Preliminary results of a 3-year breeding trial with Scanblack mink females indicate that index-based selection results in improved breeding results and larger pelts.

Niels Therkildsen.

Index selection of Scanblack mink in Denmark has been in progress since 1986. Compared with traditional selection, index selection has resulted in an improvement in pelt length, a slight deterioration in pelt quality score, and no change in pelt colour or the incidence of metallic sheen. In 1989, litter size at birth and weaning averaged 4.9 and 4.7 resp. for index-selected females vs. 4.4 and 4.0 for traditionally selected females, and the price obtained for pelts from index-selected animals was slightly higher than that of other pelts.

Dansk Pelsdyravl, 53;8, 363-365, 1990. 7 tables. In DANH. CAB-abstract.





Effect of flushing on reproductive parameters in female mink.

Anne-Helene Tauson.

A series of experiments into the effects of flushing on reproductive performance and physiological parameters of female mink were carried out at the Swedish University of Agricultural Sciences in 1983-88. In general, positive effects of flushing were mainly documented in yearling females as an increased litter size. For adult females, the effects of flushing were less pronounced. Besides age of female, several factors affected the effect of flushing, namely the body condition of the female, the length of the restriction period preceding flushing, the length of the flushing period and ambient temperature during the reproductive season. The increased litter size in flush fed females was confirmed by an increased number of corpora lutea.
Effects of flushing on hormonal parameters were studied regarding plasma progesterone, estradiol and in a minor study, LH. The level of plasma progesterone and peak values was decreased. Plasma estradiol levels were increased as an effect of flushing, which was concluded to be an effect of increased number of growing follicles. For LH there was a tendency to a more synchronised peaks in flushed females. In a study on the fertilization rate and the development of the fertilized ova, flushed females had a tendency for superior number of eggs shed early in the mating season, and flushing significantly increased the number of fertilized eggs reaching 4-cell stage or more in the period from mating to sacrificing.

International Symposium, Petrozavodsk, 1991. See Scientifur, Vol. 15, p. 299, 1991.

Age of breeding female and litter index.

Ejner Børsting.

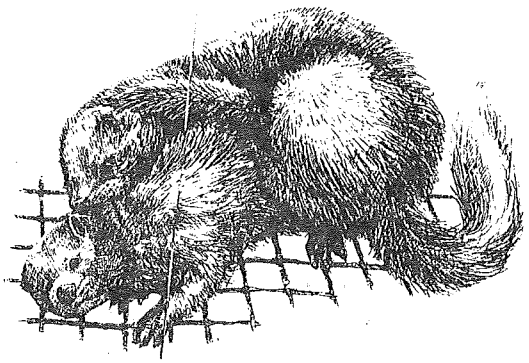
For mink breeding females at 4 farms in Denmark (311-1858 per farm) aged 1 year, litter size at birth averaged 7.06, 6.94, 7.10 and 6.39 vs. 7.46, 6.75, 6.78 and 6.72 for females aged 2 years, the differences between age groups being non-significant. Age of dam had no significant effect on the litter index, which is based on the female's own performance as well as that of her female relatives.

Dansk pelsdyravl, 54;2, 43-44, 1991. 3 tables. In DANH. CAB-abstract.

Pregnancy in mink.

Niels Therkildsen.

The effects of willingness to mate, ovulation, embryo mortality, body weight of female, mating frequency and time of mating on litter size in mink are discussed.

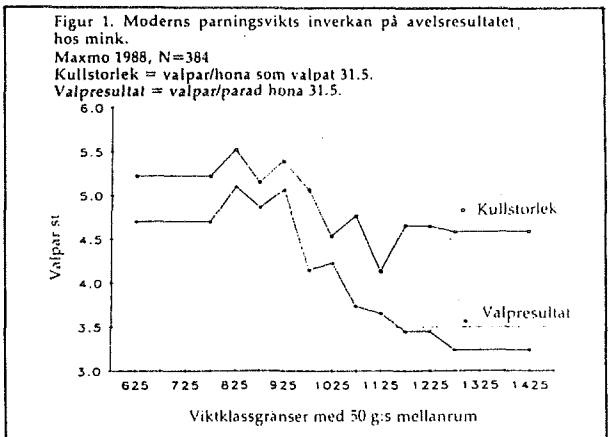


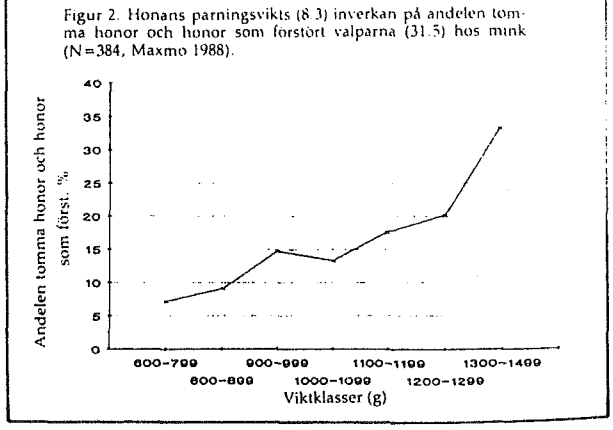
Dansk Pelsdyravl, 43;3, 94-95, 1991. 5 refs. In DANH. CAB-abstract.

Effect of dam body weight on whelping performance.

Ilpo 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. 1 table, 4 figs. In SWED. CAB-abstract.

Number and activity of nipples in year-old females of arctic fox and their effect on rearing performance.

Andrzej Frindt, Maria Bednarz, Marian Brzozowski, Tadeusz Kaleta, Roman Jaroszuk.

The number and activity of nipples of 152 females were analysed together with the number of cubs born and weaned. The correlation coefficients between the number of active nipples and rearing performance were low but significant statistically. There is evidence that the total number of nipples in Arctic fox females can be included in the selection index.

Annals of Warsaw Agricultural University SGGW-AR, Animal Science, No. 24, 41-44, 1989. 4 tables, 7 refs. Authors' abstract.

Real-time ultrasonographic determination of pregnancy and gestational age in ferrets.

A.T. Peter, J.A. Bell, D.D. Manning, W.T.K. Bosu.

Real-time ultrasonographic scanning offers a highly accurate, rapid method of confirming pregnancy in ferrets. It is a non-invasive method of assessing the status of the reproductive tract and allows an estimation of the stage of gestation to be made. Therefore, it can be a useful tool in the investigation of reproductive failure in ferrets. This technique thus provides an accurate means of investigating the dynamic changes taking place in the reproductive tract during pregnancy.

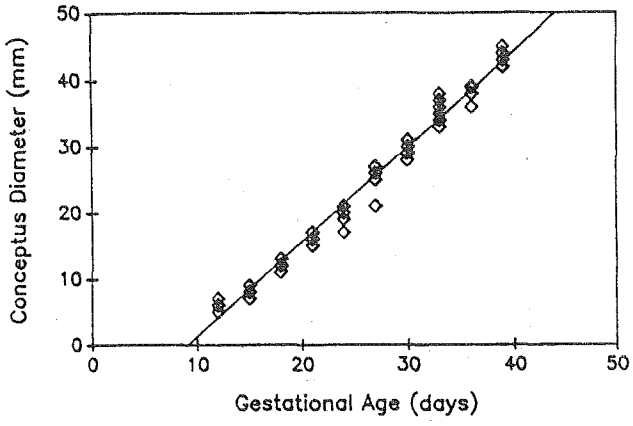


Fig. 2. Means and regression line for the length of ferret conceptus.

Laboratory Animal Science, 40;1, 91-92, 1990. 2 figs. 11 refs. Summary: G. Jørgensen.

The prediction of sexual activity in male mink and its use in breeding

T.M. Djemina.

Some trials carried out in the USSR on the selection of male breeding mink for fertility on the basis of body weight at 2 - 20 days and testis seize in November are summarised. It was concluded that it is possible to carry out early selection of males for fertility.

Deutsche Pelztierzuchter, 65;2, 27-29, 1991. CAB-abstract.

A study on artificial insemination in mink.

Hao Yifeng.

From 1983 to 1986, mink semen was collected with electroejaculation. Eighty one ejaculates were obtained from 94 collections. The successful rate was 86.2 percent.
Semen volume, sperm density and sperm motility were 0.11 ± 0.01 ml, 100.70 ± 20.99 million and 0.716 ± 0021, respectively. Twenty four samples of semen were frozen. The resuscitation rate of the semen after thawing was 83.7 percent.
In 1985 five female mink were inseminated through the vagina with the frozen thawed semen by the conventional method. Two mink were pregnant and each gave birth to 2.0 ± 1.0 kits.

Acta Veterinaria et Zootechnica Sinica, 21;1, 31-35, 1990. 4 tables, 4 refs. In CHIN. Su. ENGL. Author's summary.

Artificial insemination in foxes in 1980-90. Prospects for the next 10 years.

J.A. Fougner.

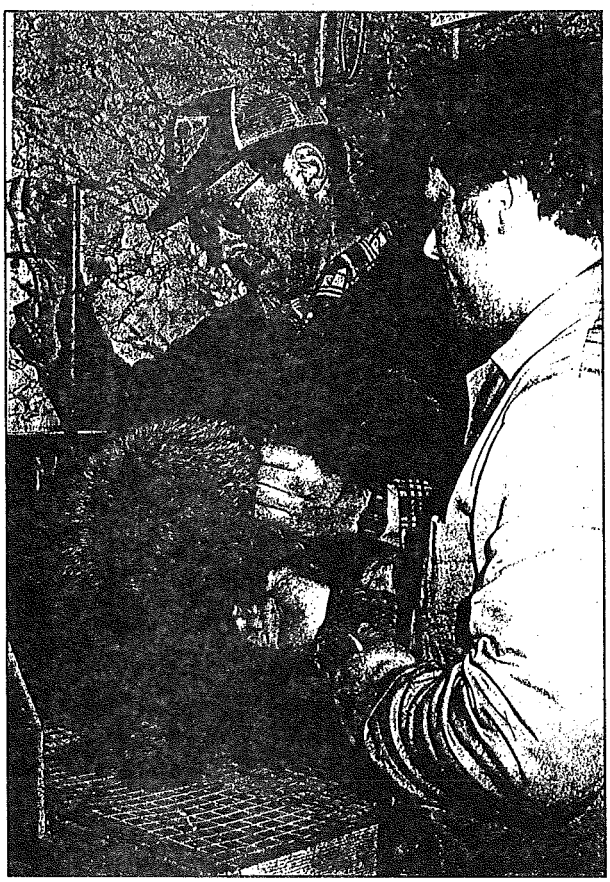
In 1990, in Norway, 15.000 blue fox and 20.000 silver fox females were inseminated at 878 farms. The average CR was 78.9%. The results are compared with those in the previous 9 years, and the effects of inseminator and the checking of oestrus on CR and litter size are discussed.

Norsk Pelsdyrblad, 65;1, 4-9, 1991. 3 tables, 4 figs., 4 photos. In NORG. CAB-abstract.

Artificial insemination of foxes in Norway in 1980-90. 2. Plans for the next 10 years.

J.A. Fougner.

Work carried out in Norway between 1969 and 1990 on various aspects of AI in blue and silver foxes is summarised, and future prospects are discussed. Data are presented in 5 tables and 1 graph.



Uttak av sæd.

Norsk Pelsdyrblad, 65;2, 14-20, 1991. 5 tables, 1 fig. In NORG. CAB-abstract.

Increased use of frozen semen in fox breeding.

P.O. Hofmo.

Insemination of 56 blue fox females in Norway with frozen silver fox semen in a preliminary trial in 1987 resulted in a CR of 69.7% and an average litter size of 6.71 (1-14). In 1988, 201 blue fox

females and 15 silver fox females were inseminated twice at an interval of 24 h with frozen silver fox semen, resulting in a CR of 87.0 and 67.7% resp. and an average litter size of 7.72 and 4.83. Of 50 blue fox females inseminated twice with half the normal dose of frozen semen (each of 75 million spermatozoa), 88.2% conceived, and litter size averaged 7.73. An account is given of the effects of sire, semen quality and insemination dose on CR.

Norsk Pelsdyrblad, 63;3, 4-5, 25, 1989. 3 photos. In NORG. CAB-abstract.

Reproductive traits of the ferret (*M. putorius furo*).

J. Rafay, V. Parkanyi, D. Mertin.

96 females of standard ferret of five consecutive generations and two populations (outbred/inbred) were used in studying five reproductive traits (duration of proestrus, duration of gravidity, number of ferrets born per litter, weaning, rearing). From the obtained results followed insignificant differences between outbred and inbred generations. Correlation coefficients between environmental temperature prior the onset of estrus, duration of estrus and duration of gravidity are highly significant with a negative value.

Scientific works of Animal Production, Nitra, XXIV, 1991, 167-171. 3 tables, 7 refs. In CHEC, Su. ENGL, RUSS. Authors' summary.

Artificial insemination of foxes in 1990.

L. Jalkanen.

In 1990, in Finland, 81.042 blue and silver fox females were inseminated, representing 20% of the total population. For blue fox females inseminated with silver and blue fox semen resp., the CR was 83 and 82 %, and litter size at birth averaged 4.4 and 5.44 cubs vs. 81% and 2.51 cubs resp. for silver fox femals inseminated with silver fox semen. Data are tabulated by district, and the results are compared with those in previous years.

Finsk Pälstidskrift, 24;12, 266-267, 1990. 3 tables, 3 figs. In SWED. CAB-abstract.

Articop inseminations in 1989.

J. Merilainen, T. Iso-Mustajarvi, J. Wilponen.

In 1989, in Finland, approx. 12.000 fox and blue fox females were inseminated using the Articop method vs. approx. 20.000 in 1988. Of inseminated females, 39% were blue fox females inseminated with blue fox semen, 25% were silver fox females inseminated with silver fox semen, and 36% were blue fox females inseminated with silver fox semen. For females in the 3 groups, litter size at weaning per inseminated female averaged 44, 2.6 and 4.1 cubs resp. Preweaning mortality was approx. 25% overall.

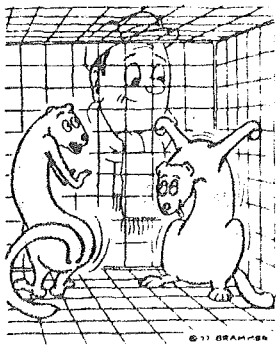
Finsk Pälstidskrift, 24;1, 16, 1990. In SWED. CAB-abstract.

Results of Articop inseminations in 1990.

J. Merilainen, J. Wilponen.

In 1990, in Finland, approx. 8000 blue and silver fox females were inseminated vs. 12.000 in 1989, and results were available for 1599 females. For blue fox females, inseminated with blue fox or silver fox semen and for silver fox females, inseminated with silver fox semen (28, 37 and 35% resp. of the total number), litter size at birth per female inseminated averaged 6.0, 4.5 and 3.0 resp., and litter size at weaning 4.8, 3.7 and 2.5.

Finsk Pälstidskrift, 25;1, 21, 1991. In SWED. CAB-abstract.



Its no good - he's just tired. I'm in HCG heat.

Original Report

Mink digestibility of new and traditional feedstuffs

Christian Friis Børsting
Dept. of Research in Fur Animals
National Institute of Animal Science
Research Center Foulum
P.O.Box 39, DK-8830 Tjele, Denmark

Abstract

Results from digestibility trials with mink performed during the past couple of years are reported as a supplement to previous papers from the department concerning digestibility of feedstuffs determined in mink. The following feedstuffs were examined:
Fresh animal feedstuffs: poultry offal, pig's ears, haemoglobin, cod fish offal, redfish offal, plaice offal, sand eel, herring offal, whole herring, mackerel offal.
Dehydrated animal feedstuffs: blood meal, haemoglobin meal, feather meal, bone protein, meat and bone meal, fish meal.
Vegetable feedstuffs: rape seed, peas, maize gluten, potato protein, soybean meal (full fat).

For most of the known feedstuffs the digestibility did not change considerably in relation to known table values. However, for some feedstuffs, mainly process-dependent feedstuffs, there is reason to change existing table values or supplement these values with new values valid for feedstuffs produced by processes differing from the previously used processes.

Introduction

Since the Dept. of Research in Fur Animals moved to Research Center Foulum at the beginning of 1989, mink digestibility trials have been carried out with 13 samples of fresh, animal feedstuffs, 16 samples of dehydrated, animal feedstuffs, and 13 samples of vegetable feedstuffs.

The examination of many of the feeds was requested by the Feed Committee of the Danish Fur Breeders Association. Some of these feedstuffs are traditional, and these experiments were carried out to secure that the digestibility did not change over time. This might be the case, for instance, with fish offal products, where the composition could have changed because of more efficient filetting processes. Other feedstuffs were examined, because the treatment procedure could have changed. All these experiments where hence performed mainly to check the digestibility values in existing feed tables.

Some of the feeds were examined in connection with production trials at Research Farms North and West, where these feedstuffs were an important part of the experimental treatments. Finally, some feedstuffs were examined in cooperation with producers of raw materials, who wanted examinations of the applicability for mink feed of new feedstuffs and feedstuffs treated by means of new processes.

In this article, a description of the production processes of the feedstuffs will only be given where the processes deviate from the standard processes and for new feedstuffs. All together, this paper is an updating and supplement to previous papers from the department (Glem-Hansen

& Jørgensen, 1978; Glem-Hansen, 1979).

Materials and methods

The digestibility trials were in principle carried out according to the guidelines given by Glem-Hansen & Jørgensen (1972). In these trials, however, two different methods were used depending on whether the feedstuffs could be fed alone, or they had to be mixed with other ingredients. Trials where the feedstuffs were fed alone are hereafter called simple digestibility trials, whereas the other trials are called regression trials, as in these trials increasing amounts of the feedstuff in question were used in the six feed mixtures included in each trial.

Simple digestibility trials also include trials where, besides the feedstuffs, only nutrients are added, the digestibility of which is not to be examined, e.g. addition of carbohydrates in trials with fish where only protein and fat digestibility is determined.

Experimental methods common for simple and regression trials.
In most trials, feed from five batches of the feedstuffs was collected in order to demonstrate the variation existing in practice as clearly as possible.

The feeds were used in an adaptation period of 10 days before the actual collection period of four days. In the collection period, faeces were collected daily and immediately frozen.

In the first 8 days of the adaptation period, the mink were given 250 kcal/day and thereafter 200 kcal/day.

In all experiments, where the feed was not given alone, the composition of the feed mixtures was composed in such a way that the energy distribution between protein, fat and carbohydrate was 35:45:20. The result was that the amount given of protein, fat and carbohydrate was nearly constant in all trials, giving an almost constant difference between true and apparent protein digestibility.

Chemical analyses were carried out partly at the Central Laboratory of the National Institute of Animal Science (NIAS), partly at the Danish Fur Breeders Association (DFBA) Analysis Laboratory at Research Farm West, so that all samples from the same experiment were analysed in the same laboratory. All amino acid analyses were carried out at the NIAS. Analyses of dry matter, ash and protein in feed and faeces were performed according to standard procedures in both laboratories.

For the analyses of fat, somewhat different methods were used in the two laboratories. At NIAS, Soxlet tubes with diethyl ether as solvent and an extraction period of 18-20 hours were used. DFBA used a Soxtec-apparatus with petroleum ether as solvent and a period of extraction of six hours. In both laboratories, the samples were hydrolized with 3N HCl before extraction.

The content of crude carbohydrate in dry matter (DM) was calculated as:

100 - % ash in DM - % protein in DM - % fat in DM.

In the first 3 experiments analysed at the DFBA laboratory, parallel analyses were performed at the NIAS laboratory. Only minor and insignificant differences in digestibilities were found when the results from the two laboratories were compared.

Experimental methods of simple digestibility trials.
These trials were performed with five adult scanblack male mink. The digestibilities of the individual nutrients are in Table 2 given as crude means with standard error of means (SEM).

Experimental methods of regression trials.
The regression trials were carried out with six groups each of three adult scanblack male mink for each feedstuff. The six groups were given from 0% up to the level, which the mink were expected to manage without negative influence on the digestibility of the feedstuff in question.

Table 1 shows the feed composition of the standard mixture used for group 1. For the groups 2-6 increasing amounts of the feed in question are added. In groups 2-6, the content of these feeds is balanced, so that the energy distribution in all groups is 35:45:20 from protein, fat and carbohydrate, respectively.

Table 1. Standard feed composition for group 1 in regression trials (% of feed without addition of water).

Cod fish	79.0
Maize starch	8.0
Vitamin mixture[a)]	1.0
Dextrose	1.5
Cellulose	2.0
Mineral mixture	0.5
Lard[b)]	5.0
Soybean oil[b)]	3.0

a) Hereof 97% maize starch,
b) The sum of soybean oil and lard was 8% in all trials, but the share of lard varied from 5-7% and the share of soybean oil from 1-3%.

The results were calculated by means of the REG procedure in SAS (SAS Institute Inc., 1987). This procedure predicts what the digestibility (± standard error of means - SEM) of the individual nutrient would have been, if 100% of this nutrient was coming from the feed in question.

Results and discussion.

Table values refered to in the following are from Nordisk Fodermedelstabell för Pälsdjur (1985).

Fresh animal feedsstuff.

Poultry offal
Four digestibility trials were carried out with boiled, frozen poultry offal.

Experiments 287 and 318 were carried out with poultry offal without feathers from the company daka in Løsning, where the offal is kept in a dry rendering plant until DM content is as high as approx. 50%. Large differences in fat and protein content were found in the two sets of samples collected in August 1989 (F287) and November 1990 (F318).

Poultry offal from Foderfabrikken Himmerland, Løgstør, contained soft offal as well as feathers, whereas it was not informed if the offal from Diepholz, Germany, contained feathers. Protein digestibility of the poultry offal from Himmerland and Diepholz was approx. 75% against only 65 and 68% in the two samples from daka, indicating that continuing the dry rendering process until approx. 50% DM is achieved has a negative influence on protein digestibility.

Pig's ears
This feedstuff was examined in connection with trials in 1990 at Research Farm West, which were conducted to asses the amino acid requirement of mink. Only 1 batch of pig's ears was included in the digestibility trial. The new values correspond very well to existing values.

Haemoglobin
Fresh, frozen hemoglobin from three different Danish slaughterhouses was used. Crude protein content was corrected, so that the content of water, ash, protein and fat totalled to 100%.

Cod fish offal.
Cod fish offal consisted of chopped heads and skeletons. The five batches of cod fish offal came from Denmark, Iceland, and Germany. Content and digestibility correspond to table values for fish offal.

Redfish offal.
Samples of redfish offal were taken from five different producers in the Faroe Islands. Protein digestibility in redfish offal was lower than in the other samples of whole fish and fish offal examined.

Plaice offal.
No special remarks regarding the origin and composition of the product. Protein digestibility was at the lower end of values for fish offal.

Table 2. Digestibility coefficients and content of digestible nutrients in new and traditional feedstuffs for mink.

Exp. No.	Feedstuff	Exp.	Max. share[a)]	Lab.	Dry mat.%	Ash	Dig. prot.	Dig. fat	Dig. carboh.	Kcal per 100g	Dig. coefficient ± SEM					
						g/100 g					Crude protein		Crude fat		Crude carbohydrate	
Fresh animal feedstuffs:																
	Poultry offal:															
287	daka	R	60	NIAS	49.1	5.2	17.2	14.8	-	218	64.8	1.7	95.1	0.6	-	-
318	daka	R	60	DFBA	47.6	3.9	14.2	21.1	-	265	68.4	0.8	96.3	0.4	-	-
288	"Himmerland"	R	60	NIAS	32.1	2.4	10.6	13.6	-	176	74.9	0.9	95.6	0.6	-	-
292	"Diepholz"	R	60	NIAS	31.8	1.8	11.6	14.1	-	185	74.1	0.7	98.1	0.5	-	-
324	Pig's ears	S	-	DFBA	38,4	1.0	19.0	15.1	-	229	89.6	0.4	97.7	0.2	-	-
307	Haemoglobin	R	35	DFBA	30.7	1.2	27.0	-	-	-	92.1	0.9	-	-	-	-
297	Cod fish offal	S	-	NIAS	21.8	4.6	13.0	-	-	-	86.2	0.4	-	-	-	-
305	Redfish offal	S	-	DFBA	22.9	6.1	8.9	5.3	-	90	80.7	0.5	96.5	0.4	-	-
289	Plaice offal	S	-	NIAS	20.6	-	11.5	-	-	-	84.3	0.3	-	-	-	-
289	Sand eel	S	-	NIAS	25.6	-	14.5	-	-	-	88.6	0.4	-	-	-	-
289	Herring offal	S	-	NIAS	30.1	-	12.7	-	-	-	87.7	0.5	-	-	-	-
297	Whole herring	S	-	NIAS	33.2	2.3	15.0	-	-	-	89.9	0.4	-	-	-	-
297	Mackerel offal	S	-	NIAS	30.2	2.1	14.2	-	-	-	86.0	0.6	-	-	-	-
Dehydrated animal feedstuffs:																
	Blood meal:															
274	Kambas	R	15	NIAS	93.9	1.8	52.2	-	-	-	58.3	2.3	-	-	-	-
298	Nagel	R	15	NIAS	95.0	2.4	55.9	-	-	251	64.4	1.2	-	-	-	-
313	daka	R	15	NIAS	90.2	4.7	75.3	-	-	-	89.3	0.6	-	-	-	-
322	Haemoglobin meal	R	15	NIAS	91.3	3.3	79.7	-	-	-	91.5	1.0	-	-	-	-
	Feather meal:															
285	ord. dried	R	30	NIAS	90.9	-	47.0	5.2	-	261	57.5	0.8	71.8	4.3	-	-
286	vac. dried	R	30	NIAS	93.4	-	54.9	5.5	-	303	65.7	1.3	73.0	4.1	-	-
326	Bone protein	R	25[b)]	DFBA	95.3	3.1	85.8	-	-	-	82.0	1.4	-	-	-	-
	Meat and bone m.:															
300	mink qual.	R	25	NIAS	94.6	25.1	38.7	8.6	-	256	69.0	0.8	67.1	3.3	-	-
306	ord. qual.	R	25	NIAS	95.1	20.5	41.1	12.6	-	305	72.1	0.9	81.3	1.8	-	-
	Fish meal:															
301	mink meal sp.B	R	40	DFBA	92.4	10.4	61.3	9.9	-	370	83.4	0.3	98.2	2.3	-	-
302	whole meal sp.A	R	40	DFBA	92.4	12.9	59.2	11.0	-	371	83.7	0.5	96.7	4.0	-	-

Table 2. continued...

Exp. No.	Feedstuff	Exp.	Max. share	Lab.	Dry mat.%	Ash	Dig. prot.	Dig. fat	Dig. carboh.	Kcal per 100g	Dig. coefficient ± SEM					
						g/100 g					Crude protein		Crude fat		Crude carbohydrate	
Dehydrated animal feedstuffs continued:																
	Fish meal:															
303	LT press cake	R	40	DFBA	92.6	16.6	60.4	13.4	-	399	86.4	0.3	94.9	1.5	-	-
304	LT whole meal	R	40	DFBA	93.3	13.4	59.2	10.0	-	361	83.6	0.4	97.2	1.9	-	-
308	LT-meal Norway	R	40	DFBA	93.3	16.3	58.9	9.7	-	357	84.3	0.5	94.7	2.6	-	-
309	LT-meal Denm.	R	40	DFBA	93.5	14.3	57.9	12.2	-	378	83.3	0.5	100	2.1	-	-
Vegetable feedstuffs:																
	Rape seeds:															
290	125°/6 min	R	20	NIAS	96.0	4.2	14.2	32.8	0.7	380	60.6	1.1	73.1	0.3	3.5	1.3
296	130°/1,5 min	R	24[c]	NIAS	95.8	4.0	11.5	25.0	5.2	310	54.9	1.1	53.9	0.3	21.3	1.7
312	Superfos 90	R	20	NIAS	93.0	3.7	14.4	18.9	0.0	244	64.1	1.0	43.9	0.3	0.0	-
	Peas 130° 3m:															
293	1,0 mm sieve	R	30	NIAS	91.4	2.9	17.8	1.7	30.5	223	83.3	1.3	79	12	47.5	1.3
317	1,0 mm sieve	R,S	25	DFBA	89.3	2.7	19.0	-	34.5	243	86.2	1.2	-	-	54.5	1.5
317[d]	1,5 mm sieve	R,S	25	DFBA	90.0	3.2	18.1	-	27.8	211	83.6	0.6	-	-	44.0	1.8
317[d]	2.0 mm sieve	R,S	25	DFBA	89.0	2.7	17.7	-	21.7	183	79.0	1.4	-	-	35.0	2.5
	Peas 160° 6m:															
294	2,0 mm sieve	R	30	NIAS	92.0	2.9	15.4	1.6	30.0	209	71.1	1.2	74	13	45.8	0.7
314	Maize gluten	R	35	NIAS	90.1	1.7	60.0	7.0	9.8	378	91.3	0.6	88.8	4.6	67.0	4.3
	Potato prot.:															
320	Brande	R	15[e]	DFBA	91.7	2.1	62.5	3.7	-	335	79.2	1.2	78	18	-	-
321	Langholt	R	15[e]	DFBA	92.2	2.3	65.7	4.1	-	349	81.2	1.3	93	12	-	-
316	Soybean meal	R	25	NIAS	92.1	5.2	31.0	17.2	8.5	370	81.7	0.9	90.9	0.7	28.3	1.7

a) States maximum share of feedstuff in % of feed before addition of water.
b) Mink given more than 10% bone protein had diarrhoea. The product is unsuitable for mink feed.
c) Only the 5 groups given 0-16% rape seeds were included in the calculation.
d) Digestibility of crude fat estimated at 75%.
e) Only the 5 groups given 0-12% potato protein were included in the calculation.

Table 3. Amino acid composition (g a.a./16 g N) and true digestibility (TD) (%) of amino acids in new and traditional feedstuffs for mink.

Feedstuff	No.	Ala.	Arg.	Asp.	Cys.	Glu.	Gly.	His.	Iso.	Leu.	Lys.	Met.	Phe.	Pro.	Ser.	Thr.	Trp.	Tyr.	Val.
Poultry offal, daka	318																		
g a.a./16 g N		6.53	6.45	7.70	0.89	12.77	9.40	2.26	3.81	6.93	5.72	1.84	3.94	6.56	4.29	3.74	0.89	3.12	4.94
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pig's ears	324																		
g a.a./16 g N		8.17	6.89	6.14	0.70	10.46	14.71	1.30	2.14	4.60	4.10	1.06	2.93	10.72	3.63	2.41	0.31	1.74	3.98
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Herring offal	289																		
g a.a./16 g N		6.01	6.79	7.90	-	11.28	6.80	2.37	3.93	6.65	7.00	-	3.51	4.49	4.17	3.99	0.92	2.82	5.17
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haemoglobin	307																		
g a.a./16 g N		7.49	3.69	10.75	0.64	7.14	4.41	7.01	0.42	12.42	8.19	0.68	6.30	3.33	4.16	2.82	1.52	1.94	9.28
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haemoglobin meal	322																		
g a.a./16 g N		7.97	3.98	11.30	0.70	8.07	4.61	7.35	0.64	13.05	8.86	0.85	6.94	3.60	4.55	3.34	1.62	2.29	9.97
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feather meal ord.dr.	285																		
g a.a./16 g N		-	-	-	5.26	-	-	-	-	-	2.50	0.79	-	-	-	4.81	-	-	-
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feather meal vac.dr.	286																		
g a.a./16 g N		-	-	-	5.25	-	-	-	-	-	2.45	0.77	-	-	-	4.75	-	-	-
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bone protein	326																		
g a.a./16 g N		7.97	7.53	5.72	0.12	10.28	12.90	1.02	1.45	3.49	3.79	0.87	2.33	11.42	3.27	2.06	0.14	1.02	2.96
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fibre mix	325																		
g a.a./16 g N		5.69	6.10	8.74	1.22	11.63	6.34	2.53	4.21	8.13	6.56	1.98	4.60	4.91	4.75	4.32	-	3.85	5.72
TD (%)		73.0	78.7	45.1	47.7	69.9	71.5	66.3	71.1	72.9	71.3	71.5	72.0	72.4	66.3	64.9	-	66.6	70.0
Rape seed	312																		
g a.a./16 g N		4.46	6.37	7.44	2.36	17.41	5.06	2.72	4.15	7.01	5.67	1.92	4.01	6.07	4.45	4.35	-	3.21	5.51
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peas 130° 3m	293																		
g a.a./16 g N		4.4	8.3	11.5	1.5	16.3	4.5	2.7	4.3	7.0	7.2	1.0	4.8	4.2	5.0	3.9	0.9	3.4	5.0
TD (%)		94.4	97.6	93.4	85.5	96.5	92.3	94.9	95.4	94.9	95.7	94.1	97.4	94.4	94.9	93.9	-	100	93.8
Maize gluten	314																		
g a.a./16 g N		8.46	3.36	6.44	1.89	22.39	2.77	2.10	4.12	16.07	1.76	2.28	6.34	9.57	5.50	3.39	0.55	5.55	4.69
TD (%)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potato protein	320																		
g a.a./16 g N		4.71	4.93	12.52	1.33	10.78	4.99	2.19	5.73	10.01	7.83	2.20	6.40	4.96	5.54	5.61	1.35	5.57	7.27
TD (%)		84.2	89.6	84.7	44.8	83.7	82.1	79.7	85.8	87.4	86.1	88.3	88.6	83.2	82.0	81.3	-	80.0	86.5

Sand eel
The protein digestibility of 89% corresponds very well with the table value of industrial fish.

Herring offal
Five samples of herring offal were collected during July 1989. The protein digestibility (88%) was slightly lower than for whole herring (90%) and table values for industrial fish.

Whole herring.
Seven batches taken in June-November 1989 were used. Five of these batches were preserved with antioxydant and acetic acid. The content and protein digestibility corresponded to table values for industrial fish.

Mackerel offal.
The mackerel offal used consisted of heads, skeletons and guts and was preserved with 1% acetic acid and antioxydant. Fat content corresponded to the content in herring offal and protein digestibility was about 2 %-units lower than for herring offal.

Dehydrated animal feedstuffs

Blood meal
The blood meal used in experiment 274 was a sample from Kambas taken in the spring of 1988. At that time Kambas used a dry rendering plant for the dehydration process. The blood meal from Nagel, Germany was dried in a drum drier. The low protein digestibilities show that blood meal dried by means of these processes are unsuitable for fur animal feed.

The blood meal from daka, Lunderskov was produced from fresh full blood by spray drying. Haemoglobin meal from Harrimix was produced from blood cells. Drying procedure was not informed.

Haemoglobin meal and blood meal from daka had a protein digestibility on the same level as fresh haemoglobin. When calculating the content of digestible protein in the four types of blood meal, the protein content was corrected, so that the content of water, ash, protein and fat totals 100%. As this correction was not made in the earlier Danish experiments with blood meal (e.g. Mejborn, 1984), the content of digestible crude protein in the new trials is lower than the previous values.

Feather meal.
Both types of feather meal were produced at the company daka from the same batch of feathers. Both types were dried on a plate drier, where the drying is done through contact with the warm plates and not by means of warm air. Passage time was approx. 3-4 hours. The difference between the two types was that vacuum was used for one type (F286) which therefore left the drier at a final temperature of approx. 80°C, whereas the final temperature was approx. 110°C at the ordinary drying procedure without vacuum (F285). Vacuum drying resulted in a higher protein digestibility.

Bone protein.
The product used was Grindsted Protein P100 from Grindsted Products with the information that it was a water soluble protein produced from fresh bones from pig slaughtering. In the experiment up to 25% bone protein was added to the feed mixture. Only data from the groups given 0, 5 or 10% bone protein could be used for calculation of digestibility, as the animals given 15, 20 or 25% bone protein had severe diarrhoea. It was proved that the majority of the product consisted of small peptides with a high osmotic effect in the intestine. The product is unsuitable for mink feed.

Meat and bone meal.
Meat and bone meal of mink quality (F300) was produced from fresh slaughter offal from pigs, i.e. this type of meat and bone meal had a high content of bones and therefore also a high content of ash. This quality did not contain solubles.

Meat and bone meal of ordinary quality was produced from dead animals and added the soluble fraction. This type contained more meat and soft parts than the meal of mink quality.

Even though meat and bone meal of mink quality was produced from the best and freshest raw materials, this quality had the lowest protein digestibility. This must be due to the fact that a higher share of the protein came from bone, and perhaps that the soluble fraction in the ordinary meat and bone meal has a higher protein digestibility than the rest of the meal. If a sufficiently hygienic and uniform quality of meat and bone meal of ordinary quality can be obtained, it will be an economic advantage to use this type, on the condition that its price is lower than the price of mink quality.

Fish meal.
Four samples of LT (low temperature) fish meal and 2 samples of fish meal dried at ordinary temperature were examined. LT fish meal used in experiments 303, 304 and 309 was vacuum dried at a max. of 72°C. The drying temperature of the other batches was not informed.

The 4 samples used in experiments 301-304 were examined in connection with production experiments on Research Farm West, whereas experiments 308 and 309 were carried out to examine whether, as claimed by the Norwegian producers of fish meal, there is a lower protein digestibility in Danish fish meal than in Norwegian fish meal. The difference of 1 %-unit in protein digestibility between Danish and Norwegian fish meal was not significant ($p>0.05$), and this allegation must therefore be denied.

Protein digestibility was equally high in the 2 samples dried at ordinary temperature as in 3 of the 4 samples of LT meal, i.e. 83-84%. The only sample differing significantly from the others, was LT meal of press cakes, the crude protein digestibility of which was 86.4%. It therefore looks as if protein digestibility is not increased by the LT drying.

Vegetable feeds

Rape seed.
Three samples of rape seed exposed to different heat treatments were examined. The heat treatment is done to break down the myrosinase enzyme of the rape seeds. This enzyme can, after grinding of the rape seeds, form toxic glucosinolate breakdown products. All three samples were ground on a laboratory mill through a 2.0 mm sieve with extra holes of 4-5 mm together with dry ice.

Heat treatment of the first sample (F290) was done without moistening in a drum drier at 120-125°C for 6 min. The other sample (F296) was heat treated without moistening in a Dantoaster at 130°C for approx. 1.5 min. The seeds were immediately cooled down and kept at a water content of approx. 6%. The conditions of the heat treatment of the last sample (F312) is a trade secret which the producer does not want to publish.

Experiment 296 showed a considerably lower digestibility of rape seed for the 2 groups given 20 and 24% rape seed than for the other 5 groups given 0-16% rape seed in the feed. This demonstrates that there is an upper limit for the share of rape seed to be used in feed mixtures for mink.

It is surprising that fat digestibility is so low, especially in F296 and F312 compared with the digestibility of rape seed oil (95%). As a whole, digestibilities are very low for all three samples. Especially the content of undigestible carbohydrate is so high that rape seed treated like this should not be used for mink feed.

Peas
In the first two experiments with peas (F293 and F294) the purpose was to determine the effect of different heat treatments on pea digestibility. The peas were, however, by mistake ground through 2 different sieves on our laboratory mill, and therefore the importance of the degree of grinding to digestibility was examined in F317.

In experiments 293 and 317 the peas were heat treated by Superfos, Holstebro in a Dantoaster at 130°C for 3-4 min., whereas the peas in experiment 294 were heat treated by Nordjysk Minkkorn in a drum drier at 160°C for 6 min. The heat treatment was done to gelatinize the starch in the peas.

Table 4. Grinding and particle size of the peas.

Experiment Group	293 -	294 -	317 2	317 3	317 4
Sieve	1.0 mm	2.0 mm (W/holes)	1.0 mm	2.0 mm (W/holes)	1.5 mm Superfos
% through 0.5 mm sieve	97.0	57.5	95.5	46.0	67.6

Table 4 shows that the particle size of the peas in groups 2 and 3 in experiment 317 corresponded to the particle size in experiments 293 and 294, respectively. In the 2.0 mm sieve used in F294 and F317 group 3 extra holes of 4-5 mm were drilled. The particle size of the peas from Superfos' normal production (group 4) was intermediary in relation to the 2 laboratory grindings.

Experiment 317 showed that the degree of grinding greatly influenced protein digestibility, as the finest degree of grinding resulted in a 7% higher protein digestibility as compared to the coarsest degree of grinding. The 12% lower digestibility of protein in experiment 294 as compared to experiment 293 may therefore be due both to the coarser degree of grinding and the higher temperature at heat treatment. In experiment 317 carbohydrate digestibility depended very much upon the degree of grinding, as this digestibility in the finely ground peas was approx. 20 %-units higher than in the coarsely ground peas. That carbohydrate digestibility was almost identical in experiments 293 and 294 in spite of the coarser grinding in experiment 294 might indicate that the higher temperature at heat treatment of the peas in experiment 294 had a positive influence on carbohydrate digestibility.

Maize gluten meal
A sample of all 5 batches of maize gluten meal was ground through a 1.0 mm sieve in a laboratory mill. An analysis showed that 64.7% could pass through a 0.5 mm sieve before grinding, and that 92.7% could pass through the same sieve after grinding.

Digestibility of both protein, fat and carbohydrate was higher than existing table values.

The content of leucin was 16.07% against only 6.8% in the Nordic Feedstuff table. As other tables also have a leucin content amounting to 16 g leucin per 16 g N, this value should be used.

Potato protein
Digestibility trials were carried out with potato protein from Brande and Langholt potato meal factories. In both experiments, only the results from the five groups given 0-12% potato protein, were used. Digestibility of the 2 products was not significantly different, neither for protein nor for fat. Protein digestibility was, however, lower than the existing table value of 86%, but at the same level as an earlier experiment with potato protein from AVEBE, Holland, which gave a protein digestibility of 81%.

Soybean meal (fullfat)
The digestibility trial was carried out as a supplement to a production trial at Research Farm North. The experiments were meant to examine whether fullfat ground, toasted soybeans are suitable for mink feed just like soybean meal and soybean oil, as soybeans are a financially attractive alternative. The toasting was done by Nordjysk Minkkorn in a drum drier with a final temperature of 134°C and a processing time of 6-7 min. The beans were moistened before toasting, and after toasting they were ground through a 1 mm sieve.

The protein digestibility found of 81.7% was fully as high as the protein digestibility of soybean meal (80%).

Fat digestibility of 90.9% was a little lower than for soybean oil (95%), whereas carbohydrate digestibility of 28.3% was identical to carbohydrate digestibility of soybean meal. Protein, fat and carbohydrate utilization in ground, toasted soybeans is thus on the same level as the utilization in soybean meal and soybean oil. The large amount of undigested carbohydrates will, however, limit the share of this feed in feed rations for mink.

Conclusion

As mentioned under Results, the digestibility of most of the known feedstuffs has not changed considerably in relation to known table values. For some feedstuffs, mainly process-dependent feedstuffs, there is reason to change existing table values or supplement existing values with new values valid for feedstuffs produced by means of processes differing to a larger or lesser extent from the previously used processes.

Literature

Glem-Hansen, N. 1979. Digestibility of feedstuffs determined in mink. Scientifur, Vol. 3, No. 2, 23-25.

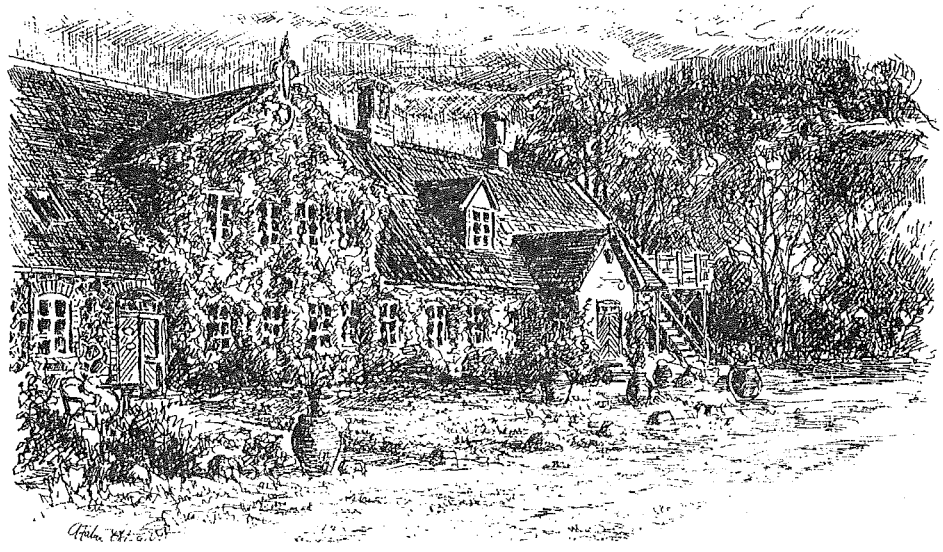
Glem-Hansen, N. & Jørgensen, G. 1972. Beskrivelse af teknikken benyttet ved fordøjelighedsog balanceforsøg med mink. Landøkonomisk Forsøgslaboratoriums Årbog, 1972, 221-223.

Glem-Hansen, N. & Jørgensen, G. 1978. Digestibility of feedstuffs determined in mink. Scientifur, Vol. 2, No. 2, 37-58.

Mejborn, H. 1984. Den sande fordøjelighed af hæmoglobinblodmel til mink. Medd. 557, Statens Husdyrbrugsforsøg. 4 pp.

Nordisk Fodermedelstabell för Pälsdjur. 1985. Udgivet af Nordiska Jordbruksforskares Förening, Subsektion för pälsdjur, 26 pp.

SAS Institute Inc. 1987. SAS/STAT Guide for Personal Computers, version 6 Editon, Cary, NC: SAS Institute Inc. 1987. 1028 pp.



Original Report

Digestibility of feeding components and nitrogen retention in polar foxes fed diets with shrimp (Leander adspersus) wastes.

M.O. Lorek, S. Florek**, I. Rusiecka****

**Animal Breeding and Productive Technology Institute*

***Animal Feeding and Fodder Institute*

****Academy of Agriculture and Technology, Olsztyn, Poland*

Summary

Because, in review of scientific literature on the subject of using meat-replacement feed stuffs in diets for carnivorous fur animals, there were not mentioned studies on the usefulness of shrimp wastes, we decided to investigate the digestibility of feed components in diets with different shares of shrimp wastes in feeding of polar foxes.
The study was done on 12 clinically healthy polar fox females at 4 month of age. Digestibility of feeding components and nitrogen retention were analysed with balance method used by other authors.

Introduction

During a one-year breeding cycle of carnivorous fur animals, the maximal need for feed in young is noted in the third and fourth quarters of year, just in the post-weaning period. Those biological conditions cause, that deficiency of feed, esp. meat-fish, is observed in this period - demand is higher than supply. Deficiency of animal origin feed can be reduced by giving meat-replacements during the young animals feeding period. However, the scientific knowledge of feeding physiology is required and should be preceded by various studies.

In literature you can read a number of papers on using different meat-replacements to feed for carnivorous fur animals. Wojcik et al. (17), in studies on using concentrates in feeding polar foxes, recorded that diet with concentrate was unwillingly eaten by animals, and morphological parameters of fox blood were reduced. However, Slawon (15) considers that high protein content concentrates used with 75% (diet energy) in the feed of polar foxes, has negative influence on productive parameters. Variety studies were done on the usefulness of waste cottage cheese as a feed for foxes and mink. According to Piereldik et al. (12) and other authors (5, 7), cottage cheese can replace 50% of meat stuffs in all breeding periods.

Jarosz (7), using cheese-replacement in the diet for mink, considered its great nutritive value, although added in appreciable amounts (60% of diet) diminished pH and taste, and influenced the rise of urea level in urine.

A the trial using oil wastes in feeding of fur animals was also undertaken. Own studies (9) on using oil wastes in feeding of polecats showed that the share of this feed in the diet improved weight gain by better total protein digestibility. Recently, a useful meat-replacement product called "livex" has been put for sale on the feed market. It contains animal blood and whey in technology prepared by Agricultural Academy in Wroclaw, Poland. Besides the nutritive value, the advantage of this product is in its regular consistency, which allows use of it in appreciable amounts in the diet without significant dilution.

In own studies (8, 10) on using "livex" in feeding foxes and ferret, it proved its great usefulness and positive influence on productive parameters.

Fish and their wastes are valuable feed stuffs in animal feed. They contribute to a great share in the animal origin feed balance. Decreased fishing levels, esp. of salt-water fish, caused their share in the diet for foxes and mink to be smaller and smaller. In that case, trials for using marine non-fish products as feeding stuff seems to be proper. Slawon (15) after Jefimowa shows the possibility to replace meat feed stuffs by Teuthoidea wastes in the diet for mink and foxes in all breeding periods. There are results of studies on using of Euphesia superba as meat substitute. Usatovs studies (16) recorded that replacement of 40% of the protein value in the diet for mink by protein from raw Euphesia superba did not diminish weight gain and coat quality, and no decrease of reproductive parameters was noted. Similar conclusions were made by Piereldik et al. (13) and Oechlenschläger (11) when replacing animal protein with Euphesia superba protein in diet for mink by 50% and 25%, respectively.

Recently, a new product appeared on the Polish feed market. This is shrimp (*Leander adspersus*) waste, after food processing.

Because, in review of scientific literature on the subject of using meat-replacement feed stuffs in diets for carnivorous for animals, there were not mentioned studies on the usefulnesss of shrimp wastes, we decided to investigate the digestibility of feed components in diets with different shares of shrimp wastes in feeding of polar foxes.

Material and methods

The study was done on 12 clinically healthy polar fox females at 4 month of age. Animals from subsequent litters were divided into 3 groups, 4 in each. The control group (I) was fed a standard diet without shrimp wastes. In the diet for group II 50% of the meat was supplied with fresh shrimp wastes, and in group III meat stuffs were replaced by dried wastes (flour) in volume comparable to the nutritive value of the fresh wastes in group II (table 1). During the balance examination animals were set in single cages adapted to quantitative feces and urine collections. A 5-day experiment period was preceded by a 5-day initial period.

Table 1. Composition and feeding value of diets.

Feed stuff	Share (%)		
	I	II	III
Beef offal	10	5	5
Various slaughter offal	40	20	20
Tough poultry wastes	10	5	5
Fresh shrimp wastes	-	30	5
Dried shrimp wastes (flour)	-	-	10
Cooked pearl barley	25	25	25
Wheat bran	10	10	10
Dried grass	5	5	5
Water	-	-	20
Mineral supplement "L" (for foxes)	0.2	0.2	0.2
Protein: energy rate	7.1	7.4	7.6
% of energy from:			
protein	31	33	34
fat	30	25	26
carbohydrates	39	42	40

Animals were fed once daily at the same time with 800 g of the experimental diets eaten to the end. Moreover, animals had continuous access to drinking water. Feces were collected every day and weighed. 1/2 of the feces sample was conserved with concentrated H_2SO_4. Next, the nitrogen content was estimated in the sample. The rest of collected feces were dried to estimate other feeding components. The urine was conserved with a 20% dilution of H_2SO_4.

Contents of feeding components in the diet and feces and nitrogen in the urine were estimated with basic methods (14).

Digestibility of feeding components and nitrogen retention were analysed with a balance method used by other authors (1, 2, 4, 6).

Results and discussion

Chemical components of diets and shrimp wastes are shown in table 2. Significant differences were found in ash, protein and fat levels. The chemical composition of shrimp wastes includes a high content of ash, which is higher than in other feed stuffs of animal origin (12, 15). Other non-fish marine products used in diets for carnivorous animals also had lower ash level, and by Slawon (15) for Teuthoidea and Euphasia superba were 2,1% and 2,7%, respectively. This has been confirmed in the chemical composition of diets with shrimp wastes, in which ash level was over 3%. This is the proof of high inorganic compounds (in shrimp wastes), mainly mineral components.

Tabel 2. Chemical composition of diets and shrimp wastes (%).

Specification		Dry matter	ASH	Organic substance	Crude protein	Crude fat	Non-nitric compounds + fibre	ME in KJ/kg of stuff
Diet for group I								
	A	32.84	1.90	30.94	9.36	10.26	11.32	5874
	B	100.00	5.79	94.21	28.50	31.24	34.47	
Diet for group II								
	A	28.23	3.10	25,13	8.16	4.75	12.22	3522
	B	100,00	10.98	89.02	28.91	16.83	43.29	
Diet for group III								
	A	30.03	3.07	26.97	8.32	4.18	14.47	3532
	B	100.00	10.22	89.78	27.70	13.91	48.18	
Fresh shrimp wastes	A	24.15	6.76	17.39	11.78	9.72	4.89	-
	B	100.00	27.99	72.01	48.78	2.98	20.25	
Dried shrimp wastes (flour)	A	87.85	22.86	64.99	43.90	2.57	18.52	-
	B	100.00	26.92	73.98	49.97	2.93	21.08	

The low protein levels and very small fat contents noted in the experimental diets had great influence on the decrease of those components by volume in the diets for the experimental groups (II, III). Especially high differences were recorded in crude fat level, which influenced the differentiation of metabolic energy in the diet (table 2).

Digestibility of feeding components is shown in table 3. The findings allow us to state that digestibility of those components, except non-nitric compounds and fiber, was lower for experimental animals. This testifies to the influence of the experimental factor (shrimp wastes) on digestibility.

Table 3. Digestibility coefficients of feed components in diets (%).

Feed components	Animal group		
	I	II	III
Dry matter	66.5	55.3	54.3
Organic substance	69.3	59.1	58.7
Crude protein	76.0	64.6	66.6
Crude fat	93.4	86.0	80.3
Non-nitric compounds + crude fibre	41.8	45.1	47.9

Significant differences were observed in protein and fat digestibility between experimental groups and control, which could be connected with the levels of mineral components. The correlation between ash and fiber levels in diets and digestibility of protein and fat were pointed out by Piereldik (12) and Slawon (15). According to these authors, a 5% increase of ash level in poultry wastes caused a 26% decrease of protein digestibility for mink. One should suppose that addition of shrimp wastes to the diet contributed to the worst use of feeding components. The correlations between fiber level in the diet and fat digestibility in polar foxes were confirmed by Bieguszewski et al. (2) in their studies.

24-hours nitrogen balance (table 4) showed that control animals consumed a higher amount of that element, which was connected with a higher content of protein in the diet (table 2). The analysis of excreted nitrogen in feces showed that experimental animals (group II and III) excreted more nitrogen, in spite of a lower dietary intake. This proves lower utilization of protein in the experimental group than in the control. Significant advantages in digestibility of nitrogen were also noted for control animals.

Table 4. Twenty-four hours nitrogen balance.

Animal group	Nitrogen (g/animal)					Utilization of nitrogen in relation to:	
	intake	excreted		digested	uptake		
		in feces	in urine			intake (%)	digested (%)
I	7.49	1.80	3.97	5.69	1.72	22.96	30.23
II	6.53	2.31	2.74	4.22	1.48	22.66	35.07
III	6.66	2.22	3.19	4.44	1.25	18.77	28.15

Recorded higher amounts of uptaken nitrogen for the control group compared to the experimental were related to higher digestibility coefficients for protein. This dependence was observed by other authors (2, 3, 6) in digestibility studies in foxes and ferrets. Nitrogen retention ratio to feed uptake for group II was similar to the control. Lower nitrogen utilization rate was observed in the group fed a diet with dried shrimp flour supplement. It is supposed that it could be connected with higher non-nitric components and fiber level in the diet for group III (table 2). It is hard to explain the increase of retaining nitrogen which was noted for group II. It could be connected with urine excretion.

In this stage of study, it is hard to find the reason for diminished protein catabolism in foxes fed diets with fresh shrimp wastes.

Conclusions

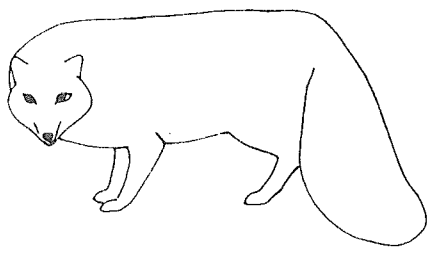
1. The addition of shrimp wastes to diets caused an increase of ash level and a decrease of protein and fat.

2. 50% replacement of meat feed with shrimp wastes decreased the digestibility of feeding components (except non-nitric components and fiber) diets for foxes.

3. Lower utilization of nitrogen by animals fed diets with shrimp wastes were shown in this study.

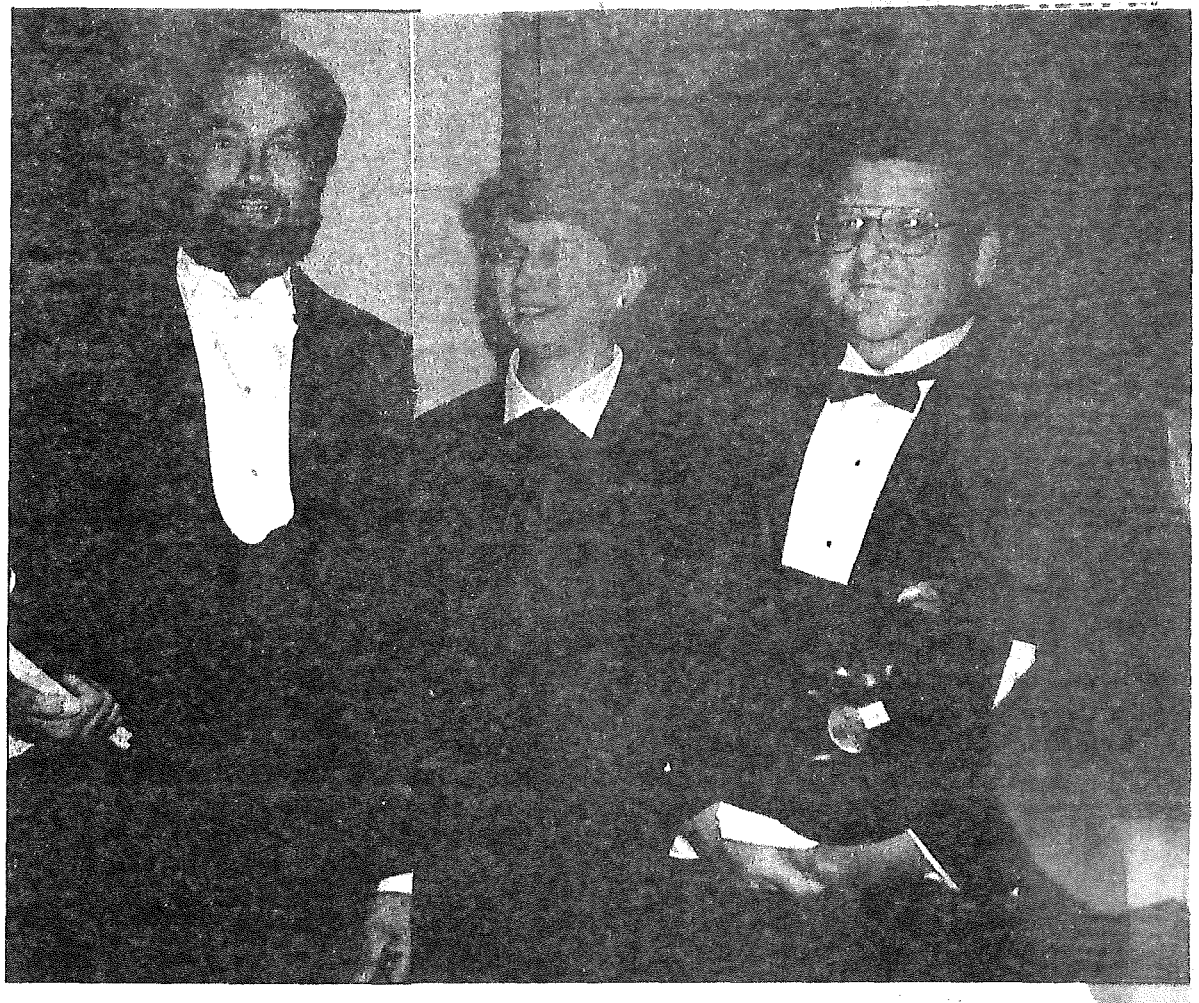
References

1. Barabasz, B., St. Jarosz. 1989. Wolyw poziomu bialka i energii w dawce na retencje azotu u ciezarnych samic tchorzyhodowlanych. Prz. Nauk. Lit. Zoot., 35, s. 54-62.
2. Bieguszewski, H., O. Lorek, R. Rajs, R.Szymeczko. 1979. Strawnosc skladnikow pokarmowuch i retencja azotu u tchorzofretek zywionych dawka pokarmowa bez udzialu bialka miesnego. Zesz Nauk. ATR Bydg. Zoot. 4, s. 23-33.
3. Bieguszewski, H., J. Zolkos. 1980. Strawnosc skladnikow pokarmowych, retencja azotu oraz niektore wskazniki krwi u tchorzofretek zywionych karma z dodatkiem krwi konserwowanej. Zesz. Nauk. ATR Bydg. Zoot. 4, s. 35-48.
4. Bieguszewski, H., O. Lorek. 1986. Strawnosc skladnikow pokarmowych i retencja azotu u jenotwo. Zesz. Nauk. ATR Bydg. Zoot. 14, s 5-9.
5. Frindt, A. 1972. Wartosc mleka i jego przetworow w zywieniu miesozernych zwierzat futerkowych. Hod. Orobn. Inwen. 6, s. 7-9.
6. Glowinska, B., H. Bieguszewski, O. Lorek. 1989. Strawnosc skladnikow pokarmowych u lisow polarnych zywionych krwia konserwowana. Prz. Nauk. Lit. Zoot. 35, s. 89-96.
7. Jarosz, St., B. Barabasz. 1983. Wsteone badania nad wykorzystaniem w Zywieniu norek duzych ilosci przeterminowanego twarogu. Zesz. Probl. Post. Nauk Rol 302, s. 139-145.
8. Lorek, O., H. Bieguszewski. 1987. Zastosowanie zeloskrzepu w zywieniu lisow polarnych Zesz. Probl. Post. Nauuk. Rol. 341, s. 201-210.
9. Lorek, O. 1987. Proba wykorzystania odpadow olejowych w zywieniu tchorzy hodowlanych. Hod. Drobn. Inwn. 7, s. 10-12.
10. Lorek, O., H. Bieguszewski, B. Glownska, R. Szymeczko. 1989. Wplyw livexu na niektore wskazniki hematologiczne i uzytkowe u tchorzofretek. Prz. Nauk. Lit. Zoot. 35, s. 97-104.
11. Oechlenschläger, J. 1980. Weitere Ergebnisse der Nerzfütterung mit Krill. Der Deutsche Pelztier 9, s. 137-138.
12. Piereldik, N. L. Milowanow, A. Jerin. 1975. Zywienie miesozernych zwierzat futerkowych. PWRiL Warszawa.
13. Piereldik, N.S., G.G. Besedina. 1978. Krillie waja muka i produktiwnost norok. Krolikovod. i Zverovod. 1, s. 22-23.
14. Skulmowski, J. 1974. Metody okreslania pasz i ich jakosci. PWRiL Warszawa.
15. Slawon, J. 1987. Zywienie lisow i norek. PWRiL Warszawa.
16. Usatow, J.S. 1977. Kril w racjone norok. Krolikov. i Zverovod., 2, s. 15-16.
17. Wojcik, S., J. Slawon, L. Saba, J. Tyczkowski, Z. Bialkowksi, A. Polonis. 1975. Ocena hematologicznych i biochemicznych wskazinikow krwi lisow polarnych niebieskich w zaleznosci od zywienia. Rocz. Nauk Rol. Seria B (3), s. 77-83



Kirsti Rouvinen doktorerade

Som kustos vid disputationen fungerade t.f. prof. Mikko Harri, Kuopio universitet, (t.h.) och som opponent prof. Derek M. Anderson (t.v.) från Kanada. I mitten Kirsti Rouvinen själv.



EFFECTS OF DIETARY FAT ON PRODUCTION PERFORMANCE, BODY FAT COMPOSITION AND SKIN STORAGE IN FARM-RAISED MINK AND FOXES

Academic dissertation

CONGRATULATIONS TO THE NEW DOCTOR FROM SCIENTIFUR!

Effects of dietary fat on production performance, body fat composition and skin storage in farm-raised mink and foxes.

Kirsti Rouvinen.

This study reveals the effects of different dietary fat sources on growth and fur quality of mink (*Mustela vison*), blue fox (*Alopex lagopus*) and silver fox (*Vulpes vulpes*) from weaning to pelting. Dietary effects on the fatty acid composition of the tissues and organs were also clarified.

Furthermore, the influence of aging during the storage of the dried raw mink and blue fox skins on their dressing properties was studied. During the growth period, no major differences in the production performance of these fur animal species could be obtained. Only colour purity of the blue and silver fox skins was shown to deteriorate when fish oil was the main dietary fat source.

Body fat composition of the animals significantly reflected the fatty acid composition of the respective dietary fat source. Moreover, the degree of saturation increases from superficial tissues towards deeper fat depots in all species studied. Also seasonal changes were observed in body fat composition, especially with the mink. The amount of unsaturated fatty acids in the skin and subcutaneous fat showed a significant increase towards winter. Furthermore, blue and silver foxes differed from mink in their liver fat composition. In these species, high amounts of the polyunsaturated omega-3 fatty acids concentrated in their livers when fed diets abundant in fats of fish origin. This is apparently an indication of impaired ability to oxidize these fatty acids by the liver mitochondria in foxes compared to mink.

Adding an ethoxyquin based antioxidative agent to blue fox diets, 200-1000 ppm during 3 weeks before pelting, was shown to be toxic to the animals. It caused cholestasis and fatty degeneration of their livers. Further testing of the safety limits of ethoxyquin in fox diets is suggested. During storage, the natural fat residues in the dried raw skins are shown to peroxidize and cause damage to the skin fiber structure. Dietary background of the animals was, however, not of big importance as regards the dressing properties of the furskins.

One-year cold storage was shown to damage blue fox skins and adversely affect their dressing properties; especially shrinkage temperature of the skins was lowered dramatically. This is probably due to changes in air humidity in the storage room and water condensation in the skins. Mink skins, however, tolerate the same circumstances fairly well. If blue fox skins have to be stored for longer periods of time, either air-tight freezing of the skins, preferably before conservation, or tanning is recommended.

This thesis is based on the following papers

I K. Rouvinen, P. Niemelä & T. Kiiskinen, 1989. Influence of dietary fat source on growth and fur quality of mink and blue fox. Acta Agric. Scand. 39, 269-278. Scientifur, vol. 14, No. 1, pp 39.

II K. Rouvinen & T Kiiskinen, 1989. Influence of dietary fat source on the body fat composition of mink (Mustela vison) and blue fox (Alopex lagopus). Acta Agric. Scand. 39, 279-288. Scientifur, Vol. 14, No. 1, pp 39.

III K. Rouvinen & E. Mäntysalo, 1989. Influence of fatty acid composition in dried raw mink and blue fox skins on their storage aging and dressing properties. Acta Agric. Scand. 39, 289-300. Scientifur, Vol. 14, No. 1, pp 24.

IV K. Rouvinen, R. Inkinen & P. Niemelä, 1991. Effects of slaughterhouse offal and fish mixture based diets on production performance of blue and silver foxes. Acta Agric. Scand. 41, in press. Present issue.

V K. Rouvinen, 1991. Dietary effects of omega-3 polyunsaturated fatty acids on body fat composition and health status of farm-raised blue and silver foxes. Acta Agric. Scand. 41, in press. Present issue.

VI K. Rouvinen, M.Marjoniemi, M. Eskolin, E. Mäntysalo & S. Nummela, 1992. Pervention of storage aging in dried raw blue-fox skins. Acta Agric. Scand. A2, in press. Present issue.

VII K. Rouvinen & T. Kiiskinen, 1991. High dietary ash content decreases fat digestibility in the mink. Acta Agric. Scand. 41, 375-386. Present issue.

Thesis. 56 pages + 6 original reports according to the list. 80 references.

Effects of slaughterhouse offal and fish mixture based diets on production performance of blue and silver foxes.

Kirsti Rouvinen, Ritva Inkinen, Paavo Niemelä.

A production experiment with blue and silver foxes was performed in order to reveal the long-term effects of feeding a diet abundant in polyunsaturated omega-3 fatty acids during the growth period. The main emphasis was on the growth performance and general fur characteristics of the animals. The experiment consisted of 200 blue foxes and 44 silver foxes and it lasted from July to pelting in 1988. The experimental diets were a SH = slaughterhouse offal based diet and a FM = fish mixture based diet supplemented with fish oil. The fat level of the diets was 20% in the dry matter. In both fox species, there were no great differences between diets in the body weight of the animals at pelting. Only blue fox males in the FM dietary group were lighter than those in the SH group. In silver foxes, the dried raw skins were longer in the FM group than in the SH group. Fur characteristics were in general better in both blue and silver foxes on the FM diet than on the SH diet, except for the color purity of the fur skins, which was shown to deteriorate on the FM diet. Improved fur quality was, however, probably not due to the fish oil supplementation, but rather to the higher protein content of the FM diet. Animal losses on the FM diet (12) were higher than on the SH diet (1) in blue foxes. In the silver foxes studied, 2 animals died in the FM group. The deaths most were likely caused by an excessively low feed temperature and , consequent to that, diarrhea, because the FM diet was mainly composed of frozen ingredients. Blue and silver foxes also differed from each other in feeding behaviour, which may have worsened the situation of the blue foxes. No clear differences could be shown in the animal growth performance of either blue or silver foxes. The deleterious or beneficial effects found in this experiment were probably not related to the accumulation of polyunsaturated omega-3 fatty acids in the animal tissues and organs. The time period from July to pelting is likely to be too short to affect production performance.

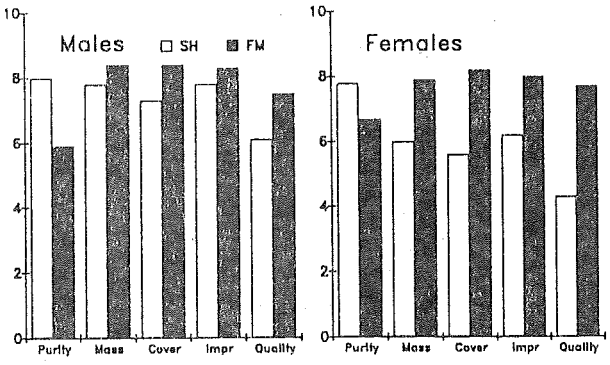


Fig. 5. Fur characteristics in male and female blue fox skins according to a scale ranging from 1 (poorest) to 10 (best). See also Table 4.

Acta Agric. Scand., 41:387-399, 1991. 5 tables, 6 figs., 31 refs. Authors' summary.

Dietary effects of omega-3 polyunsaturated fatty acids on body fat composition and health status of farm-raised blue and silver foxes.

Kirsti Rouvinen.

Farm-raised blue and silver foxes were fed diets based on slaughterhouse offal (SH) and fish mixture supplemented with fish oil (FM) from weaning to pelting in order to clarify the effects of accumulation of omega-3 fatty acids in the tissues and organs. Some blue foxes were also fed an antioxidant (Rexoquin®, 200-1000 ppm) supplemented diet. The dietary background of the animals significantly influenced the fatty acid composition of all body fat depots in both fox species. The animals of the FM group had considerably more eicosapentaenoic (EPA), docosahexaenoic (DHA) and cetoleic acids in their tissues than the animals of the SH group. In silver fox livers, the amount of DHA was even higher than in blue foxes. The fat accumulation pattern of the blue and silver fox livers also differed considerably between the diets. In the SH diets fat accumulated in the liver in large droplets, while in the FM diets it was present in small droplets. Furthermore, degenerative changes were more numerous and severe in the FM dietary group. The antioxi

dant supplementation of the blue fox diets employed appeared to be toxic to the animals. It increased liver fat content, which was also seen as fatty degeneration of the liver. The increase in the levels of the serum transaminases ALAT and ASAT was clearly connected with the disturbances in liver functions and degenerative changes. Also an increase in serum cholesterol was observed in animals with cholestatis. Liver vitamin A and selenium levels were higher in the FM diets in silver foxes. In blue foxes, the antioxidant supplementation employed had no influence on the vitamin status of the animals.

Acta Agric Scand., 41:401-414, 1991. 5 tables, 41 refs. Author's summary.

Prevention of storage aging in dried raw blue fox skins.

Kirsti Rouvinen, Marja Marjoniemi, Marianne Eskolin, Esa Mäntysalo, Seppo Nummela.

Ninety dried raw blue-fox skins having two different dietary backgrounds, saturated fat and fish fat feeding, were submitted to the following experimental treatments: dressing after pelting; control storage at +8°C or at -20°C; antioxidant diet, storage at +8°C or at -20°C; butylhydroxytoluene (BHT) drumming, storage at +8°C or at -20°C; nitrogen gas, storage at +20°C; and pickling, storage at +8°C. Each storage group contained five skins from both dietary groups. Storage duration for the dried raw skins was approximately one year, during which the changes in their fatty acid compositions were analyzed. After the storage period the skins were dressed and the physical characteristics of the leathers were determined.
The dietary background of the animals had a significant influence on the fatty acid profiles of the dried raw skins, but it did not affect their fat peroxidation during storage. Moreover, freezing at a temperature of -20°C or the antioxidant treatments employed did not prevent lipid peroxidation in the skins. In the pickle-treated skins the changes in the fatty acid profiles were even more pronounced than in the other groups. The only skins in which the fatty acid composition stayed constant were those stored in nitrogen gas.
The dietary background affected the breaking load and the elongation at break of the leather. Based on the measured physical characteristic of elongation at break, the quality of the leather decreased when the skins were stored in circumstances involving oxygen. The storage period is recommended to be kept to a minimum time, and storage temperatures above ±0°C should be avoided, because of water condensation. The results also emphasize careful conservation and proper handling of the dried raw skins.

Acta Agric. Scand., Sect. A, Animal Sci. 42:54-62, 1992. 1 table, 7 figs., 20 refs. Authors' summary.

High dietary ash content decreases fat digestibility in the mink.

Kirsti Rouvinen, Tuomo Kiiskinen.

This study clarifies the effect of high dietary ash and calcium on fat and fatty acid digestibilities in the mink. Differences between various calcium sources are also evaluated. We performed three digestibility experiments by the total collection method with 30 adult male mink of standard genotype. Each experiment had two dietary fat sources, beef tallow and rapeseed oil, and three different ash levels, 4, 8, and 14 % in dry matter (DM) of the diet. Ash level in the diets was increased either with limestone grist (experiment A), fish offal meal (experiment B), or bone meal (experiment C). Fat level in the diets was 20% in DM. In experiment A, the digestibility of beef tallow decreased from 76 to 67 % and the digestibility of rapeseed oil from 94 to 85 % with increasing ash level. In experiment B, digestibility coefficients for beef tallow and rapeseed oil varied between 67-70 and 94-95, respectively. In experiment C, the digestibility of beef tallow decreased from 87 to 66 % and that of rapeseed oil from 96 to 94 % with increasing dietary ash content. The amount of saponified fat in feces increased in all experiments with increasing dietary ash and calcium. In the beef tallow diets, however, the amount of saponified fat was significantly higher than in the case of rapeseed oil. There were also differences between ash sources in their activity to form soaps in the gut environment. Limestone grist and bone meal seem to be more reactive than fish offal meal. Not only is the level of ash and calcium important but also the source and fatty acid composition of the dietary fat. Saponification also seems to interfere during fatty acid analysis causing a distortion of varying magnitudes depending on the dietary ash and fat sources and the extraction methods used. The digestibility coefficients determined in this study for individual fatty acids are thus more reliable

the lower the dietary ash content is and the more unsaturated the fat source in question.

Acta Agric. Scand., 41:375-386, 1991. 6 tables, 23 refs. Authors' summary.

Fish oil and rapeseed oil as main fat sources in mink diets in the growing-furring period.

Anne-Helene Tauson, Maria Neil.

Effects of dietary fat source and level on feed consumption, weight gain, fur quality characteristics and some physiological parameters were investigated on 9 groups of pastel mink kits. The fat level was moderate or high (main fat source 18% or 25% each of slaughter-house offal and poultry wastes; 3% or 6% fish oil; 3% or 6% 00-variety rapeseed oil, respectively, on a wet diet basis). High fat slaughter offal products and fish oil-based diets were supplemented with vitamin E according to standards or with extra 6 mg per animal and day. Slaughter offal, rapeseed oil and the moderate level of fish oil supported a normal and similar growth rate. On the high fish oil level, weight gain and ME intake were impaired and white underfur was recorded. Hemoglobin and hematocrit values confirmed the incidence of anemia in these groups, the rate being lower when extra vitamin E was given. Anemia was probably caused by high levels of dietary PUFA. Animals fed rapeseed oil had significantly higher T_4 values and elevated ME intake compared with the slaughter offal control. Fur quality characteristics were superior in the rapeseed oil-based diets and worst in the slaughter offal groups, which was explained by differences in fatty acid composition.

J. Anim. Physiol. a. Anim. Nutr. 65, 84-95, 1991. 6 tables, 1 fig., 35 refs. Authors' summary.

Varied dietary levels of biotin for mink in the growing-furring period.

Anne-Helene Tauson, Maria Neil.

An investigation was carried out on the effects of varied levels of dietary biotin with 5 groups, each of 20 male and 20 female mink kits of the standard and the sapphire colour types, respectively. A balanced diet was fed without or with 0.1 mg biotin supplementation per kg dry matter (DM). Further, a diet based on feedstuffs with low natural biotin content was fed without biotin supplementation, with biotin supplementation up to the minimum requirement for growth or to double this level. The analysed biotin contents were above the calculated for all diets, but the contents of the low biotin diet were close to the minimum requirement for growth. No symptoms of biotin deficiency were documented. Only moderate differences in performance were found between groups. The weight gain of animals fed the low biotin diet was somewhat poorer than for animals fed the standard diet, regardless of biotin supplementation, which was explained by differences in palatability between diets. There was a tendency for a rougher hair coat of the animals on the lowest biotin level during the rearing period but this was not confirmed when the pelts were graded for fur quality characteristics, apart from a tendency for a higher frequency of fur defects in this group. There were no clear-cut positive effects of extra biotin supplementation of a balanced diet. It was concluded that biotin deficiency in practical feeding when no avidin-containing feedstuffs are used is unlikely to occur.

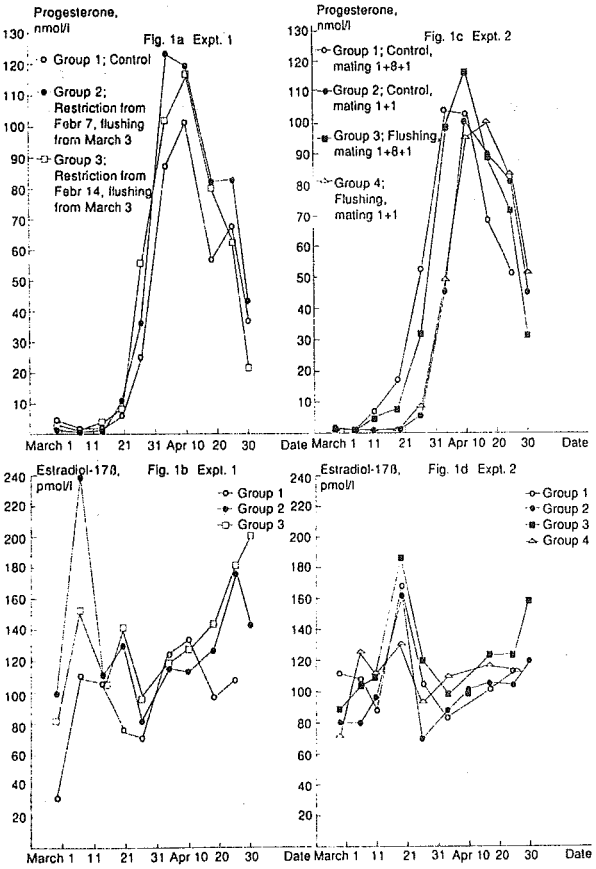
J. Anim. Physiol. a. Anim. Nutr. 65, 235-243, 1991. 5 tables, 25 refs. Authors' summary.

Effect of flushing on plasma progesterone and plasma estradiol throughout gestation in mink.

Anne-Helene Tauson.

Effects of flushing on reproductive performance in standard mink females were evaluated with yearlings (expt. 1), adults (expt. 2) and with yearlings and adults (expt. 3). Effects of the length of the preceding restriction period were evaluated (expt. 1). In expts. 2 and 3, two control and two flushing groups were used, one of which was mated days 1 + 8 + 1 and the other days 1 + 1 from March 18. Per group 5 females were blood-sampled for plasma levels of progesterone and estradiol-17ß. Samples were taken once a week from February 27 until April 30 (expts. 1 and 2) or three times a week from March 20 to April 15 (expt. 3). Animal live weights and reproductive data and in expt. 3 also number of corpora lutea (CL) and implantation sites were recorded. Estradiol-17ß had peak values on March 6 in yearlings and on March 19 in adults. Late in the sampling period, estradiol-17ß increased again. In yearlings (expt. 1), estradiol-17ß levels were significantly

increased by flushing. A similar tendency was found in expt. 3. Flushing significantly increased the number of CL (expt. 3). Plasma progesterone tended to increase faster and to have higher peaks in the flushed groups in expt. 1, but in expt. 2 there was no effect of flushing.



Figs. 1a–1d. Expts. 1 (a–b) and 2 (c–d). Plasma progesterone and estradiol 17-β profiles of females exposed to different flushing models (a–b), flushing and different mating systems (c–d). SEM (between treatment within day of sampling comparison). – a. 10–14; b. 17–44; c. 8–9; d. 14–35

J. Anim. Physiol. a. Anim. Nutr. 66, 100–110, 1991. 4 tables, 2 figs., 25 refs. Authors' summary.

Feeding of mink during pregnancy.

Vilhelm Weiss.

Slightly restricted feeding of female mink on an individual basis from fertilization until after implantation, i.e., up to about 10 April, is advised. Following implantation, the amount of feed can be increased slightly for the next 30 days, but none should be left uneaten; immediately before expected parturition feed intake should again be decreased. The adverse effects of excessive feed supply during pregnancy are explained.

Dansk pelsdyravl, 54;2, 41–42, 1991. In DANH. CAB-abstract.

Fat - effects of added fat (in mink).

E. Alden.

The effects of giving a basal diet containing 0, 2 or 4 % added fat (digestible fat 950 g/kg and metabolizable energy 37 MJ/kg) to mink from July until pelting were studied.

Vara pälsdjur, 58;2, 57–59, 1987. 5 tables. In SWED. CAB-abstract.

Examination of value and usefulness of raw meat and meal of polar fox carcasses and the source of animal protein in the feeding of polar foxes.

I. Kosko, O. Lorek.

The aim of the work has been to determine the nutritive value of raw meat and meal of polar fox carcasses as well as to examine their usefulness in the feeding of polar foxes.
On the grounds of obtained results of chemical and aminoacid composition, it is stated that fox meat contains a high level of crude protein (20.42%) and its amino acid composition, the quality being considered, makes the protein of high nutritive value. The value of protein measured by means of exogenous amino-acid index (WA-Oser) is 78 for raw meat and 76 for meal. The high level of lysine of exogenous amino-acids (8.67 g in 100 g of protein) deserves special attention. It has been determined that the influence of feeding young foxes with raw meat and meal of fox carcasses upon production effects was expedient. Experimental animals ate the given feeds willingly, and no diseases were reported during the experiment. In the experimental group in which fox meat constituted 50% of the meat feeds the animals reached a higher final body weight than the controls fed without fox meat. The final body weights of animals fed with meal from fox carcasses which constituted 50% of the animal protein in a 24 hour ration were also higher. On account of greater body weight in the experimental group, a greater number of skins has been

classified into the largest size i.e. 0 and 1.

There were 95.4% skins of the largest size in group I and in group II (control) 87.5%. On the grounds of the obtained positive results of the research one may assume that carcasses of fox or other fur-bearing animals obtained from winter slaughter could be valuable raw material for the Feed Factory "Bacutil" for production of meat meal of high nutritive value which could be used for production of substantial feeds for various animals.

Acta Academiae Agriculturae ac Technicae Olstenensis, Zootechnica, No. 32, 231-240, 1989. 4 tables, 3 refs. In POLH, Su. ENGL, RUSS. Authors' summary.

Chastek paralysis: a case of thiamin deficiency in mink.

T. Mejerland.

At a farm where the diet contained 30% fresh poultry carcass waste and Baltic herring, many young mink refused to eat or ate little and were thin, but not emaciated, and in poor condition. Symptoms were: abnormal movement, cramps, paralysis and some deaths. Breeding stock was little affected. Response to a test injection of thiamin chloride and other B vitamins was rapid, except in advanced cases. The treatment programme included addition of thiamin to the water supply, extra vitamin mixture and reduction of the herring content in the diet, as well as vitamin B injections.

Vara Pälsdjur, 61;6, 170-171, 1990. In SWED. CAB-abstract.

Energetics of animal production.

Andre Chwalibog.

Principles and results concerning Danish research during the last 10 years on energetics of animal production are reviewed. All presented results have been obtained by means of the respiration plant in Copenhagen working according to the indirect calorimetry technique. In the first part of the paper, the concepts of maintenance requirement and efficiency of metabolizable energy utilization for growth, egg and milk production are examined. Subsequently, different methods for estimation of maintenance and energy utilization are described and illustrated with 30 equations. The specific problems concerning the methodology and interpretation of the results are deliberated. Finally, the general issues concerning animal energetics are discussed and a new procedure for estimation of energy utilization is proposed.

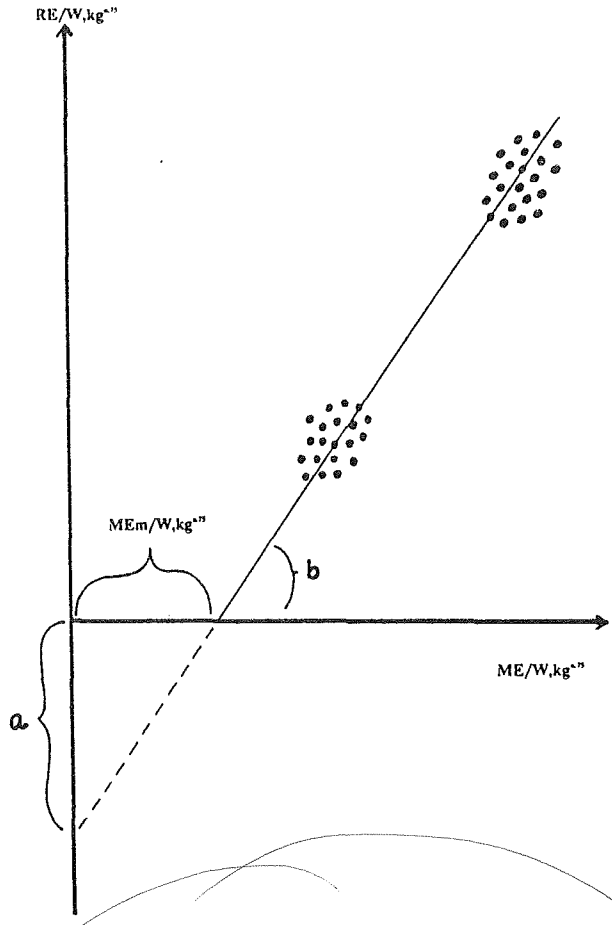
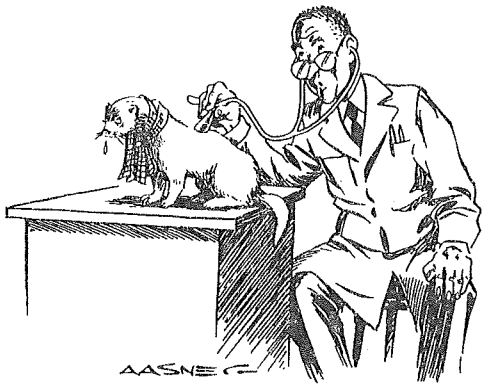


Fig. 2. Model for determination of energy requirement for maintenance and efficiency of ME utilization based on regression of RE/W, $kg^{0.75}$ on ME/W, $kg^{0.75}$.

Acta Agric. Scand. 41, 147-160, 1991. 6 tables, 2 figs., 30 refs. Author's summary.



Studies on the progression of Aleutian disease in mink.

Bent Aasted, Henrik Hauch.

One hundred ninety five male ADV-negative mink, including 79 pairs of brothers, were followed in their response to natural ADV-infection caused by mating with ADV-positive females and under epidemic conditions. Special attention was drawn to the development of progressive versus non-progressive Aleutian disease. This was done by plasmaelectrophoresis, detection of antibodies to ADV, and finally by macroscopical examination of mink organs at pelting time. We found that the progression of Aleutian disease presumably is under some genetic influence. We also found indication of differences in the response to ADV depending on how the infection was introduced. Mating to positive females (low virus concentration) resulted in significantly higher proportion of non-progressive responders than infection under epidemic conditions (high virus concentration).

Acta vet. scand., 29, 315-321, 1988. 2 tables, 12 refs. Authors' summary.

Treatment of neonatally Aleutian disease virus (ADV) infected mink kits with gammaglobulin containing antibodies to ADV reduces the death rate of mink kits.

Bent Aasted, Søren Alexandersen, Mogens Hansen.

Aleutian disease virus (ADV) can cause pneumonitis in newborn kits up to 3 weeks old. In many cases the pneumonitis is fatal, but can be reduced by treatment with antibodies to ADV. The present report describes antibody therapy in both experimentally infected mink kits and in mink kits from a farm, where an ADV epidemic developed during the whelping period in the spring of 1987. In both cases, the antibody treatment was found to have a beneficial effect on the survival rate of the mink kits. One hundred percent survival rate was found for the experimentally infected mink kits. The most pronounced effect for the naturally infected mink was found in the wildtype mink kits, where the death rate was 9.6% for the antibody treated group versus 16.9% for the untreated group ($p < 0.001$). In general the success rate of the gammaglobulin treatment seemed to correlate with the ADV-infection level in the mink sheds. The highest success rate was found in the sheds with the highest ADV-infection level (the standard and wildtype mink), while no effect whatsoever was found for the pearl mink, which were placed in a shed with a low ADV-infection level.

Acta vet. scand., 29, 323-330, 1988. 2 tables, 17 refs. Authors' summary.

Virus-specific ß-lymphocytes are probably the primary targets for Aleutian disease virus.

Bent Aasted, R.G.Q. Leslie.

368 1- to 5-year-old mink of wild-type or black genetic background were infected with Aleutian disease virus (ADV) naturally or using virus-containing immune complexes or purified virus. Thirty of the mink were immunized with dinitrophenol-conjugated ovalbumin (DNP-OA) before and during infection. Blood samples were taken at monthly intervals. We found that weak (and transient) monoclonal or oligoclonal immunoglobulin components were present in the plasma or serum approximately 1 month after injection, as judged by zone electrophoresis. In a few cases, we found quite stable myeloma-like hypergammaglobulinemia, which usually occurs much later in the infection. All sera with monoclonal immunoglobulin components and most of the sera with immunoglobulins of restricted heterogenicity were analysed by crossed serum line immunoelec

trophoresis. In all cases, the distinct immunoglobulins were found to have antibody activity to ADV proteins. In the few sera from DNP-OA-immunized mink showing restricted immunoglobulin heterogenicity, this was also the case. The findings from the study imply that ADV-specific ß lymphocytes are probably the primary targets for ADV. The resulting ADV replication introduces a "pseudo-transformation" stage, so that the infected ß lymphocytes proliferate and differentiate to an extreme degree. The mechanism behind this ß-cell pseudotransformation ability of ADV is a puzzle. It may, however, be important, that the p75/85 structural polypeptides of ADV contain an amino acid sequence almost identical to the GTP-binding pocket of the Ras oncogene.

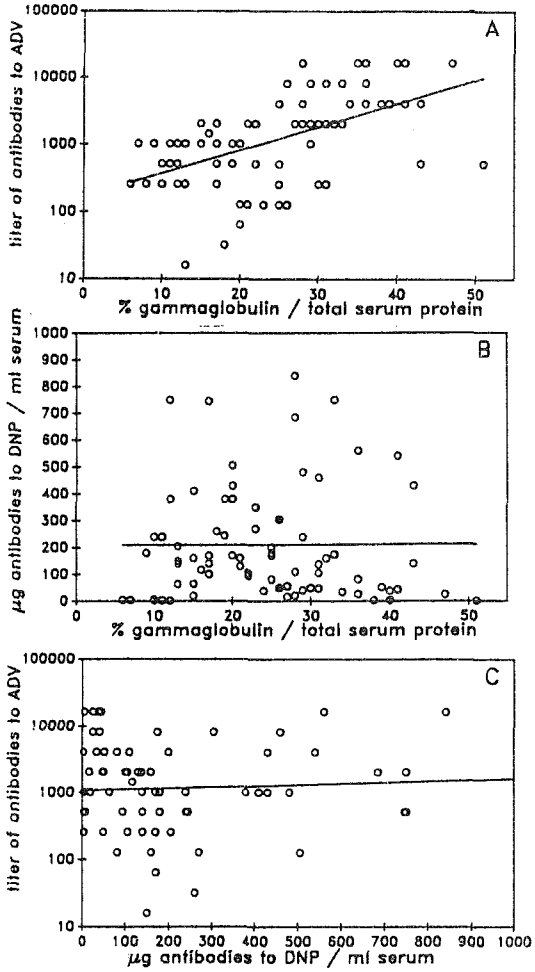


Fig. 5. Correlations among serum gammaglobulin percentage, antibodies to DNP and antibodies to ADV in 80 mink sera. Correlation coefficients: Curve A: r=0.56; curve B: r=0.004; curve C: r=0.064.

Vet. Immunol. Immunopathol., 28, 127-141, 1991. 1 table, 6 figs., 28 refs. Authors' summary.

Parvovirus and reproductive problems in blue foxes. Field data and experimental infection.

A. Indrebø, B. Hyllseth.

The studies did not provide any evidence that parvovirus is a cause of fetal death or female infertility in blue foxes, and it was concluded that vaccination of those animals against the infection is, therefore, unnecessary in Norway.

Norsk Pelsdyrblad, 64;12, 14-15, 1990. 3 tables. In NORG. CAB-abstract.

Construction and nucleotide sequence analysis of an infectious DNA clone of the autonomous parvovirus, mink enteritis virus.

Tsutomu Kariatsumari, Motohiro Horiuchi, Etsuko Hama, kazuhiko Yaguchi, Naotaa Ishigurio, Hitoshi Goto, Morikazu Shinagawa.

We have cloned the replicative form (RF-) DNA of mink enteritis virus (MEV), constructed an infectious recombinant plasmid containing MEV DNA and determined the nucleotide sequence of the cloned MEV DNA. RF-DNAs were detected and infectious virus was generated when the recombinant plasmid containing the entire MEV genome was introduced into feline kidney cell cultures. The MEV genome was 5094 nucleotides (nt) in length; the 3' end of the virion strand contained a 205 nt palindromic sequence and the 5' end a 62 nt palindromic sequence that could assume Y- and U-shaped configurations, respectively. The 5' end of the virion strand had a direct repeat of 61 nt at the carboxyl terminus of the capsid protein gene. The organization of the MEV genome is similar to those of canine parvovirus (CPV) and feline panleukopenia virus (FPLV); there are two large open reading frames (ORFs), one in the 3' half and the other in the 5' half of the genome, with coding capacities of 668 and 722 amino acid residues, respectively. Both are in the same reading frame and no significant ORFs are apparent in the virion strand (negative-sendse strand). Possible functional promoter motifs are located at map unit (m.u.) 4.5 and m.u. 40, and a possible functional poly (A) signal is located at m.u. 96. The nucleotide and amino acid sequence homology with CPV and FPLV is greater than 98%, consistent with the hypothesis that MEV and CPV are host-range variants of FPLV.

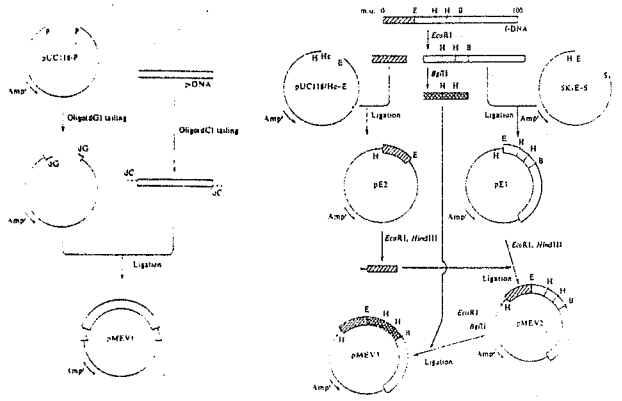


Fig. 1. Construction of MEV DNA clones. pMEV1 was constructed using protein-bound RF-DNA after proteinase treatment. pMEV2 and pMEV3 were constructed using protein-free RF-DNA. Vector DNA is represented by solid lines and MEV DNA is represented by open or hatched boxes. The details are described in Methods. Abbreviations: P, *Pst*1; E, *Eco*RI; H, *Hind*III; B, *Bg/*II; S, *Sma*I; Hc, *Hinc*II; dG, oligo(dG) tail; dC, oligo(dC) tail.

Journal of General Virology, 72, 867-875, 1991. 2 tables, 9 figs., 43 refs. Authors' summary.

Parvovirus and reproductive problems in the blue fox in Norway. A serological survey and reproductive data.

Bjørn Hyllseth, Astrid Indrebø.

A serological survey of antibodies to parvovirus in the blue fox (*Alopex lagopus*) was carried out using the hemagglutination-inhibition test (HIT) with raccoon dog (*Nyctereutes procyonoides*) faecal virus as antigen and erythrocyte-absorbed and kalolin-treated sera. Titers ≥ 40 were considered as positive. Blood samples were collected from 585 vixens in 37 farms situated in 9 counties (table 1), and the tested vixens represented 13% of the total number of vixens in the farms investigated. The selected vixens were animals that were mated last season, but were either empty, had small litters or had lost their cubs. The investigation showed that 15 of the 37 farms (41%) were seropositive, and 13% of the total of 585 vixens investigated were postitive. Twenty-eight percent of the 268 vixens in the 15 positive farms were seropositive. Farms with poor reproductive results were assigned to group 1 and those with good results to group 2. This grouping was based on average litter sizes being at least 0.2 cubs less or more, respectively, than the overall average for Norway (table 13. In group 1 the average litter sizes for negative and positive farms were 3.17 (± 0.68) and 3.19 (± 0.67), respectively. In group 2 the corresponding figures were 6.01 (± 0.98) and 6.45 (± 0.89). There were no statistically significant differences within each group or between the farms that had high antibody titers (≥ 1280) (table 2) when compared with the seronegative farms in either group 1 or 2 (table 3). There was no definite evidence in the serological, reproductive or clinical data to indicate an association between parvovirus infection and poor reproductive results in blue foxes in Norway.

Norsk Veterinaertidsskrift, 101;8-9, 681-685, 1989. 3 tables, 11 refs. In NORG, Su. ENGL. Authors' summary.

Procedure for, and efficacy of Aleutian disease eradication in Denmark.

M. Hansen.

Between 1976 and 1989 the number of mink farms increased from 2400 to 5100, and the number of mink from 800.000 to 2 million. Testing for Aleutian disease was done on 80% of farms, which were placed in 6 grades according to the proportion of positive animals. The occurrence of infertility was greater and mortality was higher on the most heavily infected farms. It was difficult to maintain freedom from infection.

7 Arbeitstagung über Haltung und Krankheiten der Kaninchen. Pelztiere und Heimtiere, 31 Mai bis 1 Juni 1990 in Cell, p. 241-248. 5 tables, 2 figs. In GERM. CAB-abstract.

Detection of coronavirus-like particles from mink with epizootic catarrhal gastroenteritis.

J.R. Gorham, J.F. Evermann, A. Ward, R. Pearson, D. Shen, G.R. Hartsough, C. Leathers.

Corona-virus-like particles have been detected by electron microscopy in fecal samples from na

turally occurring cases of epizootic catarrhal gastroenteritis (ECG) of mink. Preliminary transmission trials with bacteria-free filtrates from mink with ECG suggested that a coronavirus plays a role in the disease syndrome.

Can J Vet Res, 54: 383-384, 1990. 1 fig., 12 refs. Authors' abstract.

The occurrence of thermophilic campylobacter in mink and an experimental oral infection of pregnant mink by *Campylobacter jejuni*.

M.L. Hänninen, T. Ekman, T. Saranpää, M. Valtonen.

The occurrence of *C. jejuni* in the intestinal contents of mink and in mink feed prepared from fresh, untreated slaughter offal, was studied. The farms and the central feeding kitchens, from which the intestinal and feed samples were collected, were situated in the northwestern part of Finland. All mink samples, originating from 9 farms, and feed samples, originating from 2 central feeding kitchens were negative for *C. jejuni* and for *C. coli*. The only positive faecal samples were obtained from a farm located in the southern part of Finland.
Experimental colonization of *C. jejuni* was followed in 10 pregnant mink during their last trimester of pregnancy. The animals colonized only transiently with *C. jejuni*. Five of the animals shedded campylobacters only for 1-2 weeks after inoculation. Two experimental animals aborted. These animals were colonized at the time of abortion with *C. jejuni*. The association of *C. jejuni* infection to abortion was not, however, confirmed. The uterine contents and the fetuses examined were negative for campylobacters.

Acta vet. scand. 29, 463-468, 1988. 1 table, 1 fig., 16 ref. Authors' summary.

Evaluation of *Campylobacter jejuni* colonization of the domestic ferret intestine as a model of proliferative colitis.

Judith A. Bell, Dean D. Manning.

Forty 3- to 17-week old domestic ferrets, including 2 gnotobiotes, were inoculated orally and/or rectally with 10^6 to 10^9 colony-forming units of 1 or more of 4 strains of *Campylobacter jejuni*, 3 of mink and 1 of human origin. Feeding or gavage of any of the 4 strains, in milk or broth, with or without preinoculation sodium bicarbonate treatment to neutralize stomach acid, induced colonization in 38/40 ferrets; diarrhea lasted 2 to 4 days in conventional kits, 6 days in gnotobiotes. Bacteremia was detected in 4 of 18 tested, 2 to 5 days after inoculation. Two strains caused no more severe disease or prolonged colonization after 3 serial IV passages in kits than they did before passage. Multiple inoculations with a given strain resulted in progressively briefer colonization and milder disease, but subsequent inoculation with a different strain induced colonization and gastrointestinal disease similar to a primary infection. Five kits inoculated rectally after 4 previous homologous inoculations were resistant to colonization as well as to disease. Agglutinin titers of ferrets inoculated orally or rectally once were low or undetectable, but increased in response to repeated inoculation. Pretreatment with a 1% formalin enema caused mild colon irritaion without clinical or histologic evidence of proliferative colitis in ferrets concurrently inoculated orally and/or rectally, whether or not they had preexisting antibodies to any strain of *C. jejuni*. Histologic examination of tissues revealed leukocytic infiltration of intestinal lamina propria in 29 of 35 infected kits and 5 of 8 non-infected controls, and cryptosporidiosis in 5 infected kits plus 1 control. Examination of silver-stained sections of intestine from 15 infected ferrets revealed *Campylobacter*-like organisms on the surface of, but never inside, epithelial cells. The lack of characteristic gross or histologic lesions suggested that *C. jejuni* is not, by itself, responsible for proliferative colitis in ferrets.

Am J Vet REs, Vol. 52, No. 6, 826-832, 1991. 3 tables, 20 refs. Authors' summary.

Role of temporary intestinal brush border dysfunction in *Campylobacter jejuni* diarrhea.

Judith A. Bell, Dean D. Manning.

The pathophysiologic effects of *Campylobacter jejuni* on weanling ferrets were investigated by assessing jejunal disaccharidase activities, glucose and theophyline stimulation of jejunal mucosal ion transport, fecal levels of reducing sugars, and histologic appearance of the gut. Compared with uninoculated controls, ferrets at the peak of *Campylobacter*-induced watery diarrhea exhibited

two- to threefold reductions in sucrase, maltase, and lactase activity, a sixfold lower short-circuit current response to glucose stimulation, and a twofold higher response to theophyline stimulation, plus a striking increase in fecal levels of reducing sugars. These physiologic alterations rapidly returned to normal as diarrhea subsided. Jejunal epithelial cells of all diarrheic animals appeared morphologically normal by light microscopy. Passively immunized kits, heavily colonized but not diarrheic, were indistinguishable from controls in every assessment. These observations suggest that (i) *Campylobacter jejuni* exerts its pathophysiologic effect primarily by inducing a transient depression of intestinal brush border function and (ii) such effects can be prevented by humoral antibodies.

Current Microbiology, Vol. 21, 355-359, 1990. 1 table, 28 refs. Authors' summary.

Possible effect of vaccination against *Trichophyton mentagrophytes* infection in a Swedish fox farm.

L. Englund, R. Mattson, L.T. Berndtson.

Based on experience in 1987 with the attenuated live *T. mentagrophytes* vaccine Mentavak (Medexport, Moscow, USSR) on a Swedish fox farm where silver and blue foxes were bred, it was suggested that a large-scale study would be worthwhile, because of the apparent efficacy of the vaccine. I.m. injection of infected adults with 3 ml and pups with 2 ml on 2 occasions, with an 8-day interval, and prophylactic injection of apparently healthy adults with 2 ml and pups with 1 ml of the vaccine resulted in all animals becoming clinically healthy. Cages, nest boxes and soil in contact with the animals were treated with an iodophor disinfectant. The following year all of the 850 pups were vaccinated with 1 ml Mentavak after positive hair samples and a positive soil sample had been found. No further cases occurred.

Acta vet. scand., 31, 121-123, 1990. 1 fig., 9 refs. CAB-abstract.

Bleomycin chemotherapy for metastatic squamous cell carcinoma in a ferret.

Terrance A. Hamilton, Wallace B. Morrison.

Bleomycin, an antitumour antibiotic, was effective in temporarily reducing the size of a metastatic squamous cell carcinoma in a ferret. The tumour had recurred after previous excision and had metastatized to the right submandibular lymph node. The ferret was treated without effect at a dose of 10 U/m2, s.c., once a week. The dose was then increased to 20 U/m2 once a week, and reduction of tumour size was observed.

Fig. 1. Gross appearance of squamous cell carcinoma in a ferret.

Journal of the American Veterinary Medical Association, 198;1, 197-198, 1991. 1 fig., 9 refs. CAB-abstract.

Safety and efficacy of ivermectin against ear mites (*Otodectes cynotis*) in ranch foxes.

William J. Roreyt.

Efficacy of ivermectin at a dosage of 0.2 mg/kg body weight was evaluated against naturally acquired ear mite (*Otodectes cynotis*) infestation in commercially raised ranch foxes (*Vulpes fulva*).

Efficacy of ivermectin given SC twice at 3-week intervals was 97.4%. Toxicosis associated with drug treatment was not observed. Increased dosage of 1.0 mg/kg was given SC to 5 foxes each week for 6 consecutive weeks, and signs of toxicosis or illness were not observed after treatment.

Journal of the American Veterinary medical Association, 198;1, 96-98, 1991. 1 table, 13 refs. Author's summary.

Species specificity of the mange mites of furbearing animals.

P.I. Pashkin, M.V. Shustrova.

Sarcoptic, notoedric and otodectic mange occurred in furbearing carnivores. An outbreak of sarcoptic mange, affecting particularly the feet, occurred among farmed red foxes on a single premises in the Leningrad region, and it attendants developed mange.

Sbornik Nauchnykh Trudov-Leningradskii Veterinarnyi Institut, 94, 63-69, 1988. 8 refs. In RUSS. CAB-abstract.

Neuropathology and host-parasite relationship of acute experimental toxoplasmosis of the blue fox (*Alopex lagopus*).

I. Bjerkås.

The neuropathology and host-parasite relationship of experimental infection with the RH-strain of *Toxoplasma gondii* were studied in 27 blue foxes (*Alopex lagopus*) aged 0 to 23 days, using light microscopy, including immunohistochemical staining, and transmission and scanning electron microscopy. All cases displayed multifocal necrotic lesions with numerous parasitic tachyzoites in the brain and spinal cord. The gray matter and the meninges were most seriously affected. Although a wide variety of cell types were parasitized, neurons and astrocytes seemed to be the main target cells. Individual parasitophorous vacuoles usually contained only a few tachyzoites, with rosette formations as a prominent feature. The present ultrastructural study supports the theory that the parasites actively invade the host cells by mechanisms that are different from those of phagocytosis. This is apparently the first report in dicating that the formation of the network of tubular structures within the parasitophorous vacuole of *T. gondii* is associated with a transient, sack-like formation in the posterior end of the tachyzoites.

Vet Pathol 27: 381-390, 1990. 2 tables, 24 figs., 24 refs. Author's summary.

Contribution to the neuropathology of martens.

O. Geisel, J. von Sandersleben.

The present knowledge about the neuropathologic findings and postmortem investigation methods in neurologic diseases of martens is reviewed. The following diseases are discussed: encephalitis due to viruses (rabies, distemper), bacteria (streptococcus, staphylococcus), and parasites (toxoplasmosis, hepatozoonosis, nematodes); furthermore, metabolic disorders (amyloidosis, congophilic angiopathy, calcinosis), and congenital malformations.

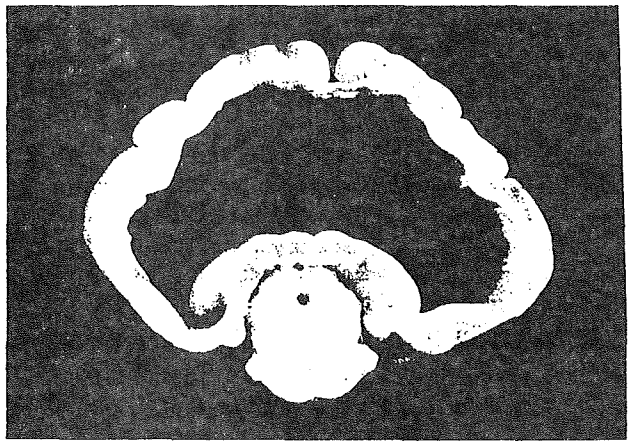


Abb. 5 Querschnitt durch das Gehirn eines drei Monate alten Marders mit kongenitalem Hydrocephalus internus.

Tierärtzliche Praxis, Vol. 19 (3), 320-323, 1991. 5 figs., 16 refs. Authors' summary.

Investigation of the spreading of Enterococcus faecium Cernelle 68 from female mink to suckling kits.

Mogens Jørgensen, Karl Pedersen.

In order to investigate the transfer of the lactic acid bacterial strain *Enterococcus faecium* Cernell 68, nine mink females were fed a rifampicin re-

TAKE THE GAMBLE OUT OF MINK VACCINES!

DISTOX®-PLUS

. . . contains *Pseudomonas aeruginosa* Serotypes 5, 6, 7-8 & 9 which are commonly involved in outbreaks of hemorrhagic pneumonia.

In addition, Distox-Plus provides kits with solid protection against botulism, distemper and all known strains of **mink virus enteritis**. . . the other leading kit killers. So why roll the dice when it's just as easy to vaccinate with the proven winner. . . Distox-Plus. Taking the gamble out of pseudomonas protection is one less thing to worry about.

Schering-Plough Animal Health

ASL

In Mink Vaccines, Schering-Plough Is the Leader in Innovation.

State-of-the-art health protection for mink breeding stock and kits is firmly rooted in the quality, research and technical service for which Schering-Plough Animal Health is famous worldwide.

Behind each vial stand generations of experience in developing innovative approaches to the control of mink diseases, and research that assures quality and efficacy. Today, Schering-Plough proudly carries on the traditions and record of achievement of ASL, pioneer in mink immunology.

But most important—Schering-Plough is the leader in professional technical service to mink ranchers . . . supporting our products and the people who use them with solid answers and practical solutions whenever questions arise. For additional information, contact the nearest International Representative listed below.

WESTERN EUROPE

Essex Tierarznei
Triebstrasse 32
D-8000 Munich 50
Germany
Phone: (49) (89) 1498-9500
Fax: (49) (89) 1498-9522

Schering-Plough S.A.
Apartado Postal No. 36220
Madrid 16
Spain
Phone: (34) (1) 841-8250
Fax: (34) (1) 402-8912

EASTERN EUROPE

Essex Chemie A.G.
Department of Eastern Europe
Postfach 2769
6002 Lucerne
Switzerland
Phone: (41) (41) 44-6232
Fax: (41) (41) 44-5573

CANADA

Schering-Canada Inc.
3535 Trans Canada Highway
Pointe Claire, Quebec H9R 1B4
Canada
Phone: (514) 426-7300
Fax: (514) 695-7641

U.S.A.

Schering-Plough Animal Health
P.O. Box 529
Kenilworth, N.J. 07033 U.S.A.
Phone: (908) 709-2800
Fax: (908) 709-2807

Schering-Plough Animal Health

SPASL-DIS-9R

sistant strain of the bacterium during a 25 day period, 5 x 10^9 c.f.u. per kg feed, while another nine females were kept as a control group. All 18 females had kits. One litter from each group was given 10^7 c.f.u. of *E. faecium* Cernelle 68 per kit. Kits were killed for bacteriological examination and scanning electron microscopy of the digestive tract. Furthermore, fecal samples from females and kits together with samples of nest material were collected for bacteriological examination.
The intestinal microflora of the kits was sparse. In nest material and in a fecal sample from a female in the test group high numbers of *E. faecium* Cernell 68 were found. However, the *E. faecium* strain was not transferred to the kits. Kits inoculated with *E. faecium* Cernelle 68 excreted the strain within 15 hours - 2 days. No permanent colonization occurred.
Simultaneously, it was investigated in a challenge study, if *E. faecium* Cernelle 68 was able to prevent outbreak of diarrhoea in kits. Three females were given the rifampicin resistant *E. faecium* strain while 3 untreated females served as a control group. From each group one litter was challenged with 10^8 c.f.u. of a pathogenic *Staphyloccus intermedius* strain per kit, and a second litter from each group with a pathogenic *Escherichia coli* strain. A third pair of litters were given an *Aerococcus viridans* strain. All three strains were previously isolated from outbreaks of "sticky kits" but probably only the *s. intermedius* and *E. coli* strains were causal organisms.
The kits challenged with the *S. intermedius* or the *E. coli* strains developed diarrhoea in both control and test groups, while the two litters given the *A. viridans* strain did not.
In the digestive tract of all kits examined from both control and test group a *Lactococcus lactis subsp. diacethylactis* was cultured in large numbers. By scanning electron microscopy this strain was shown to associate with the mucosa in the jejunum.

Dansk Veterinærtidsskrift, 75, 1, 1/1, 9-13, 1992. 1 table, 1 fig., 19 refs. In DANH, Su. ENGL. Authors' summary.

Chronic dermatomycosis in chinchillas.

Anonymous.

The purpose of this brief, general account is to advise farmers that the chronic disease is usually of long standing, often brought on by poor feeding and management and the introduction of infected animals or contaminated hay. Treatment consists of giving griseofulvin in the feed and dealing with concurrent problems and infections. No specific fungal agent is mentioned.

Deutsch Pelztierzuchter, 65;1, 11-12, 1991. In GERM. CAB-abstract.

Medical and surgical management of an esophageal foreign body in a ferret.

R. Caligiuri, J.R. Bellah, B.R. Collins, N. Ackerman.

A ferret was examined because of anorexia, repeated episodes of regurgitation, and subsequent dehydration. Radiography revealed a radiodense midoesophageal foreign body. Results of endoscopy of the oesophagus, however, could not confirm the diagnosis. Contrast radiography revealed oesophageal perforation, with subsequent penetration of the foreign body into the right pleural space, causing pleural effusion. Surgical repair of the oesophagus was performed, and a gastrostomy feeding tube was inserted to provide adequate nutrition during oesophageal healing. Nine days after surgery, radiography revealed a severe stricture at the oesophageal surgical site. Surgery was repeated; the oesophagus was transected, the stricture was removed, and oesophageal tissues were closed in 2 layers. Systemically administered antibiotics and gastrostomy tube feedings were continued thoroghout the postoperative healing period. The oesophagus healed with a mild stricture that diminished over time in response to corticosteriod administration.

Journal of the American Veterinary Medical Association, 195;7, 969-971, 1989. 4 figs., 3 refs. CAB-abstract.

Epidemiological interrelationships between distemper among farmed mink and seals of the Danish coast.

M. Hansen.

An outbreak of morbiliviral infection among *Phoca vitulina* along the Danish coast in April 1988 was followed by outbreaks of distemper on 9 mink farms in April and May 1989. Distemper had not occurred on Danish mink farms for 3

years. The disease affected 6 mink farms in West Jutland in April-May 1990. Isolates of virus are being compared.

7 Arbeitstagung über Haltung und Krankheiten der Kaninchen, Pelztiere und Heimtiere, 31 Mai bis 1 Juni 1990 in Celle, 220-221. 2 refs. In GERM. CAB-abstract.

Winter vaccination.

Mogens Hansen.

Recommended vaccination strategies for distemper, viral enteritis, bacterial lung inflammation and botulism are given for mink and foxes, with reference to the disease situation in Denmark in 1990.

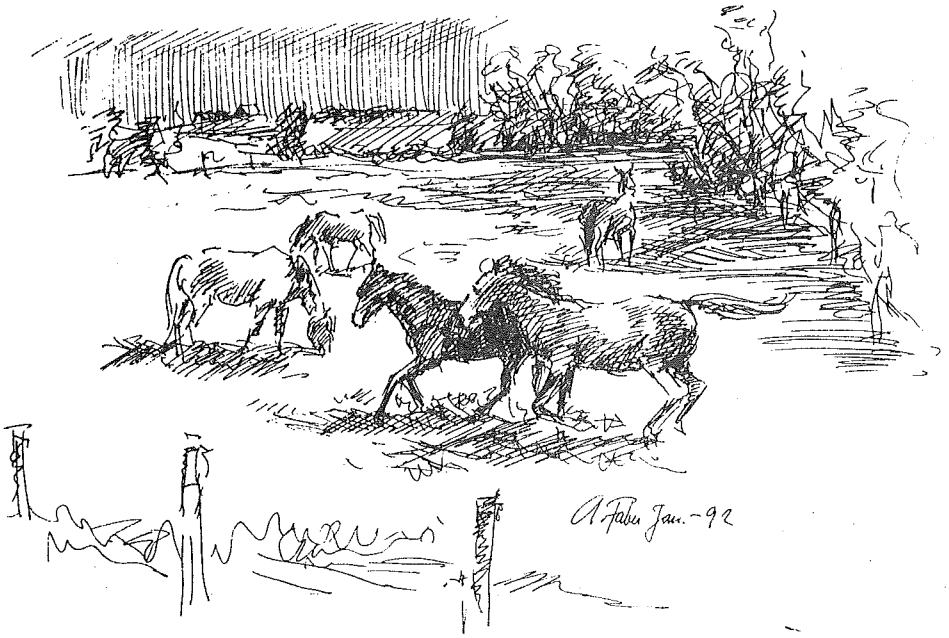
Dansk Pelsdyravl, 53;12, 584-585, 1990. In DANH. CAB-abstract.

Diseases of furbearing animals in 1990.

Mogens Hansen.

In general the health status on Danish mink farms was better in 1990 than in previous years. There were fewer outbreaks of distemper and mink enteritis virus infection and also fewer recurrences of Aleutian disease. The general situation in relation to these 3 diseases as well as other forms of viral enteritis (including reovirus, calicivirus and coronavirus infections), respiratory disease, Campylobacter infection and botulism is discussed. Changes in Danish regulations covering compensation to breeders for losses through disease are mentioned.

Dansk Pelsdyravl, 54;1, 13-15, 1991. 1 table. In DANH. CAB-abstract.



STUDY INTO THE LEGAL, TECHNICAL AND ANIMAL WELFARE ASPECTS OF FUR FARMING

COMMISSION
OF THE EUROPEAN
COMMUNITIES

Price (excluding VAT) in Luxembourg: ECU 16

OFFICE FOR OFFICIAL PUBLICATIONS
OF THE EUROPEAN COMMUNITIES

L-2985 Luxembourg

ISBN 92-826-0504-3

In ENGL. 111 pp, 16 tables.

Luxembourg: Office for Official Publications of the European Communities, 1991
ISBN 92-826-0504-3

Catalogue number: CM-60-91-935-EN-C

Printed in Belgium

TABLE OF CONTENTS

List of addresses

Albert G. Bezirksinstitut für Veterinärwesen Leipzig, Goethesteig, DDR 7030 Leipzig.

Alden, Eva. Pälsdjursavdelningen, Inst. för husdjurens utfodring och vård, Sveriges Landbruksuniversitet, Funbo-Lövsta, 75007 Uppsala, Sverige.

Alexandersen, Søren. Laboratory of Persistent Viral Diseases, Rocky Mountain Laboratories, National Institute of Allergy and Infectious Diseases, Hamilton, Montana 59840 USA.

Bakhtadze, N.G. Institute of Zoology of the Academy of Sciences of the Georgian SSR, Tbilisi, USSR.

Barta, Milan. Research Institute of Animal Production, Hlohovska 2, 949 92 Nitra, Czechoslovakia.

Bell, Judith A. Department of Veterinary Science, University of Wisconsin, Madison, Wisconsin, USA 53706.

Bell, Ronald C. Pathology Division, United States Army Medical Research Institute of Infections Diseased, Ft. Detrick, MD, USA.

Bjerkaas, Inge. Norwegian College of Vet. Med., Inst. of Pathology, P.B. 8146, Dep., N-0033 Oslo 1, Norway.

Blomstedt, Leena. Zoological Institute, Department of Physiology, Arkadiank. 7, SF-00100 Helsinki, Finland.

Boettcher, Flint A. Hearing Research Lab., State University of New York at Buffalo, Buffalo, NY 14214, USA.

Boissin-Agasse, L. Laboratoire de Neurobiologie Endocrinologique, Université de Montpellier-II, place Eugéne-Bataillon, 34060 Montpellier-Cedex, France.

Brunnert, Steven R. Division of Comparative Pathology, Department of Pathology, University of Miami School of Medicine, Miami, FL., USA.

Burdel', L.A. USSR.

Børsting, Christian. National Institute of Animal Science, Research Center Foulum, Dept. for research in fur animals, P.O. Box 39, DK-8830 Tjele, Denmark.

Børsting, Ejner. Danish Fur Breeders Association, 60 Langagervej, DK-2600 Glostrup, Denmark.

Caligiuri, R. Department of Small Animal Clinical Sciences, College of Vet. Medicine, Universi of Florida, Box J-126 Health Science Center, Gainesville, FL 32610, USA.

Carpenter, J. USA.

Chen-pan, C. Laboratory of Veterinary Anatomy, Faculty of Agriculture, University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku Tokyo 113, Japan.

Chwalibog, Andre. The Royal Veterinary and Agricultural University, Division of Animal Nutrition, Department of Animal Science and Animal Health, Bülowsvej 13, DK-1870 Frederiksberg C, Denmark.

Deresienski, Diane T. The Wistar Institute of Anatomy and Biology, 36th Street at Spruce, Philadelphia, Pennsylvania 19104, USA.

Djemina, T. M. Forschungsinstitut für Pelztier- und Kaninchenzucht, Gebiet Moskau, USSR.

Engh, Espen. Norway

Englund, L. National Veterinary Institute, P.O. Box 7073, SVA 759 07 Uppsala, Sweden.

Erdman, Gary R. Departments of Pharmacy Practice and Pediatrics, University of Minnesota, Minneapolis, MN 55455, USA.

Erdman, S.E. Division of Comparative Medicine, Massachusetts, Institute of Technology, Cambridge, MA 02139, USA.

Ermolaev, V.I. Institute of Cytology and Genetics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk 630090, USSR.

Falkenberg, Henrik. Research Farm "South", Lindknudvej 35, Lindknud, DK-6650 Brørup, Denmark.

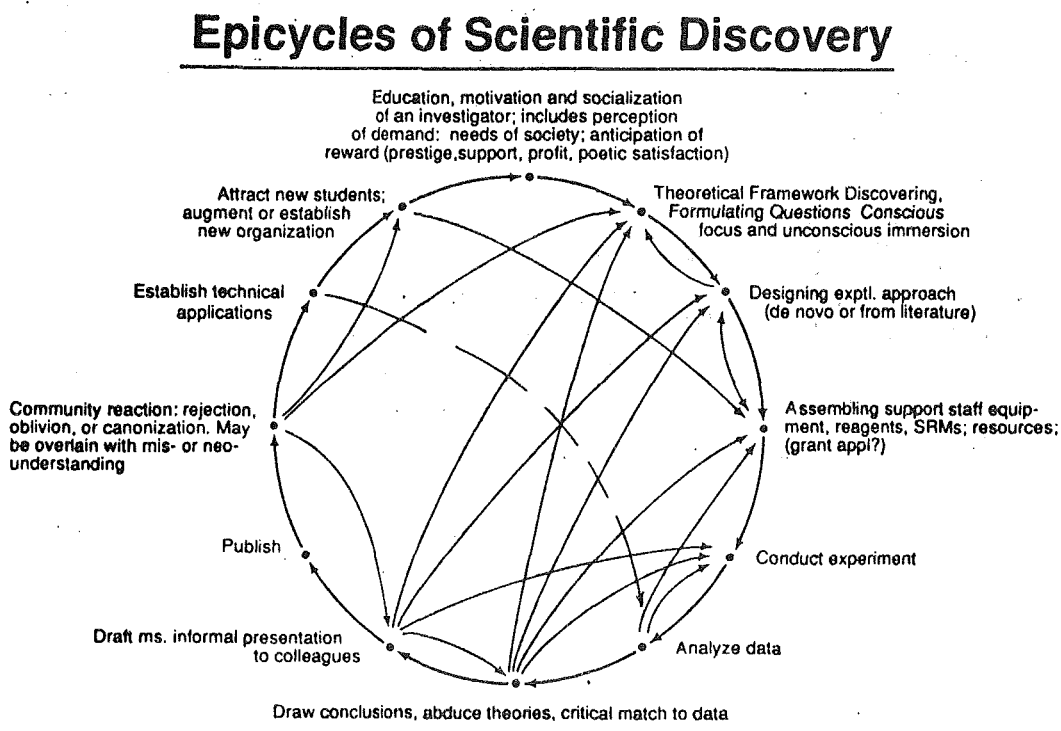
Fokin, V.B. USSR.

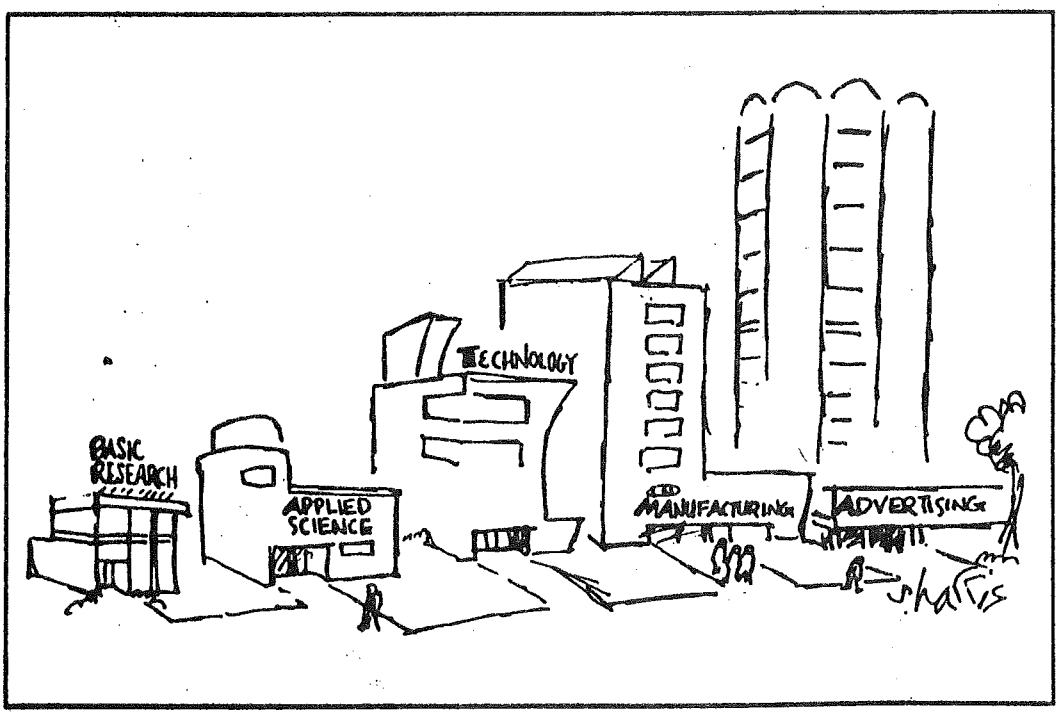
Fomicheva, I.I. Institute of Cytology and Genetics, Academy of Sciences of the USSR, Siberian Branch, Novosibirsk 630090, USSR.

Foreyt, William J. Department of Veterinary Microbiology and pathology, Washington State University, Pullman, WA 99164, USA.
Fougner, Jan. Norwegian Fur Breeders Association, P. O. Box 145, Økern, N-0509 Oslo 5, Norway.
Frindt, Andrzej. Institute of Animal Breeding and Technology Animal Production, Warsaw Agricultural University, SGGW-AR Warsaw, Poland.
Geisel, O. München Universität, Tierärztliche Fakultät, Germany.
Gorham, J.R. U.S. Department of Agriculture/Agricultural Research Service and Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, Washington 99164-7040.
Goscicka, Danuta. ul. Powst. Wlkp. 44/14, 85-090 Bydgoszcz, Poland.
Groot, Jens. Danish Fur Breeders Association, 60, Langagervej, DK 2600 Glostrup.
Hagen, Gunnar. Department of Pathology, Norwegian College of Veterinary Medicine, Oslo, Norway.
Hamilton, Terrance A. Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Purdue Uniersity, Lynn Hall, West Lafayette, IN 47907. USA.
Hammond, David L. Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, 3850 Spruce Street, Philadelphia, Pennsylvania 19104-6010, USA.
Hansen, Mogens. Danish Fur Breeders' Association, 60 Langagervej, DK-2600 Glostrup, Denmark.
Hansen, N. Enggaard. Department of Fur Animal Production, The Royal Vet. and Agric. University, Bülowsvej 13, DK-1870 Frederiksberg C.
Hansen, Steffen W. National Institute of Animal Science, Research In Fur Animals, Post Box 39, DK-8830 Tjele.
Hao, Y.F. Department of Livestock Improvement, University of Xuzhou, China.
Harada, Yasuhiro. Research and Development Division, Kikkoman Corporation, 399 Noda, Nodashi, Chiba 278, Japan.
Harri, Mikko. Dept. of Applied Zooloogy, University of Kuopio, P.O. Box 6, SF 70211 Kuopio, Finland.
Henriksen, Per. Statens Veterinære Serumlaboratorium, Hangøvej 2, DK 8200 Aarhus N, Denmark.
Hofmo, Peer Ola. Dept. of Reproductive Physiology and Pathology, Norwegian College of Veterinary Medicine, P.O. Box 8146 Dep., N-0033 Oslo, Norway.
Hyllseth, B. Norges Vetrinaerhoegskole, Inst. for Mikrobiologi og Immunologi, Oslo, Norge.
Hänninen, M.L. Department of Food and Environmental Hygiene, College og Veterinary Medicine, Helsinki, Finland.
Indrebø, A. Norwegian College of Vet. Med., Box 8146 Dep., N-0033 Oslo 1, Norway
Isupov, B.A. Kirovskii Sel'skokhozyaistvennyi Institut, Kirov, USSR.
Jalkanen, Liisa. Finnish Fur Breeders Association, Tiaisen Katu 42, SF-80200 Joensuu, Finland.
Jeantet, Anne-Yvonne. Laboratoire d'Histophysiologie fondamentale et appliquée, Université Paris-VI, 12, rue Cuvier, Paris.
Jeppesen, Leif Lau. Inst. of Population Biology, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark.
Jones, M.G.S. Agricultural Development and Advisory Service, Wolverhampton, UK.
Jørgensen, Mogens. Mosbjerg, DK-9870 Sindal, Denmark.
Jørgensen, Bettina C. National Institute of Animal Science, Dept. for research in Fur Animals, Research Center Foulum, Post box 39, DK-8830 Tjele.
Kariatsumari, Tsutomu. Department of Veterinary Public Health, Faculty of Veterinary Medicine, Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido 080, Japan.
Kenttämies, Hilkka. University of Helsinki, Department of Animal Breeding, Viikki, SF-00710 Helsinki, Finland.
Khlebodarova, T.M. Inst. of Cytology and Genetics, Academy of Sciences of the USSR, Siberian Branch, 630090 Novosibirsk, USSR.
Kjær, Jørgen. National Institute of Animal Science, Research Center Foulum, Dept. for Research in Poultry and Rabbits, Post Box 39, DK-8830 Tjele.

Korhonen, Hannu. Agricultural Research Centre of Finland, Fur Farming Research Station, SF-69100 Kannus, Finland.
Kosko, I. Instytut Hodowli i Technologii Produkcji Zwoerzecej, AR-T Olsztyn-Kortwo, Poland.
Kostro, Krzysztof. Clinic of Infectious Diseases of Animals, Veterinary Faculty, Agricultural Academy, 20-612 Lublin, Al. PKWN 30, Poland.
Lagerkvist, Gabrielle. The Seedish University of Agric. Sciences, Dept. of Anim. Breed. and Genetics, Funbo-Lövsta, S-755 97 Uppsala, Sweden.
Langenfeld, Marian. Department of Animal Anatomy, University of Agriculture, Krakow, Poland.
Lavrent'eva, M.V. Inst. of Cytology and Genetics, Siberian Branch of the Academy of Science of the USSR, Novobirsk, USSR.
Lodmell, Donald L. National Institute of Allergy and Infectious Diseases, Laboratory of Persistens Viral Diseases, Rocky Mountain Laboratories, Hamilton, MT 59840, USA.
Loftsgaard, Gudbrand. Norges Pelsdyralslag, Økern torgvei 13, 0580 Oslo 5, Norge.
Lorek, M.O. Animal Breeding and Productive Technology Institute, Olsztyn, Poland.
Luhrs, G. Germany.
Lyngs, Bente. Research Farm "North", Hundelevvej 75, Nr. Rubjerg, DK-9480 Løkken, Denmark.
Lähteenmaki, Markku. Finnish Fur Breeders Association, PB 5, 01601 Vanda 60, Finland.
Makita, Takashi. Department of Veterinary Anatomy, Faculty of Agriculture, Yamaguchi University, 1677-1, Yoshida, Yamaguchi City, 753 Japan.
Manning, Dean D. Departments of Medical Microbiology, University of Wisconsin, Madison Medical School, 436 Services Memorial Institute, Madison, WI 53706, USA.
Mejerland, T. Sweden.
Meriläinen, Jouko. Finland.
Mertin, Dusan. Research Institute of Animal Production, Dept. of Fur Animal Breeding, Hlohovska 2, 949 92 Nitra, Czechoslovakia.
Mezzadra, C. INTA, Balcarce Experimental Station, Argentina.
Mäntysalo, E. Tampere University of Technology, Laboratory of Fur and Leather Technology, P.O. Box 527, SF-33101 Tampere, Finland.
Nakamura, Fumio. Faculty of Agriculture, Hokkaido University, Kita-ku, Saporo-shi 060, Japan.
Nordholm, Jørgen. Agricultural Advisory Center, Udkærsvej 15, DK-8200 Århus, Denmark.
Orlov, P.P. USSR.
Parkanyi, Vladimir. Research Institute of Animal Production, 949 92 Nitra, Hlohovska 2, Czechoslovakia.
Pashkin, P.I. USSR.
Peter, A.T. Medical Sciences, School of Veterinary Medicine, Univesity of Wisconsin-Madison, Madison, WI 53706.
Petrova, I.P. USSR.
Pölönen, Ilpo. Finnish Fur Breeders Association, PB 5, 01601 Vanda 60, Finland.
Rafay, J. Research Institute of Animal Production, Nitra.
Roreyt, William J.
Rouvinen, Kirsti. Agricultural Research Centre of Finland, Fur Farming Research Station, SF-69100 Kannus, Finland.
Rubis, A.V. USSR.
Scheelje, Reinhard. Zentralverband Deutscher Pelztierzüchter e. V. Johannssenstrasse 10, D-3000 Hannover 1, Germany, Deutschland.
Shaichov, R. T. Central Asian Department of All-Union Hunting and Fur Farming Research Institute, 700000, Tashkent, main A/S 145 post office.
Snytko, V.S. USSR.
Svechin, Yu. K. USSR.
Sylvina, Teresa J. Division of Comparative Medicine, Massachusetts Institute of Technology, Cambridge, MA 02139.
Sönderup, Michael. Danish Fur Breeders Association, 60, Langagervej, DK 2600 Glostrup.

Tauson, Anne-Helene. Department of Animal Science and Animal Health, Royal Veterinary and Agricultural University, Bülowsvej 13, DK-1870 Frederiksberg C, Denmark.
Therkildsen, Niels. Research Farm "South", Lindknudvej 35, Lindknud, DK-6650 Brørup, Denmark.
Vyazovkina, I.V. USSR.
Weiss, Vilhelm, Research Station West, Herningvej 112, Tvis, 7500 Holstebro, Denmark.
Wiland, Cezariusz. Wydawnictwo Uczelniane Akademii Techniczno-Rolniczej w Budgoszczy.
Yifeng, Hao. China.
Zhiping, Chen. Kunming Institute of Zoology, Academia Sinica, Kunming, China.
Aasted, B. Department of Veterinary Virology and Immunology, Royal Veterinary and Agricultural University of Copenhagen, Bülowsvej 13, DK-1870 Frederiksberg.




BASIC RESEARCH
APPLIED SCIENCE
TECHNOLOGY
MANUFACTURING
ADVERTISING