

**SCIENTIFUR**  
ISSN 0105-2403  
Vol. 13, No. 4  
November 1989

Published by  
NJF's Fur Animal Division

1. Contents	257
2. Notes	268
3. Multidisciplinary	273
<b>Element concentrations in milk of ranch mink (<i>mustela vison</i>). R.J. Aulerich, L.J. Nelson and W.E. Braselton. Original Report. Code 3-5-14-M.</b>	273
<b>Thermal protection provided by year-round nest boxes or farmbred foxes and raccoon dogs. Mikko Harri, Jaakko Mononen, K. Haapanen, Hannu Korhonen. Original Report. Code 10-11-12-F-O.</b>	277
<b>Light reflection of abnormal guard hairs of mink. Palle Vistisen Rasmussen. Original Report. Code 2-M.</b>	287
<b>Flat areas on the back of mink pelts. Palle V. Rasmussen, Outi Lohi. Code 2-M.</b>	291
<b>Fine structural changes in the developing gastric gland cells in the ferret during the postnatal period. M. Asari, Y. Kano, S. Wakui, T. Nakamura, H. Oshige. Code 2-O.</b>	291
<b>Seasonal comparison of body composition and hair coat structure between mink and polecat. Hannu Korhonen. Code 2-10-M-O.</b>	291

<b>Morphology in the caecum in nutria (<i>Myocastor coypus</i> Mol.).</b> <i>Ewa Kochan, Marian Langenfeld. Code 2-O.</i>	292
<b>Histology of the caecum in nutria (<i>Myocastor coypus</i> Mol.).</b> <i>Marian Langenfeld, Ewa Kochan. Code 2-O.</i>	292
<b>Anatomical description of the male sexual system of nutrias (<i>Myocastor coypus</i>). Part II.</b> <i>Vaclav Kulisek, Milan Barta, Ivor Jakubicka, Lubomir Zavodny, Igor Zemanovic. Code 2-5-O.</i>	292
<b>Anatomical description of the female sexual system of nutria (<i>Myocastor coypus</i>).</b> <i>Vaclav Kulisek, Ivor Jakubicka, Milan Barta, Lubomir Zavodny, Igor Zemanovic. Code 2-5-O.</i>	293
<b>Regional differences in hindgut structure and function in the nutria, <i>Myocastor coypus</i>.</b> <i>R.L. Snipes, H. Hörnicke, G. Björnhag, W. Stahl. Code 2-O.</i>	293
<b>Use of different types of nest box for foxes.</b> <i>Vivi Pedersen. Code 10-11-12-F.</i>	293
<b>Trials using screens for young mink females.</b> <i>Maria Neil. Code 10-5-11-M.</i>	294
<b>Behaviour of the nutria (<i>Myocastor coypus</i>) in pens with and without water basins.</b> <i>Andrea Schürg, H. Hörnicke. Code 10-11-O.</i>	294
<b>Behaviour of blue foxes and raccoon dogs.</b> <i>Hannu Korhonen, Mikko Harri, Liisa Nurminen, Jaakko Mononen, Ritta Tirkkonen, Ritva Inkinen. Code 11-F-O.</i>	295
<b>Stress in farmed fur animals.</b> <i>Leif Lau Jeppesen. Code 11-3-M-F.</i>	295
<b>A chronic jugular catheterization for remote blood sampling in freely moving mink.</b> <i>C. Bonnefond, L.G. Fouche, L. Martinet. Code 3-14-M.</i>	295
<b>Vitamin B<sub>12</sub> in blood plasma of blue and silver foxes.</b> <i>Romuald Rajs. Code 3-2-F.</i>	296
<b>Amino acid composition of hair protein of growing polar foxes.</b> <i>Romuald Rajs. Code 3-2-14-F.</i>	296
<b>Blood values of chinchilla.</b> <i>Monika Spann, H. Kraft. Code 3-2-O.</i>	296
<b>Hematology and serum biochemistry of captive swift foxes (<i>Vulpes velox</i>).</b> <i>S.A. Mainka. Code 3-F.</i>	296

Exotic pet medicine. <i>J.E. Harkness. Code 14-M-O.</i>	297
Repeatability of grading scores for colour and body size in silver foxes. <i>Hilkka Kenttämies. Code 2-14-F.</i>	297
Mink. <i>Farol N. Tomson. Code 14-M.</i>	297
Biology and medicine of the ferret. <i>Cynthia L. Besch-Williford. Code 14-O.</i>	297
First record of the raccoon <i>Procyon lotor</i> (L., 1758) in Belgium. <i>R.M. Libois. Code 1-O.</i>	297
The otter: an endangered animal? <i>Annegrete Schimmer. Code 1-O.</i>	298
A field study of ocelots ( <i>Felis pardalis</i> ) in Peru. <i>Louise H. Emmons. Code 1-O.</i>	298
Fur trade in Canada: An econometric analysis. <i>Roselyne Joyeux. Code 1-14-M-F-O.</i>	298

Titles of other publications - not abstracted.

Effect of early handling on open-field behaviour and fear of humans in young silver foxes (*Vulpes vulpes*). *T. Tennesen. Proceed. of the International Congress on Applied Ethology in Farm Animals, Skara, 1988, 392-394. Code 11-10-F.*

Histological and histochemical aspects of the prediaphragmatic digestive tube of the nutria (*Myocastor coypus*). *C. Cotea, V. Cotofan, Valentina Hritcu. Cercetari agronomice in Moldova, Romania, 1, 81, 130-132, 1988. In ROMN. Code 2-O.*

Chinchilla production - it is worthwhile? (Management on the basis of a commercial contract critically analyzed). *Anonymous. Württembergisches Wochenblatt für Landwirtschaft, 154, 44, 24-26, 1987. In GERM. Code 14-12-O.*

Peculiarities in the silver-fox breeding technology. *Speranta Sava, O. Sava. Productia animala - zootehnie si medicina veterinara, 1, 45-49, 1987. In ROMN. Code 4-F.*

The polecat a valuable indigenous animal for increasing the fur production. *Ovidiu Sava, I. Simon, D. Felmeri, M. Miclea, Z. Papay, Speranta Sava. Productia animala - Zootehnie si medicina veterinara, 1, 59-63, 1988. In ROMN. Code 14-1-O.*

The behaviour of Nutria (*Myocastor coypus*) in fenced areas with and without water container. *Andrea Schürg, H. Hörnicke. Deutsche Pelztierzüchter, 60, 1, 7-8, 1986. In GERM. Code 10-11-O.*

Preconditions for a successful nutria production. *G. Schult. Deutsche Pelztierzüchter, 60, 3, 44-46, 1986. In GERM. Code 14-O.*

The nutria, *Myocastor coypus*. *E. Körner. Schlutersche Verlagsanstalt, Hannover, GFR, 153-172, 1987. In GERM. Code 14-O.*

Ferret and marten. *K. Gabrisch. Schlutersche Verlagsanstalt, Hannover, G.F.R., 101-129, 1987. In GERM. Code 14-O.*

**Chinchillas.** *H. Egen, H. Ernst. Schlutersche Verlagsanstalt, Hannover, G.F.R., 131-151, 1987. In GERM. Code 14-O.*

**Martens (*Martes martes*) and marten raising.** *Vidar Selås, Nils Chr. Stenseth. Norsk Pelsdyrblad, 62, 11, 11-14, 1988. In NORG. Code 1-12-14-O.*

**Investigations of the stone marten (*Martes foina*) in Denmark.** *Anders Maltha Rasmussen, Aksel Bo Madsen, Tommy Asferg, Birger Jensen, Mogens Rosengaard. Danske Vildtundersøgelser, Rønde, Denmark, 41, 1986. ISSN 0416-7163. In DANH, Su. ENGL. Code 1-14-O.*

**The otter (*Lutra lutra*).** (Technical notes: card no. 43). *C. Bouchardy. Bull. Mensuel de l'Office Natl. de la Chasse, France, 122, 1-6, 1988. In FREN. Code 14-O.*

**Taxonomy of the European otter (*Lutra lutra*) in Czechoslovakia.** *Jan Zejda, Jozef Voskar, Folia Zoologica, Czechoslovakia, 36, 2, 1987. In ENGL, Su. RUSS. Code 1-2-O.*

**Habitat suitability index models: Mink, revised.** *Arthur W. Allen. U.S. Fish Wildl. Serv. Biol. Rep. 82 (10.127). 1986. (First printed as: FWS/OBS.82/10.61, October 1983). Code 1-10-11-M.*

#### 4. Genetics

**Silver fox gene mapping: conserved chromosome regions in the order Carnivora.** *N. Rubtsov, A. Graphodatsky, V. G. Matveeva, S.I. Radjabli, T.B. Nesterova, N.A. Kulbakina, S. Zakian. Code 4-3-F.* 299

**Genetic polymorphisms of blood proteins in foxes.** *R.K. Juneja, T. Niini. Code 4-3-F.* 300

**Standard Sable mink.** *K.V. Kuznetsov, I.I. Shirotov. Code 4-5-M.* 300

**Breeding colour types of fox.** *A.P. Nyukhalov, T.M. Chekalova, A.P. Maksimov, N.N. Shumilina. Code 4-F.* 300

**Beige chinchilla mutations.** *Frank Joelsson. Code 4-O.* 300

**Genetic parameters of some features in females of blue polar foxes on Lochowo and Wiartel farms.** *Henryka Bernacka, Luboslawa Nowaczyk. Code 4-F.* 301

**Synaptonemal complex formation among supernumerary B chromosomes: an electron microscopic study on spermatocytes of Chinese raccoon dogs.** *Liming Shi, Liren Tang, Kun Ma, Caixia Ma. Code 4-5-2-O.* 301

**The planning and organisation of fox breeding.** *Einar J. Einarsson. Code 4-F.* 301

**Wilson White and Black Velvet.** *F. Joelsson. Code 4-O.* 301

**Titles of other publications - not abstracted.**

- Chromosomal localization of the proopiomelanocortin gene in American mink (*Mustela vison*).** N.M. Matveeva, T.M. Khlebodurova, G.I. Karasik, N.B. Rubtsov, O.L. Serov, S. Ya. Golovin, A.A. Bondar, V.A. Karginov, I.Z. Morozov, S.M. Zelenin, N.P. Mertvetsov. *Doklady: biological sciences - Akademiia nauk SSSR*, 298, 1/6, 47-51, 1988. In ENGL. Code 4-3-M.
- Planning and organizing of breeding programs with foxes.** Einar J. Einarsson. *Norsk Pelsdyrblad*, 62, 12, 16-18, 1988. In NORG. Code 4-F.

**5. Reproduction**

- Frozen semen in fox breeding.** Peer Ola Hofmo. Code 5-F. 302
- Failure of fertilization following abbreviated copulation in the ferret (*Mustela putorius furo*).** Brian J. Miller, Stanley H. Anderson. Code 5-O. 302
- Evidence implicating aromatization of testosterone in the regulation of male ferret sexual behavior.** R.S. Carroll, C.E. Weaver, M.J. Baum. Code 3-5-O. 302
- Fertility of muskrat (*Ondatra zibethica*) in cages.** Frantisek Kukla. Code 5-10-11-O. 303
- Whelping results in 1988.** Kaj Lindh. Code 5-13-M-F-O. 303

**Titles of other publications - not abstracted.**

- A study on factors influencing litter size in silver fox.** K.D. Seo, S.K. Kim. *WAAP-88*, Helsinki, *Repro.* 5.34, pp 607, 1988. Code 5-F.

**6. Nutrition & Food Technology**

- Weight gain and fur length in nutria fed three balanced diets of 16, 21 and 27% of crude protein, without green forage.** Oscar N. Di Marco, German Garrido. *Original Report*. Code 6-2-O. 305
- Effects of dietary energetic composition and water content on water turnover in mink.** Maria Neil. Code 6-3-M. 307
- 3. Feed evaluation and nutritional requirements. 5. Fur-bearing animals.** Anne-Helene Tauson. Code 8-M-F. 307
- Effect of nutrition on whelping results in mink.** Ilpo Pölönen. Code 6-5-M. 308

- Aiming for better whelping results. *Tuula Dahlman*.  
Code 5-6-M-F. 308
- The effects of streptococcus faecum as an additive  
to fox pellets. *Hans Kolbein Dahle, Gudmund Holstad*.  
6-8-F. 308
- Prevention of urolithiasis in the ferret (*Mustela putorius furo*) with phosphoric acid. *Catherine H. Edfors, Duane E. Ullrey, Richard J. Aulerich*. Code 9-3-O. 308
- Grain feeds in the diet for polecats. *T.I. Kazakowa, L.A. Lutova, Yu I. Gladilov, V.V. Shutov*. Code 6-7-O. 309
- Crown vetch (*Coronilla varia L.*) poisoning of the coypu. *G. Salyi, V. Sztojkov, Magda Hilbertne Miklovics*.  
Code 8-O. 309
- Use of krill for feeding arctic foxes. *A.A. Khudyakova, V.K. Yudin*. Code 7-F. 310
- Squid meal in diets for arctic foxes. *Yu A. Samkov, N.V. Molchanova*. Code 7-F. 310
- Effect of feeding hide wastes on protein metabolism  
in blood of mink. *A.D. Sobolev, O.A. Komov, E.A. Romanovskii*. Code 6-7-3-M. 310
- Effect of feeding mink with hide wastes on their  
liver lipids. *A.D. Sobolev, E. A. Romanovskii*.  
Code 6-7-3-M. 310

**Titles of other publications - not abstracted.**

- The effect of offal, hemoglobin meal and iron addition in preventing fish anemia in minks. *Ilpo Pölönen*. *Pälsdjursstudier, Finland, Finnish Fur Breeders Association*, 27, 1987., ISSN 0358-3759. In FINN. Code 6-7-3-9-M.
- Experiments with concentrated ensilage of fish to foxes and minks. *Anders Skrede*. *Norsk Pelsdyrblad*, 61, 20-22, 1987. In NORG. Code 7-6-M-F.
- The activity of digestive enzymes and the structure of diets. *V.A. Berestov, V.M. Olejnik*. *Krolikovodstvo i Zverovodstvo, USSR*, 6, 6, 1987. In RUSS. Code 3-6-M-F-O.
- Poultry produce and by-products - important sources of feeding fur-bearing carnivora. *Paul Adamescu*. *Productia animala - zootehnie si medicina veterinara, Romania*, 1, 59-61, 1987. In ROMN. Code 7-6-M-F-O.
- Coma in ferret after infestation of cannabis. *R.A. Smith*. *Veterinary and human toxicology*, 30, 5, 486, 1988. Code 8-O.
- Methods of conservation and use of pack-house blood for mink feeding. *G.G. Besedina*. *Krolikovodstva i Zverovodstva, USSR*, 33, 34-41, 1986. In RUSS. Code 7-8-14-M.
- Cubiceps pauciradiatus as new feed for minks. *V.K. Yudin, G.V. Kovrov*. *Krolikovodstvo i Zverovodstvo, USSR*, 6, 11, 1987. In RUSS. Code 7-M.

7. Veterinary Science

- A case of uterine torsion in a blue fox vixen.**  
*Wenche Farstad, Nina Valberg, Gunnar Hagen.*  
*Code 5-9-F.* 311
- Indirect immunofluorescent detection of oocysts of *Cryptosporidium parvum* in the feces of naturally infected raccoons (*Procyon lotor*).** *Daniel E. Snyder.*  
*Code 9-O.* 311
- Serological investigations for brucellosis in farm-bred foxes.** *J. Gorski, J. Wawrzkiwicz.* *Code 9-F.* 311
- Encephalitozoon infection of blue Arctic foxes.**  
*Miroslav Persin, Jiri Dousek.* *Code 9-F.* 312
- Necrotic dermatitis in mink.** *A.M. Litvinov.*  
*Code 9-M.* 312
- Viral enteritis of mink and disinfection procedures.**  
*N.F. Chertovich.* *Code 9-12-M.* 312
- Passive transfer of antiviral antibodies restricts replication of Aleutian mink disease parvovirus in vivo.** *Søren Alexandersen, Steen Larsen, Anders Cohn, Aase Uttenthal, Richard E. Race, Bent Aasted, Mogens Hansen, Marshall E. Bloom.* *Code 9-M.* 312
- Raccoon dog and blue fox parvoviruses.**  
*Pirjo Veijalainen.* *Code 9-F-O.* 313
- Canine parainfluenza virus-induced encephalitis in ferrets.** *W. Baumgärtner, S. Krakowka, J.R. Gorham.*  
*Code 9-O.* 314
- Aujeszky's disease in fur bearing animals.**  
*P.N.G.M. van Beek.* *Code 9-M-F.* 314
- A study on the epizootology of coccidiosis in nutria.**  
*P. Zourliiski.* *Code 9-O.* 315
- Immunity to *microsporium canis* in fur bearing animals.**  
*T.V. Chuchina.* *Code 9-F.* 315
- The use of repeated treatment with Ivomec and Neguvon spray in the control of murine fur mites and oxyurid worms.** *V. Baumans, R. Havenaar, H. van Herck.*  
*Code 9-2-O.* 315
- The coypu (*Myocastor coypus* Molina) as a rodent reservoir of leptospirosis.** *S.W. Wanyangu, Sheena A. Waitkins.* *Code 9-O.* 315

**Comparison of the nucleoprotein genes of a chicken and a mink influenza A H 10 virus.** *U. Reinhardt, C. Scholtissek. Code 9-4-3-M.* 316

**Diseases in fur bearing animals 1986.** *Central Bureau of Statistics, Norway. Code 9-13-M-F.* 316

**Occurrence of distemper in fur animals in Finland 1985-1987.** *Taina Loikala, Jouni Kangas. Code 9-M-F.* 316

**Titles of other publications - not abstracted.**

**The concept emaciated minks in Danish mink production.** *Chr. Hyldgaard-Jensen. Dansk Veterinærtidsskrift, Denmark, 71, 23, 1222-1225, 1988. In DANH. Code 9-M.*

**Ivermectin treatment in mange in rabbits, arctic foxes, red foxes, rabbits and polecats.** *Brief report. A.I. Maiorov, L.E. Vereta. Krolikovodstvo i Zverovodstvo, 4, 47-48, 1988. In RUSS, Code 9-F-O.*

**Pseudomoniasis in arctic foxes - a brief note.** *O.B. Livinov, G.A. Komarova, A.K. Kirillov, A.I. Maiorov. Krolikovodstvo i Zverovodstvo, 4, 46, 1988. In RUSS. Code 9-F.*

**Infection of dogs and foxes with the sheep strain of Echinococcus granulosus.** *M.J. Clarkson, T.M.H. Walters. Proceed. of the second Internat. Symposium on taeniasis/cysticercosis and echinococcosis/hydatidosis, Czechoslovakia, December 1985, 147-155, 1986. In ENGL. Code 9-F-O.*

**8. Scientific meetings, symposiums, and congresses.**

**NJF Seminarium 170, 1989.** 317

**Development and use of feed optimisation technique in the production of feed for fur animals in Norway.** *Halgeir Sterten, Åshild Longva Eldegard. Code 6-12-14-M-F.* 318

**Diagnosis of iron deficiency in mink.** *Jouko Työppönen. Code 6-3-M.* 318

**Biochemical investigations concerning fur quality in mink and fox.** *Søren Michaelsen, Hilmer Sørensen. Code 3-2-M-F.* 319

**Aging and dressing properties of mink and blue fox skins.** *Kirsti Rouvinen, Esa Mäntysalo. Code 2-6-14-M-F.* 319

**The use of carbohydrates in mink feed during the breeding season.** *Tuula Dahlman, Ilpo Pölönen, Jaakko Mäkelä. Code 6-M.* 320

**The nest box as a thermal environment for newborn foxes and raccoon dogs.** *Jaakko Mononen, Mikko Harri, Kimmo Haapanen Hannu Korhonen. Code 10-11-5-F-O.* 321



<p><b>Thermal environment of year-round nest boxes for farmed foxes and raccoon dogs.</b> <i>K. Haapanen, Mikko Harri, J. Mononen, Hannu Korhonen. Code 10-11-12-F-O.</i></p>	321
<p><b>Raising fur animals in barns - the present situation in Finland.</b> <i>Fjalar Fors, Kjell Nydahl, Jarmo Lehtinen. Code 10-12-M-F.</i></p>	322
<p><b>Perinatal mortality in farmed fur bearing animals. Characteristics of the perinatal kit; perinatal mortality as affected by dietary composition and specific infections.</b> <i>Anne-Helene Tauson, Lena Englund. Code 5-6-9-M.</i></p>	322
<p><b>Experimental parvovirus infection of pregnant blue fox vixens. Clinical findings, blood parameters and foetal losses.</b> <i>Astrid Indrebø, B. Hyllseth. Code 9-3-5-F.</i></p>	323
<p><b>Improvement of cage and nestbox system for farmed foxes.</b> <i>Vivi Pedersen. Code 10-11-12-F.</i></p>	324
<p><b>Humoral immune response in mink.</b> <i>Henrik Falkenberg. Code 3-4-9-M.</i></p>	324
<p><b>The possible influence of recent vaccination on the serological reactions in mink against Aleutian disease virus antigen.</b> <i>Christian Munck. Code 9-M.</i></p>	324
<p><b>Euthanasia of mink by means of carbon dioxide, carbon monoxide and nitrogen.</b> <i>N. Enggaard Hansen, Annette Creutzberg, H.B. Simonsen. Code 12-14-M.</i></p>	325
<p><b>Profiles of progesterone and estradiol-17β and follicular development during the estrous cycle in mink.</b> <i>Gabrielle Lagerkvist, Einar J. Einarsson, Mats Forsberg, Hans Gustafsson. Code 5-3-M.</i></p>	326
<p><b>Artificial insemination with frozen semen in the fox. Effect of different sperm number on whelping rate and litter size.</b> <i>Wenche Farstad, Jan A. Fougner. Code 5-F.</i></p>	326
<p><b>Bacteriological status of the fox semen and its effect on the pregnancy.</b> <i>Liisa Jalkanen. Code 5-F.</i></p>	327
<p><b>Fox mating circles in Norway. Experiences and results from progeny testing of male foxes.</b> <i>Kai-Rune Johannessen. Code 4-5-F.</i></p>	328
<p><b>Inter specific hybrids in the estimation of breeding value.</b> <i>Hilkka Kenttämies. Code 4-2-F.</i></p>	329
<p><b>Heritability of body length and body weight in mink and the influence of litter size and age on size development.</b> <i>Outi Lohi, Bente Krogh Hansen. Code 4-2-M.</i></p>	329
<p><b>Heritability and breeding of the litter size on blue fox.</b> <i>Kari Saarenmaa. Code 4-5-F.</i></p>	330

- A curley hair defect in silver foxes.** *Raija Ingo, Leena Blomstedt, Jouko Työppönen, Jouni Kangas, Maija Valtonen.* Code 2-F. 330
- The inherited curly fur form of silverfox (*Vulpes vulpes*).** *Kari Saarenma, Paavo Niemelä.* Code 4-2-F. 331
- Reticulocytosis is normal in mink.** *Veli-Mikko Niemi, Minna Liinamaa.* Code 3-9-M. 331
- Some factors causing mortality among female minks during the puerperium and lactation periods.** *Raija Ingo, Martti Luoma, Ilkka Virtanen.* Code 14-10-6-5-M. 331
- Feed factors and perinatal mortality in blue fox (*Alopex lagopus*).** *Ilpo Pölonen, Jouko Työppönen.* Code 6-5-9-F. 332
- Repeatability of grading in mink and bluefox pelts.** *Hilkka Kenttämies, Kerstin Smeds.* Code 2-12-14-M-F. 332
- Curly fur forms of the silverfox.** *Kari Saarenma, Raija Ingo.* Code 2-F. 333
- Electrolyte and acid/base changes in lactating female mink (*Mustela vison*) subject to nursing sickness.** *Tove Nørgaard Clausen, Søren Wamberg.* Code 3-5-9-M. 334

**Contents of Proceedings from 2. Internationales Pelztiersymposium, Leipzig, 1986.**

**Titles - not abstracted.**

- |   |  |
|---|--|
| <p><b>Tasks and objectives of fur animal production in Eastern Germany.</b> <i>A. Schöneboom.</i> pp 11. Code 14-13-M-F-O.</p>                                      | <p><b>The influence of number of teats on the reproduction result in mink.</b> <i>Andrzej Frindt.</i> pp 47. Code 5-2-M.</p>         |
| <p><b>Cross breeding programmes in mink breeding.</b> <i>H. Pingel.</i> pp 19. Code 4-M.</p>  | <p><b>Effect of various mating conditions on reproduction results in mink.</b> <i>B. Pischel, H. Pingel.</i> pp 51. Code 5-M.</p>    |
| <p><b>Comparative investigations regarding correlation between live animal quality and fur evaluation.</b> <i>P. Zunft, Marion Krause.</i> pp 27. Code 4-2-M-F.</p> | <p><b>The possibility of early weaning in the Greenland coypu.</b> <i>St. Niedzwiadek.</i> pp 64. Code 5-O.</p>                      |
| <p><b>Selection for litter size by means of litter size index.</b> <i>J. Clausen.</i> pp 33. Code 4-5-M.</p>  | <p><b>Experimental investigations of activity periods in the coypu.</b> <i>K. Löhle, W. Bernau, C. Ulrich.</i> pp 72. Code 11-O.</p> |
| <p><b>A breeding programme for mink production.</b> <i>Ejner Børsting.</i> pp 36. Code 4-M.</p>   | <p><b>Results of pastel fox breeding in Poland.</b> <i>J. Maciejowski, Grazyna Jezewska.</i> pp 77. Code 4-5-F.</p>                  |
| <p><b>Application of biotechnological methods in mink breeding.</b> <i>H. Hattenhauer, R. Krieg.</i> pp 39. Code 3-14-M-F-O.</p>                                    |  |

Identification on basis of practical fur farm data. *N. Glem-Hansen. pp 82. Code 12-13-14-M-F.*

Research in fur animals at the National Institute of Animal Science. *G. Jørgensen. pp 87. Code 14-M-F-O.*

Effect of feed restriction methods on mink growth. *R. Krieg, H. Hattenhauer. pp 100. Code 6-2-M.*

Slaughter offal preserved by means of fermentation with *Lactobacillus plantarum* in fox and mink feeding. *Anders Skrede. pp 107. Code 7-8-M-F.*

Quantity and content of trace elements in guard hair of various kinds of commercial fur animals. *M. Anke, K. Elze, Elke Pingel. pp 115. Code 2-3-M-F-O.*

Relations between dl-alpha-tocopherylacetate, NA-Selenit, Antioxidants and unsaturated fat in mink feeds. *Asbjørn Brandt. pp 129. Code 3-6-M.*

Vitamin-E requirements in mink especially considering the Tocopherol distribution in plasma, liver and fatty tissue. *Tapio Juokslah-ti. pp 137. Code 6-3-M.*

The question of using complete feed mixes for the coypu. *R. Cholewa, Rose-Marie Wegner, W. Hartmann. pp 141. Code 6-O.*

Bacteriological examinations of mink feed. *G. Albert, U.D. Wenzel. pp 148. Code 8-M.*

Possibilities of preventing loss of kits. *V.A. Berestov. pp 151. Code 5-M-F.*

Selected diseases of the central nervous system in mink. *U. Johannsen. pp 154. Code 9-M.*

Loss of mink females during the birth period. *Horst Zimmermann. pp 161. Code 5-9-M.*

Coccidiosis in mink. *I. Reinhardt, U.D. Wenzel. pp 165. Code 9-M.*

Anthrax in mink. *U.D. Wenzel, G. Albert, B. Gloxyn. p 168. Code 9-M.*

Pathology and Pathogenesis of virus enteritis in mink. *U. Johannsen. pp 171. Code 9-M.*

Comparative investigations regarding serological diagnosis of Aleutian disease in mink by means of electrophoresis and direct immune fluorescence test. *A. Neubert. pp 175. Code 9-M.*

A contribution to the epizootiology of plasmacytosis in mink. *A. Tohtz. pp 187. Code 9-M.*

Nosematosis in farm foxes - a disease with growing importance in the Nordic countries. *Per Henriksen. pp 192. Code 9-F.*

Transformations of the coypu. *W. Scheuring, Z. Michalski. pp 196. Code 9-O.*

The prevalence of erysipelas in the coypu. *U. Tornow. pp 199. Code 9-O.*

## Notes

### SCIENTIFUR

Vol. 13, No. 4.  
November 1989

This issue of SCIENTIFUR is the last of totally 52 issues produced and distributed by The Scandinavian Association of Agricultural Scientists, Division of Fur Animals.

After 13 years under this management, SCIENTIFUR will now from January 1st, 1990, serve as a scientific journal for members of and managed by the INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION (IFASA).

The aim of the "new" journal is that it shall be an important, international link between all persons interested in fur animal production.

The journal is planned to cover the following information:

- a. Scientific reports - approved by referees.
- b. Abstracts of scientific reports published elsewhere.
- c. Applied reports and reviews.
- d. International market information.
- e. Actual internationally interesting branch news and information from member countries (scientific, technical, organizational).
- f. Information regarding new books, educational material etc.
- g. International advertisements.
- h. Information to members.

The change and the direction towards a more professional product will go on in accordance to the economy of IFASA and the journal.

You, who have followed SCIENTIFUR during its first 13 years and read the Notes will understand that the editor is disappointed because during that time it has not been possible to obtain the economic power to produce a better journal.

But - in confidence of the future - we can at the same time look back and remember all the pleasure it has given to produce an attractive journal and to make all the friendly contacts to colleagues all over the world. I am positive that both Ellen Andersen and I will look back at some of our best working hours in the past 13 years.

I would like to take this opportunity to thank the writer and administrator of SCIENTIFUR during all these years. Without the enthusiasm and extremely qualified efforts of Ellen Andersen, SCIENTIFUR could not have been realized.

It is therefore with deep regret that we must also say goodbye to Ellen Andersen from the end of this year. If I could nominate Ellen for a small Nobel Prize, I would do so, because she is the lady behind SCIENTIFUR. Hopefully somebody will give Ellen a prize for what she has done for SCIENTIFUR.

THANK YOU ELLEN AND GOOD LUCK IN THE FUTURE.

On the following pages you will find the president's invitation to become a member of IFASA and the approved Constitutions.

Due to the delay in establishing the new ownership of SCIENTIFUR, it has been necessary to state the subscription price for SCIENTIFUR in 1990 independently of membership of IFASA. IFASA will, however, graduate membership payment in relation to SCIENTIFUR subscription:

Subscription price for  
SCIENTIFUR, Vol. 14, 1990 DKK 500.-

Membership of IFASA (with  
subs.to SCIENTIFUR) DKK 150.-  
(approx. US\$ 20.-)

Membership of IFASA (without  
subs.to SCIENTIFUR) DKK 300.-  
(approx. US\$ 40.-)

All subscribers to SCIENTIFUR will receive  
two invoices at the beginning of 1990, one  
for the subscription and one for the member-  
ship. New subscribers and/or members are

asked to fill out the attached reply card, and  
invoices will be forwarded.

Dear subscribers, contributors and adver-  
tisers. Thank you very much for 13 inspiring  
years and the best wishes for a Merry Christ-  
mas and a Happy New Year and welcome as  
members of IFASA and subscribers of a  
hopefully successful journal in the future.

REMEMBER THAT THE FUTURE DE-  
PENDS ON YOUR SUPPORT.

Best regards  
Your Editor



Gunnar Jørgensen

After a nursing period of 13 years the baby  
"Scientifur" now has grown up into a pretty  
teenager and the time has come for separa-  
tion.

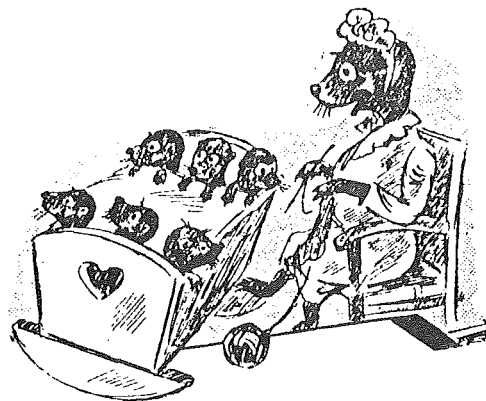
Thank you very much for our cooperation  
during the years. I will miss all of you.

Good Luck to IFASA.

Best regards



Ellen Andersen  
nurse/secretary



Please note our address from  
January 1st, 1990:

SCIENTIFUR  
P.O. Box 13  
DK 8830 Tjele, Denmark

Phone: (+45-86-652500)  
Fax.: (+45-86-652912)



Dear member of IFASA.

You will probably ask if you are a member of the INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION - IFASA. Well not yet, but we assume that you will join the new worldwide organization.

The objectives of IFASA are:

- \* to promote the distribution of knowledge of all aspects of fur animal science and the fur industry,
- \* to act as a formal link between scientists, the Fur Breeders Associations and governmental agencies at an international level,
- \* to arrange the International Fur Animal Congresses and other relevant international meetings,
- \* to cooperate with other international organizations to achieve these aims.

SCIENTIFUR - that has been a very valuable link between the scientists and advicers - will continue. However, there will be some changes as we plan to include four equal parts in the coming issues: scientific papers with referees, scientific abstracts, commercial and practical news, and advertisements.

More information about IFASA is given in the Constitutions.


IFASA is open for individual membership for persons who are, or have been, engaged in fur animal production and fur animal industry.

Apply for membership today to the secretary:

IFASA  
c/o National Inst. of Animal Science  
Department of Fur Animals  
P.O. Box 13  
DK- Tjele  
Denmark

Phone +45-86652500, fax +45-86652912

WELCOME AS A MEMBER OF IFASA - YOUR NEW WORLDWIDE ORGANIZATION WITHIN THE FUR ANIMAL PRODUCTION.

  
DR. EINAR J. EINARSSON  
PRESIDENT OF IFASA

## **International Fur Animal Scientific Association.**

### **Constitution (May 1988).**

#### Article I - Name.

The name of this organization is the International Fur Animal Scientific Association, referred to as the IFASA.

#### Article II - Objectives.

1. To promote the advancement of knowledge of all aspects of fur animal science and the fur industry.
2. To act as a formal link between scientists, the Fur Breeders Associations and governmental agencies on an international level.
3. To be responsible for the arrangements of international fur animal congresses and other international meetings within the field of fur animal science.
4. To cooperate with other international organizations in achieving these aims.

#### Article III - Membership.

1. Application for membership shall be made to the secretary to be approved by the Board.
2. Type of membership.
  - a. Individual membership may be held by any person who is interested in the objectives of the Association.
  - b. Organizations, companies or institutions can be associated members.
  - c. Honorary members, elected by the Council.
3. The Council may appoint as Honorary Life Members, such members as it consider to have made a noteworthy contribution to the work of the Association or to fur animal science.
4. The annual fee should be paid before February 1st of each year to the secretary of IFASA. If the fee is not paid before July 1st this year, the members name shall be removed from the list of memberships.

5. A member may forfeit his membership for failure to act in accordance with the objectives of the Association set out in Article II.

#### Article IV - Council and Board Members.

##### 1. Council.

The Council will consist of representatives from each country according to the following schedule.

Number of individual memberships	Number of representatives of the Council
1-5	1
6-20	2
more than 20	3

The councillors shall be elected for a period of four years. If a councillor resigns between elections, the President shall appoint a new number under advisement for the same country. Quorum shall be 30% of the numbers of the Council.

The President will circulate the agenda 45 days prior to the meeting.

##### 2. Board.

The Association shall be managed by the members of the Board, according to the guide-lines set forth in this Constitution and policies established by the Council. The Board shall consist of a President, a Vice President, three members and the Past President. The members of the Board are elected for a period of four years, and may only be elected for two consecutive terms. Election to the Board will take place at the Council meeting held at the IFASA international congresses.

The Board shall be responsible for the approval of the projected annual programs and budgets of IFASA. Each Board-member has a personal alternate. If the President is unable to attend the Board meeting, the

Vice President will replace him. In absence of both the President and the Vice President the member of the Board will elect an interim chairman. The quorum for the Board will be four.

### 3. *Nominations and voting.*

Nominations for Board members may be made by any individual member. The nominations must reach the secretary not later than thirty days before the election. The members of the Council and of the Board may also nominate new Board members. Voting for Board members will be by secret ballot. The simple majority is sufficient for election to the Board. Each Board member is elected individually, beginning with the President.

The past President is a regular member of the Board.

### Article V - Working Groups.

The working groups must be approved by the Board of IFASA. The working groups may have their own board, but their by-laws and activities must be in accordance with the IFASA constitution. All members of a working group must be members of IFASA.

### Article IV - Publications.

1. An official organ of IFASA will be published (an international journal).
2. The official language of IFASA is English.

### Article VII - Meetings.

1. The Council of IFASA shall meet once every fourth year associated with the International Congresses.
2. The Board of IFASA shall meet at least once a year.
3. Upon a request signed by at least six members of the Council representing at least four countries, the Board will be required to communicate by post with all

members of the Council, and seek their votes on any matter which has been raised.

4. Between annual board meetings the President and the Vice President should have the authority to make decisions on behalf of the Board. Financial commitments will require a written approval by the quorum of the Board.

### Article VIII - Honorary Past Board Members.

1. An individual member can be elected as a honorary member by the Council.
2. Any President may be declared as a Honorary Past President by the Council after having served as President for four years, and Board members as Honorary Past Board Members after serving for eight years.
3. The terms of Honorary Past President or Past Board Member shall hold as long as they remain active members.

### Article IX - IFASA's Congresses.

1. World congresses shall be held every fourth year.
2. The Council shall decide the venue of the next congress.
3. Countries that wish to host the Congress, should send an invitation to the Board at least sixty days before the Council meeting.

### Article X.

An annual report, including a financial statement, should be published by the Board of directors.

### Article XI - Disposal of Assets.

If it is decided by two thirds of the Council that the Association should be dissolved, the Council will decide of the disposal on the assets.



Original Report.

## Element concentrations in milk of ranch mink (*Mustela vison*)<sup>1</sup>

R.J. Aulrich, L.J. Nelson and W.E. Braselton<sup>2</sup>

### Introduction.

Report in the literature on the composition of mink milk are limited to analyses of protein, fat, carbohydrate, ash, and energy values (Jørgensen, 1960; Conant, 1962; Kinsella, 1971). Information on the element concentration in mink milk is lacking. Such data could be useful in detecting mineral toxicoses or deficiencies and would contribute to our knowledge of the biology of the mink. Analyses were, therefore, performed to formulate milk element profiles for "healthy" lactating mink fed a conventional mink farm diet.

### Materials and methods.

were housed individually under an open-sided shed in wire breeder cages (76 cm L x 61 cm W x 46 cm H) with attached wooden nest boxes (31 cm L x 28 cm W x 27 cm H). The animals were cared for according to routine commercial mink farm procedures. They were provided a conventional mink diet (Table 1) and drinking water *ad libitum*. Prior to milking between 10:00 and 12:00 a.m., the females were separated from their kits for two to three hours. The milk samples were collected using the procedure described by Jones *et al.* (1980), except that the females were anesthetized with 0.3 ml Ketaset<sup>3</sup>. The females were nursing between four and eight "healthy" kits when the milk samples were collected. Between one and three ml of milk were obtained from each female. The samples were stored frozen (-6°C) until prepared for multielemental analyses by

- 1) Supported in part by the Mink Farmers Research Foundation, Thiensville, WI and published with the approval of the Michigan Agricultural Experiment Station as Journal Article No. 13138.
- 2) Department of Animal Science (Aulrich) and Animal Health Diagnostic Laboratory (Nelson and Braselton), Michigan State University, East Lansing, MI 48824.
- 3) Ketamine hydrochloride, 100 mg/ml; Bristol Myers Co., Syracuse, NY.
- 4) ICP, Jarrell-Ash model 955 Plasma Atomcomp Direct Reading Spectrometer System; Thermo Jarrell Ash Corporation, Franklin, MA.

inductively coupled plasma atomic emission spectroscopy (ICP)<sup>4</sup>, as described by *Braseltton et al. (1981)*. A sample of the diet fed to the females was analyzed in triplicate by ICP. The milk and diet samples were analy-

Table 1. Composition, nutrient analysis, and element concentration of mink diet.

Ingredients	Percentage
Cereal <sup>1</sup>	22.28
Poultry by-products	22.28
Fish (cod, haddock, and flounder trimmings)	17.83
Beef trimmings	8.91
Corn oil	0.71
Salt	0.18
Wheat Germ oil	0.18
Water	27.63
<u>Nutrient analysis<sup>2</sup></u>	
Moisture	62.6
Protein	13.9
Fat	6.79
Ash	4.08
Fiber, crude	1.39
Carbohydrate	11.2
<u>Element concentration (ppm dry weight)<sup>3,4</sup></u>	
Al	87.9 (1.31)
As	ND <sup>5</sup> (0.658)
B	18.0 (1.31)
Ba	10.9 (0.131)
Ca	13633 (1.31)
Cd	ND (0.0658)
Co	ND (0.131)
Cr	ND (0.263)
Cu	6.76 (0.0658)
Fe	109 (0.658)
Hg	ND (1.31)
K	7547 (1.31)
Mg	1943 (0.0658)
Mn	59.3 (0.0658)
Mo	ND (0.263)
Na	7480 (0.131)
P	18067 (1.31)
Pb	ND (0.658)
Sb	ND (1.31)
Se	ND (5.26)
Tl	ND (6.57)
Zn	117 (0.0658)

1) XK-40 mink cereal, XK Mink Foods, Inc., Thiensville, WI.

2) Analysis by National Environmental Testing, Inc., Bartlett, IL.

3) Analysis by Inductively Coupled Plasma-Atomic Emission Spectroscopy, Michigan State University, Animal Health Diagnostic Laboratory, East Lansing, MI.

4) Detection limits shown in parantheses.

5) Not detected.

zed for aluminium (Al), arsenic (As), boron (B), barium (Ba), calcium (Ca), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), potassium (K), magnesium (Mg), manganese (Mn), molybdenum (Mo), sodium (Na), phosphorus (P), lead (Pb), antimony (Sb), selenium (Se), thallium (Tl), and zinc (Zn). The detection limits for the ICP analyses are listed in Tables 1 and 2. Differences in individual element concentrations between the natural dark and pastel mink were compared using the "Student" t-test. Total milk solids were determined for the natural dark and pastel mink by drying a composite of three one ml samples of milk from each color phase to a constant weight at 100 C in a forced draft oven. Differences in individual element concentrations between the natural dark and pastel mink were compared using the "Student" t-test.

## Results and discussion.

The composition, nutrient analyses, and element concentrations of the diet fed to the lactating mink are shown in Table 1. Of the 22 elements screened, 12 were detected in the diet (Table 1) and 11 in the milk samples (Table 2). Statistical comparison of the element concentrations in the milk from the natural dark and pastel females showed no significant differences ( $P < 0.05$ ) between the two color phases of mink. Thus, the mean values (Table 2) are based on the combined element concentrations for the natural dark and pastel mink. B and Ba were not detected in all 12 milk samples. The values for these elements (Table 2) are the mean concentrations for the samples in which B and Ba were detected.

The total solids for the milk samples analyzed in this study were 20.4% for the natural dark mink and 22.7% for the pastels. These values are similar to the average of 21.2% solids reported for mink milk by *Conant (1962)*.

It is well known that the composition of milk varies considerably with the stage of lactation. In general, most elements are present in greatest concentration in the colostrum

Table 2. Element concentrations in mink milk.

Element	No samples where element was detected per 12 samples analyzed	Mean concentration $\pm$ SD (ppm wet weight)	ICP detection limits for milk (ppm wet weight)
Al	0	ND <sup>1</sup>	1.0
As	0	ND	1.0
B	2	2.42 $\pm$ 0.905	1.0
Ba	8	0.307 $\pm$ 0.2967	0.1
Ca	12	1104 $\pm$ 145	1.0
Cd	0	ND	0.1
Co	0	ND	0.1
Cr	0	ND	0.2
Cu	12	0.632 $\pm$ 0.1650	0.05
Fe	12	10.9 $\pm$ 2.81	0.5
Hg	0	ND	2.0
K	12	950 $\pm$ 96.3	1.0
Mg	12	46.7 $\pm$ 6.11	0.1
Mn	12	0.136 $\pm$ 0.616	0.1
Mo	0	ND	0.2
Na	12	891 $\pm$ 133	0.1
P	12	1227 $\pm$ 183	1.0
Pb	0	ND	1.0
Sb	0	ND	1.0
Se	0	ND	4.0
Tl	0	ND	5.0
Zn	12	17.1 $\pm$ 6.36	0.05

1) Not detected.

and/or during the early stages of lactation and decrease in concentration as lactation progresses (Keen, 1981; Ullrey, 1966, 1974). Variation in the concentration of elements in mink milk during various stages of lactation was not addressed in this study. The concentration of elements in mink milk reported in this study are representative of values obtained around the peak of lactation (21-days post partum).

Considerable variation exists among species in the concentration of certain elements in milk. Mink milk is notably higher in Fe, Mn, Na, and Zn than human, cow, ewe, goat (Souci et al., 1981), mare (Ullrey et al., 1966, 1974), and rat (Keen et al., 1981) milk and, except for the rat, is higher in Cu than in the other species.

The concentration of some elements in milk is unaffected by nutrition, while the level of other elements in milk can be altered by an animal's intake of those elements. The concentration of most major elements in milk, including Ca, Cl, K, Mg, Na, and P, is con-

trolled to a large extent by genetic factors. Nutrition and environment have little influence on the concentration of these elements in milk (Kirchgessen et al., 1967; Lonnerdal, 1986). Although research results are not in complete agreement, most studies indicate that Al, B, Co, I, Mn, Mo, and Zn concentrations in milk can be influenced by the quantity of these elements ingested by an animal (Kirchgessen et al., 1967; Lonnerdal, 1986; Keen, 1981). Therefore, dietary levels of these elements should be considered in assessing their concentrations in milk. Ratios for the concentration of the elements detected in the feed and milk of mink are shown in Table 3. All the detected elements were substantially lower in the milk than in the feed.

Table 3. Ratios for element concentrations in the diet and milk of mink.

Element	Dietary concentration (ppm as fed)	Mean milk concentration <sup>1</sup> (ppm wet weight)	Milk/diet ratio
B	6.73	2.42	0.36
Ba	4.08	0.307	0.075
Ca	5099	1104	0.22
Cu	2.53	0.632	0.25
Fe	40.8	10.9	0.27
K	2823	950	0.34
Mg	727	46.7	0.064
Mn	22.2	0.136	0.061
Na	2798	891	0.32
P	6757	1227	0.18
Zn	43.8	17.1	0.39

1) N = 12, except for B (N = 2) and Ba (N = 8).

## References.

- Braselton, W.E., Meerdink, G.L., Stowe, H.D. and Tonsager, S.R., 1981. Experience with multielement analysis in diagnostic clinical toxicology and nutrition. Proc. Ann. Meet. Amer. Assoc. Vet. Lab. Diagn., 24: 111-126.
- Conant, R.A., 1962. A milking technique and the composition of mink milk. J. Vet. Res., 23: 1104-1106.

Jones, R.E., Ringer, R.K. and Aulerich, R.J., 1980. A simple method for milking mink. *Fur Rancher*, 60, 9: 4, 6.

Jørgensen, G., 1960. Minkmælkens sammensætning og den næringsværdi. (Composition and nutritive value of mink's milk). *Dansk Pelsdyravl*, 23: 37-38.

Keen, C.L., Lonnerdal, B., Clegg, M. and Hurley, L., 1981. Developmental changes in composition of rat milk: Trace elements, minerals, protein, carbohydrate, and fat. *J. Nutr.* 111: 226-236.

Kinsella, J.E., 1971. Biochemical analysis of the lipids of mink milk. *Inter.J. Biochem.* 2: 6-9.

Kirchgessen, M., Friesecke, H., and Koch, G., 1967. Nutrition and the Composition of Milk. J. B. Lippincott, Philadelphia. 273 pp.

Lonnerdal, B., 1986. Effect of maternal dietary intake of human milk composition. *J. Nutr.* 116: 499-513.

Souci, S.W., Fachmann, W., and Kraut, H., 1981. Food Composition and Nutrition, Tables 1981/82. Wissenschaftliche Verlagsgesellschaft mbH Stuttgart, Germany, 1352 pp.

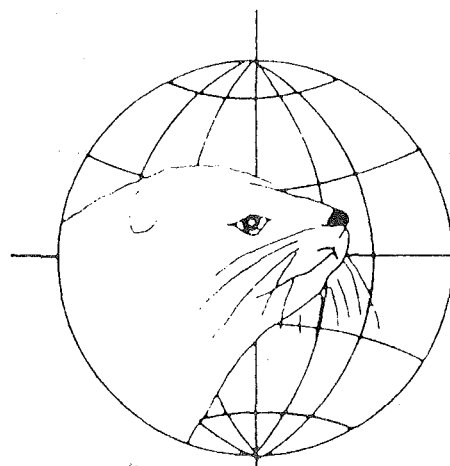
Ullrey, D.E., Ely, W.T., and Covert, R.L., 1974. Iron, zinc, and copper in mare's milk. *J. Anim. Sci.*, 38: 1276-1277.

Ullrey, D.E., Struthers, R.D., Hendricks, D.G., and Brent, B.E., 1966. Composition of mare's milk. *J. Anim. Sci.* 25: 217-222.



**Scientifur**

&



**IFASA**

THE GUARANTI FOR INTERNATIONAL COMMUNICATION AND COOPERATION IN

FUR ANIMAL PRODUCTION

**YOUR FULL SUPPORT IS NEEDED IN ALL RESPECTS**

SAME ADRESS : P.O.BOX 13, DK-8830 TJELE, DENMARK

SAME PHONE NUMBER : +45 86652500, LOCAL NUMBER 4501

SAME FAX NUMBER : + 45 86652912

AT THE SAME PLACE YOU CAN ORDER FORMER VOLUMES OF SCIENTIFUR, THE SCIENTIFUR INDEX AND THE BOOKS MINK PRODUCTION, BEAUTIFUL FUR ANIMALS AND THEIR COLOR GENETICS AND HEMATOLOGY AND CLINICAL CHEMISTRY OF FUR ANIMALS. ---PLEASE DO'NT FORGET US IN THE NEW YEAR---

Original Report.

## Thermal protection provided by year-round nest boxes for farmbred foxes and raccoon dogs.

Mikko Harri, Jaakko Mononen\*, K. Haapanen, Hannu Korhonen  
Dept. of Applied Zoology, University of Kuopio, P.O. Box 6, SF 70211 Kuopio, Finland.

\* Corresponding author. Phone -358-71-163127.

### Abstract.

1. Fur increased the thermal insulation of a thermostatically controlled model fox from 1.1 to 6.5 °C/W. The nest box and its insulation improved the total insulation of the model only slightly.
2. Due to the low thermal capacity of the wooden floor, its temperature rose within seconds and reached almost skin temperature after the animal or model entered the box, and fell quickly after the animal went out. Temperature gradients across the roof, walls and air were only 1-2 °C.
3. Use of a nest box by an animal can be monitored by changes in the nest box floor temperature.
4. The floor contributed to 40% of the total heat loss from the nest box, the ceiling 23% and the walls 36%. The contribution of ventilation to heat loss was negligible even in windy conditions.

Key word index: Farmed furbearers, silver fox, blue fox, raccoon dog, nest box, temperature gradient, heat loss, insulative capacity, ventilation, Newton's law of cooling.

### Introduction.

In addition to their own fur coat, wild mammals can rely on various shelters provided by nature when exposed to extreme weather

conditions. They can use dens, build nests, dig burrows and depressions into snow and earth. Man offers extra protection and even extra heating to his domestic animals. The known exceptions are farmbred furbearers, foxes of the genera *Alopex* and *Vulpes* and raccoon dogs (*Nyctereutes procyonoides*), which, according to normal practice, are kept in bare wire cages for most of the year. Only at breeding time are they offered nest boxes. Under farm conditions, this group of animals is, thus, totally unable to utilize any additional shelters as they could in their natural environment. Perhaps because of the tropican origin of man, increasing complaints of animal protectionists are focused to a great extent on this lack of protection. It has been demanded that fox and raccoon dog cages should also be equipped with year-round nest boxes as is already the practice in the farming of minks and polecats.

However, we do not really know to what extent foxes and raccoon dogs benefit from thermal protection of boxes throughout the year. While there are some indications that a winter box from December or January onwards could improve the reproductive success of blue and silver fox in Denmark (Konnerup-Madsen, 1982 a, b; Sønnerup, 1988 a, b), the results in Finland have been less promising (Valtonen and Moss, 1983). Assuming that harsh weather is responsible for poor reproductive performance, logically then the reproductive success of these species should be much poorer in Finland's cold

climate than in Denmark's rather mild winter climate. Furthermore, within a country the reproductive success of furbearers should decrease when moving from south to north. According to the long-term statistics of the Fur Breeders' associations in both countries just the opposite occurs. The average reproductive success for both species is better in Finland and increases steadily from southern Finland to Lapland. This is not to say that these species require or do not require boxes throughout the year. Our experience is still too limited to make any firm recommendations, and in order to assess the benefits of year round nest boxes, we have to proceed with different strategies. The first is to evaluate the thermal protection provided by the boxes. What really is the microenvironment inside the boxes? Is the environment different at breeding time from that in natural dens? What is the effect of different manipulations aimed at improving the nest environment? The second strategy is to evaluate to what extent the animals use the boxes provided and when. The third strategy is a statistical field evaluation of the effects of nest boxes on health, behaviour and reproductive success of these animals. The present study focuses on the first approach.

#### Materials and methods.

Thermophysical properties of nest boxes were measured in a laboratory cold room at  $-18\text{ }^{\circ}\text{C}$  and under actual farm conditions. In the laboratory measurements a tanned blue fox skin with winter pelage was fitted onto a 10 cm diameter stainless steel cylinder 14 cm long. The cylinder was filled with water. A thermostat held the water temperature constant at  $38\text{ }^{\circ}\text{C}$ . The electric power input to the cylinder in watts was measured in an equilibrium situation for each run. Some measurements with a constant power input of 15, 25 and 40 W were also performed. The cylinder mount was constructed by the Instrument Laboratory of the University of Kuopio. The cylinder with and without the fur cover was always placed on its side in the middle of the nest box floor.

Temperatures of both internal and external surfaces of the boxes were measured by mea-

ns of copper-constantan thermocouples attached with an adhesive tape. The floor temperature was measured at three points: in the center of the floor, just below the mid-point of the model animal, in the corner of the floor about 5 cm from the wall, and midway between the center and the corner thermocouples, i.e. beside the model animal. The wall temperature was measured in the middle of a side wall and the roof temperature from the middle of the cover. Air temperatures were measured for the ambient air and that of the nest box air from the center of the air space of each box. The temperatures were continuously recorded on a Tracor Westronics DDR 10 multichannel programmable temperature recorder. The thermal insulation of the model animal was obtained by dividing the temperature difference between the model core and the ambient air by the power input to the model.

Heat flow ( $Q$ ) through different surfaces of the nest box was calculated according to a general equation:  $Q = h/lA (T_{in}-T_{out})$  ( $\text{W}/\text{m}^2$ ), where  $h$  is thermal conductivity of the material ( $\text{W}/\text{m}^{\circ}\text{C}$ ),  $l$  is the thickness of material (m),  $A$  is the surface area of each surface of the box ( $\text{m}^2$ ) and  $T_{in}-T_{out}$  is the temperature difference across the structure ( $^{\circ}\text{C}$ ). In some runs straw, both dry and wet, was placed into the boxes to serve as bedding.

The tracer technique of *Birbaum and Crockford* was employed for measuring the ventilation rate of the nest boxes (for a description of the method see *Cena and Clark, 1979; Harri and Korhonen, 1985*). The air inside the box was first replaced by pure nitrogen. The rate of air exchange was then estimated from the subsequent exponential return of the oxygen concentration to its initial value, about 21%. This process was followed by means of an oxygen sensor (Beckman OM-14) placed in the middle of the box floor and recorded on a Servogor 460 chart recorder. The fractional ventilation rate in units of time was obtained as the slope of the plot of  $\ln(O_{2out}-O_{2in})$  over time. The heat loss through ventilation was calculated as the product of the volumetric specific heat of air ( $1298\text{ J}/\text{m}^3\text{K}$  at STP), the

temperature difference of ambient and nest box air and the rate of ventilation in  $\text{m}^3$  per unit of time. The rate of ventilation was measured under calm conditions and with wind. The air flow ("wind") was produced by a fan placed at different distance from the nest box. The air stream velocity was measured by means of a hot wire anemometer.

There exist more than ten different types of commercial nest boxes. In addition farmers tend to build their own boxes, the construction of which depend on the material available and on each farmer's personal preference. We measured all ten commercially available boxes, from which we then selected those five which differ most from each other. (Table 1).

Table 1. Description of the nest boxes used in the present study.

Nest box	Dimensions (cm) <sup>a</sup>	Material and added insulation	Entrance
Blue fox	45 x 35 x 37	Board, 16 mm	Hall
Silver fox	45 x 35 x 37	Double board walls, 25 mm styrofoam between	Hall
Round	ø40x34	Board 16 mm, Plywood floor 8 mm polyurethane below floor	Tunnel
Kombi	ø40x34	Board 16 mm. Round box inside a quadratic one.	Hall
Nortriple	43x38x27	Plywood 8 mm. 25 mm styrofoam below floor. Ventilation window 33 cm <sup>2</sup>	Zig-zag tunnel

<sup>a</sup> Length x width x height (internal dimensions)

## Results.

### Thermal insulation.

The thermal insulation of the nest box functions in series to the insulation provided by the fur coat the animals already have. Our measurement with a thermostated model with and without silver fox pelage confirm the known fact: the thermal insulation of the fur coat is considerable. Without fur the insulative capacity of our model animals was only 1.1 °C/W (Fig. 1). In a situation, where the animal's own insulation is negligible, the nest box doubles the total insulation of the system. This extra insulation provided by a nest box is, however, slight in comparison to that provided by the fur coat alone, which improves the insulative capacity of the system to a value of 6.8 to 7.0 °C/W. Under these circumstances, the effect of adding insulation to the nest boxes brings about very little benefit to the total insulation. The silver fox nest box has double walls with 25

mm of styrofoam between them. In comparison with an uninsulated blue fox nest

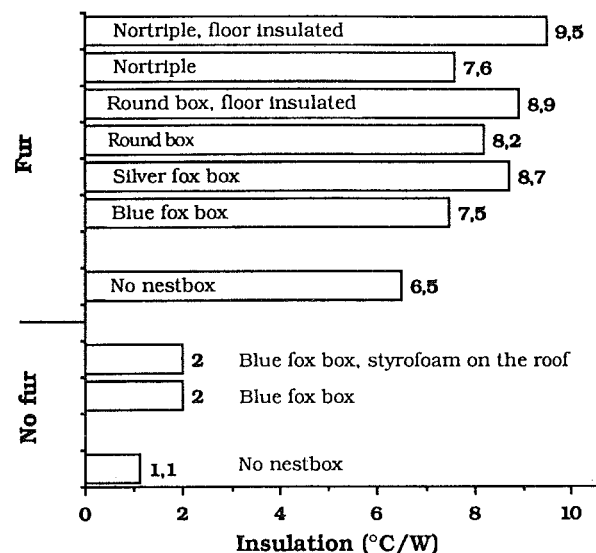


Fig. 1. Thermal insulation of thermostated model fox with and without silver fox winter pelage and with various nest boxes and added insulations.

box, the silver fox nest box was only slightly warmer. Insulation of the floor only (Nor-triple or roundbox with and without floor insulation) improved the total insulation of the system about as much as did the insulation of the walls. Added styrofoam on the roof produced no measurable improvement to the total insulation of the system.

It is interesting to note that the addition of straw as a bedding material into the uninsulated blue fox nest box improved the total insulation of the system about as much as styrofoam on the walls or floor (Fig. 2). The straw retained its insulative capacity even when wet. Closing of the nest box entrance opening with a cloth produced only a minimal improvement in the total insulative

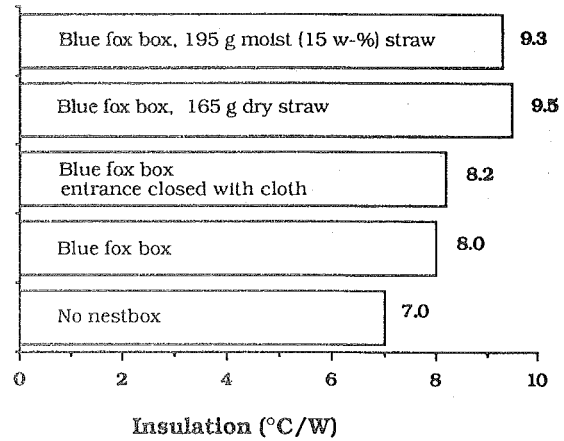


Fig. 2. Effect of blue fox nest box with and without straw bedding and cloth door on the thermal insulation of a thermostated model silver fox. capacity.

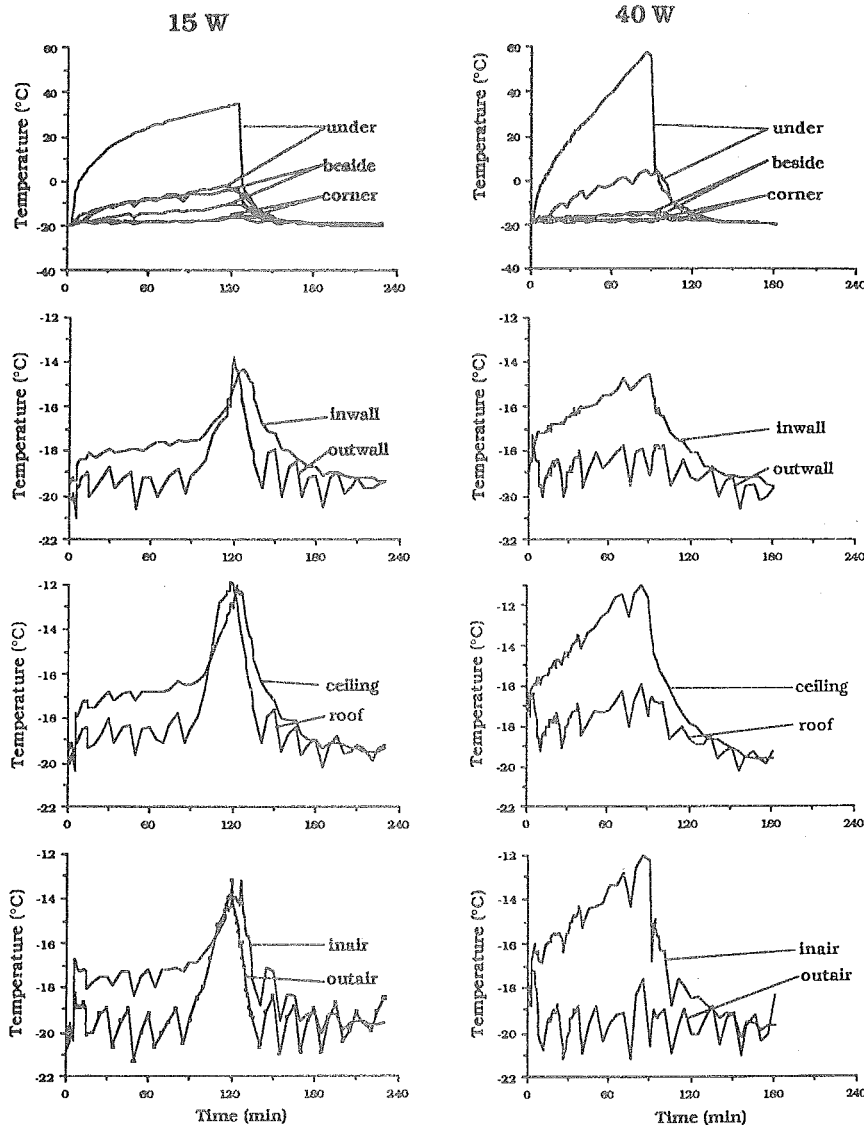


Fig. 3. Temperature changes of internal and external surfaces and air of a standard blue fox nest box in response to constant 15 and 40 W electric heaters. Note the different scales for the y-axes in the upper panels in comparison to other panels.



*Thermal environment inside nest boxes.*

When the fox or raccoon dog enters the nest box it brings the approximate equivalent of a 15 W heater (Korhonen et al., 1983) with it, and this heater then begins to heat the air and nest box structures until an equilibrium is reached. When measured with the electrically heated model animal inside the blue fox nest box with constant 15 or 40 W power inputs, the floor temperature just below the model rose most from its initial value of about -18 °C to about 35 and 55 °C within one and half hours and two, respectively. (Fig. 3). Changes in the floor temperatures beside the model, in the corner and on the outside of the nest box floor were much

smaller. Temperatures of the walls, ceiling and the nest box air rose, at most, only 4 to 5 °C even with the 40 W model animal inside the box. Of course, the 15 W heater produced smaller changes than the 40 W heater. The situation was about the same with the thermostatically controlled model animal (Fig. 4). Since the thermostat held the temperature of the model constant, equilibrium was reached within an hour. Here again, only the floor temperature just below the model rose to any great extent, while the other temperatures reached values only one to two °C higher than outside. At equilibrium the power input to the model was about 6-8 W.

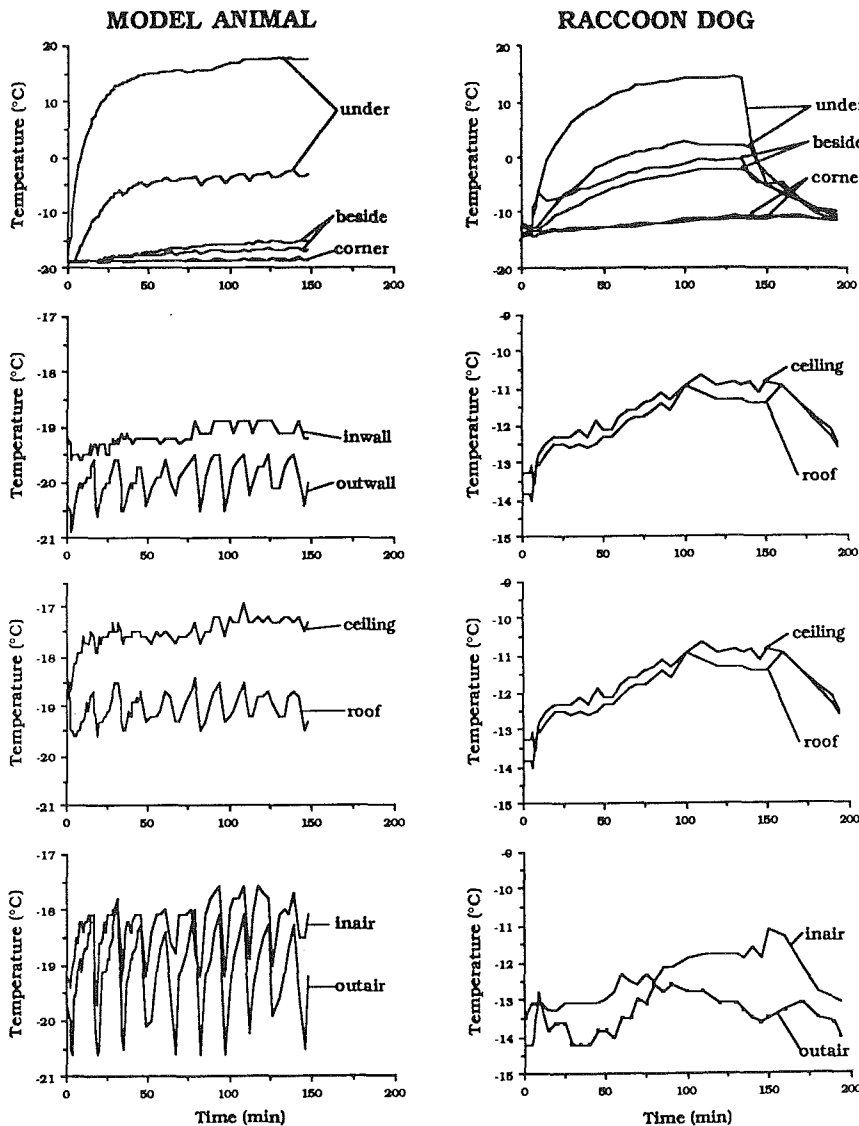


Fig. 4. Temperature changes of internal and external surfaces and air of a standard blue fox box in response to a thermostated model silver fox and a live raccoon dog. Note the different scales for the y-axes in the upper panels in comparison to other panels.

That the model situation corresponds to field conditions was confirmed on a farm with a live raccoon dog inside the box (Fig. 4). As with the model, the floor temperature below the animal rose markedly while the other structures and nest box air remained cool. Because of its larger body size in comparison with the cylinder model, the lying animal also partially covered the measuring point about 15 cm away from the center of the floor, which now rose more than with the model. Fig. 5 shows the long-term changes in floor temperatures when a raccoon dog was offered free access to the box in January. The animal entered the box at about 1 o'clock at night, came out at about 3 o'clock, went in again at about 6 o'clock, came out to say good morning to the farmer and to eat at about 9 and 11 o'clock, respectively.

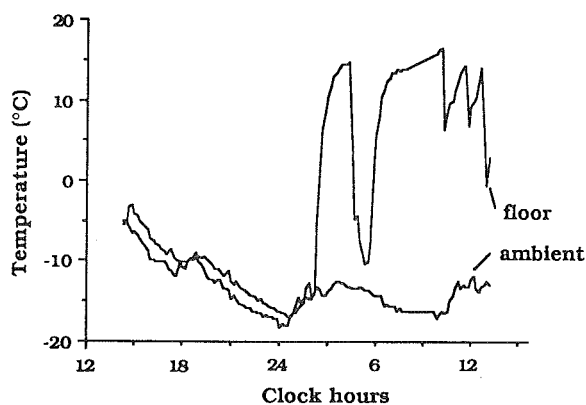


Fig. 5. An original record of nest box floor and ambient air temperatures during a day in January. Entries, exits and time spent inside by a live raccoon dog can be read from changes in floor temperature.

During the day and evening it preferred to stay outside. This is a very typical behavioural pattern of farmed raccoon dogs in winter if they are offered a possibility to use nest boxes. A more detailed description of this pattern will be given in another paper. Several attempts were also made to measure the response of the nest box temperature to the visit of blue fox. However, our blue foxes never went inside the boxes, so we had to give up these measurements.

The dependence of the rate of heating and cooling and of equilibrium temperature on floor insulation was evaluated for different nest boxes and heating sources. Assuming that heating and cooling rates follow "Newton's law of cooling" (Bakken, 1976), then a plot of the  $\log(T_{\text{floor}} - T_{\text{air}})$  vs. time should yield a straight line. The slope of this line is proportional to the initial cooling (or heating) rate of the floor.

The results in Fig. 6 show that the cooling rate of the floor can be described by this equation, whereas the heating rate does not follow "Newton's law". The rate of temperature rise is faster at the beginning, due to the direct heating of the thermocouple by the animal or heat source. For this reason, the half-warming time was the preferred measure of the heating rate of the floor. As expected, equilibrium temperatures were higher with higher power inputs and with added insulation under the floor (Table 2). The half-warming rates of the floors were fast, variable, and independent of equi-

Table 2. Half-warming rates, cooling constants and equilibrium temperatures for nest boxes in different situations.

Nest box	Heat source	$T_a$ (°C)	$T_{\text{floor}}$ (°C)	Half-warming time (min)	Cooling constant (1/min)
Blue fox	15 W	-18	35.0	18	0.051
	25 W	-19	42.7	35	0.055
	40 W	-19	55.9	23	0.061
	Model $\approx$ 7 W	-18	29.3	7	0.053
	Raccoon dog	-13	14.8	19	0.034
Nortriple	Model $\approx$ 7 W	-18	29.3		0.154
+styrofoam	Model $\approx$ 7 W	-18	32.7		0.079

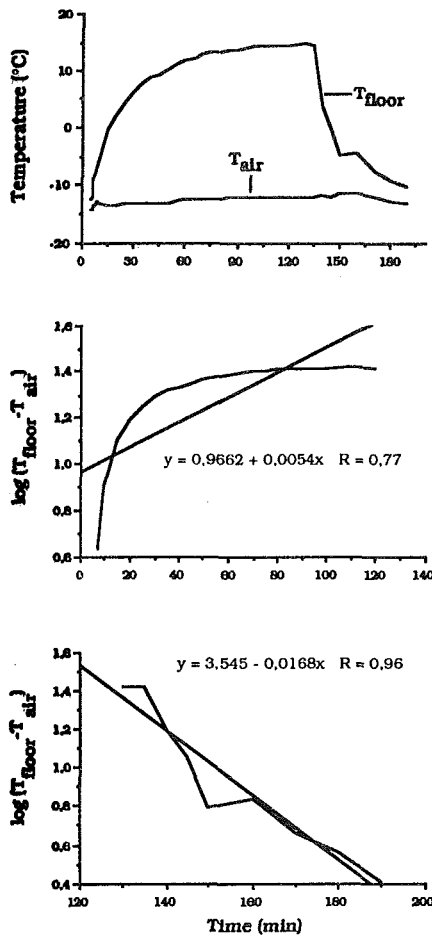


Fig. 6. An original record of nest box floor temperature in response to the entry and exit of a live raccoon dog (upper panel), and the same data when plotted as the logarithm of the temperature difference between the floor and ambient air vs. time for warming (middle) and cooling rate (lower panel) of the floor.

librium temperature. The cooling rate increased with increasing starting temperature and decreased with added floor insulation. These changes were, however, small. This means that the heat storing capacity of the floor is small. As soon as the animal leaves the box, the heat stored by the floor quickly escapes mainly into the nest box interior even from floors insulated from below.

Ventilation rates with and without wind are depicted in Table 3 for different nest box types and conditions. The ventilation rate is a complex phenomenon which depends on nest box configuration, its openings, and also on wind velocity and direction. For example, the air is exchanged 25 times per h under calm conditions in the standard silver fox nest box having an entrance tunnel. The rate of air exchange rises to 46 times per h if the roof is opened slightly (1 cm) and to 130 times per h with a broader opening (6 cm). In the Nortrippe box, opening the ventilation window doubles the rate of air exchanges. Wind always very effectively increases the ventilation rate, but its effect is greatly dependent on wind direction. A slight wind against the nest box opening increases the ventilation rate manyfold, while the same wind blowing from the side can have almost no effect.

Table 3. Rates of air exchange (times per h) in different nest boxes and situations with and without wind.

Nest box and situation	Rates of air exchange (times per h)		
	Calm	Wind (3 m/s)	
		Towards opening	From side
Silver fox box+entrance tunnel	25		
-roof 1 cm open	46		
-roof 6 cm open	130		
Kombi+entrance tunnel	8	65	12
-no tunnel	23		
Blue fox box+entrance hall	17	62	
Round box+entrance tunnel	23	49	
-roof 1 cm open	32		
-no tunnel	43		
Nortrippe+zig-zag entrance	29	50	16
-ventilation window open	20	100	19

Based on the above mentioned figures, the heat loss through different avenues were calculated for a standard blue fox nest box (Fig. 7). The small temperature gradient across the roof and walls can explain their relatively small contribution to heat loss. On the other hand, the temperature gradient was large for the floor. Therefore, despite a small surface area (19% of the shell), as much as 40% of the total heat loss was measured from the floor.

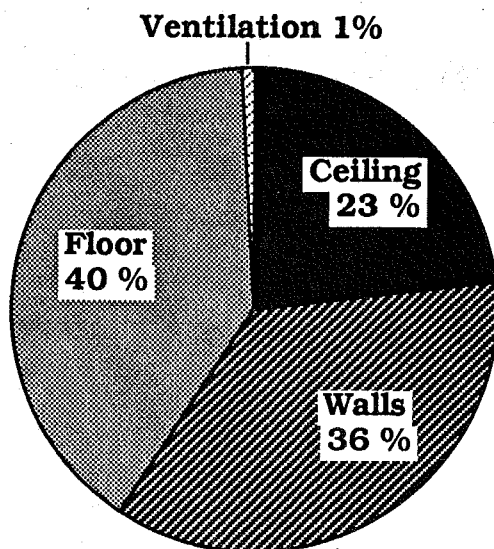


Fig. 7. Calculated proportional heat loss avenues in a standard blue fox nest box at  $-18^{\circ}\text{C}$  under calm conditions.

Unexpectedly, ventilation seems unimportant to heat loss. With 17 air exchanges per h, ventilation removed only 1% of the total heat from the box. This is again due to the small temperature gradient between the nest box and the ambient air. When cool air is replaced by a slightly cooler air, little heat is transferred. Under these circumstances, even a strong breeze does not increase the rate of heat loss very much.

#### Discussion.

Although the main purpose of the year-round nest box is to protect the animals from harsh weather, a comparison with human houses reveals several differences despite similar purposes. Man lives in a tropical climate inside the house. The tropical cli-

mate is a result of a massive consumption of external energy for heating. Within this climate the temperature gradient between the skin and the indoor ambient air is small, and, accordingly, man does not need much insulation provided by clothing. By contrast, a large temperature gradient is found across the walls of the house. This gradient must be compensated for either by massive heating systems or by effective shell insulation.

For foxes and raccoon dogs the situation is different. They do not have any heating devices which could produce a tropical microclimate inside their nests. Therefore, there exists no major temperature gradient across the shell and, as a result, shell insulation does not bring about much benefit from the energy conservation point of view. There also exists no need for major shell insulation since the fox, in contrast to man, already has a very warm fur coat which provides a tropical microclimate where the temperature receptors receive their information i.e. at the skin. This conclusion is in agreement with the results of *Thorkelson and Maxwell (1974)*. They measured a heat transfer model of a raccoon in a closed tree den and found that more than 65% of the total resistance to heat loss through the model was in the fur, 17% in the air space of the den, and the rest in the den wall. From the data of *Schlander et al., (1950)*, *Hammel (1955)* and *Korhonen et al. (1983)*, we can conclude that the thermal insulation of a raccoon dog, blue fox or silver fox pelt is better than that of the raccoon. Accordingly, even a greater proportion of the resistance to heat loss is in the fur of these more arctic animals than in that of the raccoon.

Unlike human houses, the heat flow through the nest box floor was greater than what would be expected from its surface area. This is due not only to the compression of the fur below the lying animal which considerably reduces its thermal resistance (*Thorkelson and Maxwell, 1974*), but also to a large contact area which increases the proportion of conductive heat transfer. Therefore, as shown by our results, if extra insulation is added to the nest box, the effectiveness of added insulation is greatest on the floor, can barely be measured on the

wall, and is almost negligible when added on the roof. The figures are thus just the opposite of those generally applied to the insulation of human houses. It is interesting to note that effective floor insulation can be achieved by adding bedding on the floor. The effectiveness of the bedding has been confirmed earlier for mink nest boxes (*Korhonen and Harri, 1984*). There were no major differences between different nest box configurations. Regarding warmth, a round box is not warmer *per se* than a quadratic one, and an entrance tunnel does not produce warmth. Double walls are more expensive than they are effective from a thermal insulation point of view. If the only purpose of the nest box is to produce warmth, all the different solutions satisfactorily fulfill this criterion and in this respect, differences between well insulated and noninsulated model are minimal.

Because of the low air temperature inside the boxes, heat loss through ventilation was small even with a wind. The calculated contribution of ventilation to heat loss of the nest box was only 1% (actually less) under calm conditions. For the same reason different tunnel entrances or the closing of the nest box entrance with a cloth brought about only small effects on the total insulation of the nest box.

The effect of wind can be easily measured under laboratory conditions, but extrapolation of the results to field conditions is almost impossible. The effect of wind on the rates of air exchange in the nest boxes depends on wind direction in addition to its velocity. A mild wind blowing against the nest box opening has a great effect whereas the same wind from the side has a much smaller effect. However, due to the low temperature gradient between the nest box and the ambient air, the contribution of ventilation to the heat loss of the nest box amounts to about 2% even with strong wind blowing just against the nest box opening. On a farm, the shed houses and other structures disturb wind flow and produce turbulences so that wind conditions can vary from one nest box to the next.

A comparison of the nest box temperature between different electric heaters and those of a real animal reveals that the heating power of a raccoon dog is considerably smaller than that of a 40 W heating device but greater than that of a thermostated model animal, heated with a power input of about 6-8 W. Both produced nearly equal floor, wall, ceiling and air temperatures, but, because of its smaller size, the heated floor area was less with the model than with the raccoon dog. If the oxygen consumption data obtained for the raccoon dog under the same conditions are converted into watts (*Korhonen et al., 1983*), we get a value of about 15 W for a raccoon dog weighing 7 kg. This fits well the values obtained in the present study.

Due to the low thermal capacity of the wooden floor, its temperature rises within seconds after the raccoon dog enters the box and also falls within seconds after the animal goes out. The former change does not follow "Newton's law of cooling (heating)" (*Bakken, 1976*) but rises more quickly at the beginning. This is due to the direct heating of the thermal sensor by a warm animal or animal model. The large variance in the warming rate data can be explained by the variable position of the model animal on the thermal sensor; a direct contact brought about a faster warming rate than a less direct one. By contrast, the cooling rate of the floor depends on the amount of heat stored by the floor and can be described by "Newton's law of cooling". These rapid temperature changes indicate, however, that the heat storing capacity of nest box structures are low. Thus, an animal entering the box does not need much of its heat production to warm up the box. On the other hand, the nest box structures cannot store much heat which then could warm the pups as the vixen leaves the nest.

*Acknowledgements.* This work is one part of an internordic project on the ethology of farmed foxes. This work was also financially supported by the National Research Council for Natural Sciences, Finland. The Regional Development Fund of Finland Ltd. and the Finnish Fur Breeders Association.

References.

- Bakken, G.S., 1976.* An improved method for determining thermal conductance and equilibrium body temperature with cooling curve experiments. *J. Therm. Biol.*, 1, 169-175.
- Cena K., Clark, J. A., 1979.* Transfer of heat through coats and clothing. In *International Review of Physiology. Environmental Physiology III*: 20, 1-42. (Edited by Robertshaw, D.). University Ark Press, Baltimore.
- Hammel, H.T., 1955.* Thermal properties of fur. *Am. J. Physiol.*, 182, 369-376.
- Harri, M., Korhonen, H., 1985.* Thermophysical properties of nests of farmed mustelids; effect of wind and ventilation. *Scientifur*, 9, 16-20.
- Konnerup-Madsen, H., 1982 a.* Læforsøg med blåsræve. *Dansk Pelsdyravl*, 45, 451.
- Konnerup Madsen, H., 1982 b.* Læforsøg med sølvæve. *Dansk Pelsdyravl*, 45, 689.
- Korhonen, H., Harri, M., 1984.* Thermophysical properties of nests of farm mustelids; thermal insulation. *Scientifur*, 8, 285-290.
- Korhonen, H., Harri, M., Asikainen, J., 1983.* Thermoregulation of polecat and raccoon dog: a comparative study with stoat, mink and blue fox. *Comp. Biochem. Physiol.* 74 A, 225-230.
- Scholander, P.F., Hock, R., Walsters, V., Irving, L., 1950.* Adaptation to cold in arctic and tropical mammals and birds in relation to body temperature, insulation, and basal metabolic rate. *Biol. Bull.*, 99, 259-271.
- Sønderup, M., 1986 a.* Giv sølvæve læ - det lønner sig. *Dansk Pelsdyravl*, 49, 689-691.
- Sønderup, M., 1986 b.* Gode læforhold forbedrer blåsrævens hvalperesultat. *Dansk Pelsdyravl*, 49, 774-776.
- Thorkelson, J., Maxwell, R.K., 1974.* Design and testing of a heat transfer model of a raccoon (*Procyon lotor*) in a closed tree den. *Ecology*, 55, 29-39.
- Valtonen, M., Moss, S., 1983.* Talvikoppikokeita ketuilla. *Turkistalous*, 59, 634-636.



*Original Report.*

## **Light reflection of abnormal guard hairs of mink.**

*Palle Vistisen Rasmussen.*

*National Institute of Animal Science, Dept. of Fur Animals,  
P.O. Box 39, DK 8830 Tjele, Denmark.*

### **Abstract.**

The report deals with a pilot examination of some types of single abnormal (curved guard hairs of mink, which show a modification or abnormality of the reflection of light.

By means of a microscope-photometer the hairs have been examined with regard to reflection of white light.

The result is presented as reflection curves indicating the lancet shape and position of the guard hair in question.

A bell-shaped reflection curve indicates that the guard hair is curved to such an extent that the angle of incidence of the light is 0 in one or more points of the obverse part of the lancet part.

If the reflection curve is rising gradually, it indicates that the guard hair is moderately curved.

### **Introduction.**

A detailed morphological description of abnormal hairs in fur animals is necessary to identify the real causes of their occurrence and as documentation for a specific optical impression. (*Rasmussen, 1988*).

Knowing the angle of incidence of light and applying the physical-optical laws, it must be possible to use the light reflection from individual abnormally shaped guard hairs to indicate the lancet shape of the hair. The objective of this pilot experiment is to substantiate these indications.

### **Material and methods.**

A mink pelt (scanblack) with several abnormal guard hairs with clearly curved lancet parts was first analyzed macroscopically. Three guard hairs (A, B and C), which subjectively seemed different with regard to degree of curvature and where the curving level was more or less perpendicular on the surface of the skin, were examined.

This was done by means of a Zeiss microscope-photometer, type MPMO1K. The measuring objective used was an Epiplan 4/0.1 Pol. ( $D = 0$ , i.e. the angle of incidence = 0 compared to the horizontal plane of the mink skin). The diameter of the measuring field in the objective was calculated at approximately 20  $\mu\text{m}$ . Furthermore, the equipment consisted of a stabilized transformer, a measuring amplifier and a digital indicator instrument.

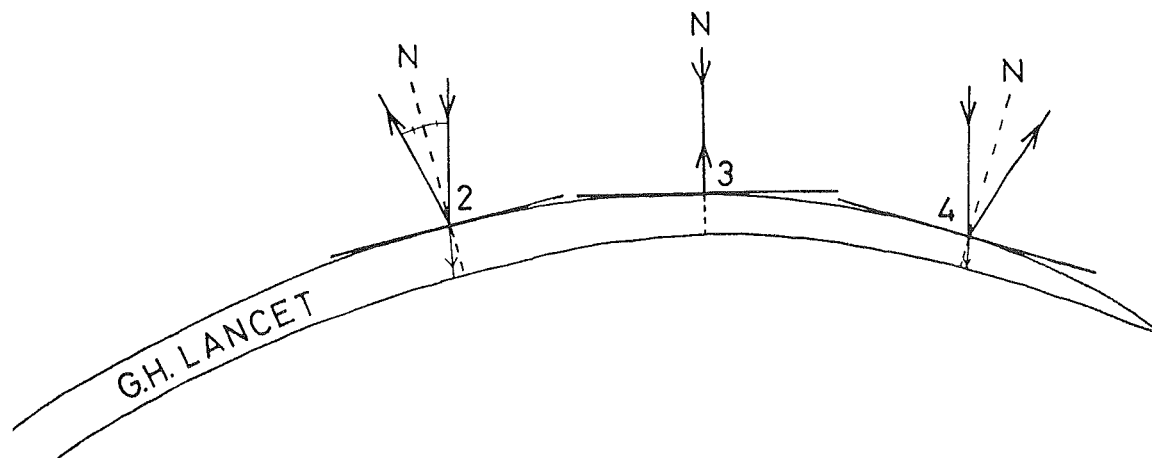


Fig. 6. The drawing outlines how the light is reflected and refracted in guard hairs B and C.

In connection with the measurements it became obvious that these will be more accurate, if the actual hair is prepared and then fixed in the natural position. Errors like vibrations and air flow are reduced. In this way it will be possible to use a smaller measuring field. This will be tried on several types of guard hairs.

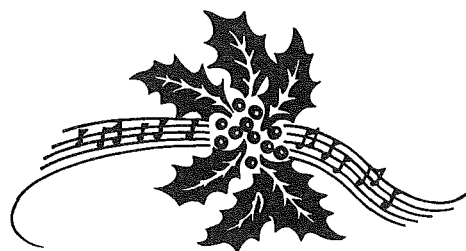
#### Conclusion.

It has been shown that by microscope-photometry it is possible to describe some types of abnormal guard hairs with regard to their shape and position. By improving the preparation of the object (the lancet part of the

guard hair) the method will probably become more accurate.

#### References.

- Alonso, M., Finn, E., 1972. Physics.*
- Rasmussen, P.V., 1985. Dissertation. (University of Copenhagen).*
- Rasmussen, P.V., 1988. Morphological description of abnormal guard hairs of mink and silver fox. (poster). The 4th Int. Sci. Congr. in Fur Animals, Toronto, Canada.*
- Zeiss - Mikroskop-Photometer MPM01K, Gebrauchsanleitung.*





### Flat areas on the back of mink pelts.

Palle V. Rasmussen, Outi Lohi.

The "weak hip" fur defect in mink is described and illustrated. Affected mink have shorter than average hairs and poorer fur density on the hips, resulting in an area of the pelt having a flattened appearance. Of 200 Scan Black pelts investigated, 100, 19, 43, 31 and 7 resp. were scored 0, 1, 2, 3 and 4 for the defect (0 = non-affected pelts and 4 = badly affected pelts); for pelts in the 5 groups, weight of hair on a 1.3 cm<sup>2</sup> pelt hip sample averaged 55 ± 7, 45 ± 6, 45 ± 4, 43 ± 6 and 40 ± 6 mg resp., and that of a similar sample obtained from the back of the pelt averaged 77 ± 9, 72 ± 10, 69 ± 12, 70 ± 11 and 60 ± 9 mg.

*Dansk Pelsdyravl*, 51, 9, 624-627, 1988.  
6 figs., 3 tables. In DANH. CAB-abstract.

### Fine structural changes in the developing gastric gland cells in the ferret during the postnatal period.

M. Asari, Y. Kano, S. Wakui, T. Nakamura, H. Oshige.

The development of the gastric gland cells in the ferret was studied with particular reference to maturation during the postnatal period. In the newborn, the glands consist of immature parietal cells with numerous mitochondria, and shallow rudimentary intracellular canaliculus with numerous microvilli, and undifferentiated cells. At one week old, mucous neck cells are present containing scattered mucin granules and the parietal cells contain tubulovesicular components. At two weeks old chief cells can be seen with large secretory granules in their basal cytoplasm. The gastric gland cells subsequently increase considerably in size, and their epithelium undergoes rapid histological maturation towards weaning.

*Res. Veterinary Science*, 45, 296-299, 1988.  
5 figs., 27 references. Authors' summary.

### Seasonal comparison of body composition and hair coat structure between mink and polecat.

Hannu Korhonen.

1. Chemical body composition and hair coat structure between summer and winter were compared in adult minks (*Mustela vison*) and polecats (*Mustela putorius*).
2. Considerable site-specific variations existed in physical traits of pelage in both species. Hair coat of the mink was more dense than that of the polecat.
3. Seasonal changes in hair coat structure were evident for both species.
4. Marked seasonal changes in body mass of both species were found. From maximum values occurring in mid-winter their body weight dropped 20-30% reaching the minimum values in mid-summer. This marked change was the result of changes in the amount of subcutaneous fat reserves and body water content.
5. Species-specific differences in thermoregulatory properties of minks and polecats seem to reflect their natural distribution.

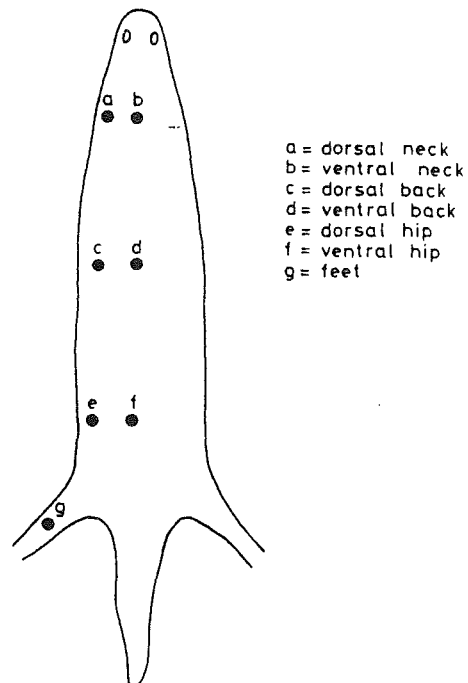


Fig. 1. Sketch showing different sampling positions for measured pelage parameters.

*Comp. Biochem. Physiol.*, 91A. 3. 469-473, 1988. 1 fig. 3 tables, 13 references. Authors abstract.

**Morphology in the caecum in nutria (*Myocastor coypus* Mol.).**

*Ewa Kochan, Marian Langenfeld.*

In this study the macroscopic structure of the nutria caecum was investigated and described. Anatomical studies by the method of evisceration were carried out on 24 Greenland Sapphire nutria of either sex (12 males and 12 females), aged 8 months, over 1 year and 4 years.

Investigations concerned the topography of the caecum, shape, length, diameter, and volume as well as the length and width of the swellings. The swellings and tapes in the nutria caecum are similar to those found in pigs and horses. Following measurements of the caecum were obtained: length from 35.0-50.5 cm, diameter from 18 mm at apex to 54 mm at basis, volume 555 ml

The general anatomical structure of the caecum in nutria has many common features with those in other mammals despite differences in shape, length and volume.

*Acta Agraria et Silvestria, Zootechnica, 27, 43-52, 1988. 3 figs. 5 tables, 10 references. In POLH. Su. ENGL, RUSS. Authors' summary.*

**Histology of the caecum in nutria (*Myocastor coypus* Mol.).**

*Marian Langenfeld, Ewa Kochan.*

The aim of this study was to investigate and describe the microscopic structure of the caecum wall in nutria. Experiments were conducted on 6 Greenland Sapphire nutria, 3 males and 3 females, aged 3 years.

It was shown that in general the structure of the caecum wall in nutria was similar to that in other mammals. The most pronounced growth of the lymphoid tissue occurs in the proper and submucous layers of the membrane, responsible for the proper functioning of immunologic system. Among structures of

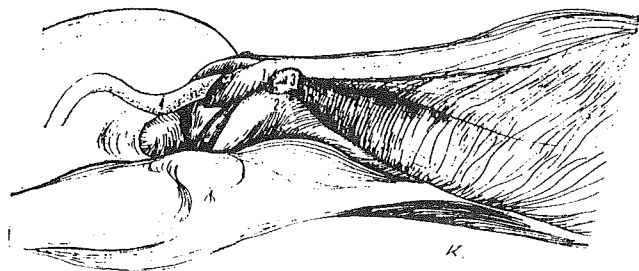
the lymphoid tissue are of interest largesizes conglomerations of lymphocytes, exceeding 1000 microns. In addition, the well-developed intestinal glands were found, densely distributed in the field of vision of the studied slides.

*Acta Agraria et Silvestria, Zootechnica, 27, 53-59, 1988. 4 figs., 7 references. In POLH. Su. ENGL, RUSS. Authors' summary.*

**Anatomical description of the male sexual system of nutrias (*Myocastor coypus*). Part II.**

*Vaclav Kulisek, Milan Barta, Ivor Jakubicka, Lubomir Zavodny, Igor Zemanovic.*

In the previous paper we have admitted at the general description of the male sexual system. Since, however, scrotum is absent in nutria males, in this paper we are presenting the description of the abdominal wall and *canalis inguinalis*. A part of the insertion section in the inner oblique abdominal muscle and transverse abdominal muscle winds spiral-like and forms a spirallike muscular ring, which is an analogy of the *musculus cremaster*. The above muscular ring protrudes over the *canalis inguinalis* and touches subcutaneous tissue. The head section of the spermary penetrates into this ring and grows firmly with it together. In dependence on the external temperature the muscular ring is liberated or contacted, and thus the temperature in the spermary and epidymis is controlled.



Obr. 2. Vnútorné prekríženie crus mediale a musculus rectus abdominis  
 Fig. 2. Internal intersection of the crus medialis and musculus rectus abdominis  
 1 — crus medialis  
 2 — m. rectus abdominis  
 3 — svalový prstenec — muscular ring  
 4 — telo penisu — body of penis

*Polnohospodarstvo, 34, 9, 1988. 2 figs., 5 references. In SLOE. Su. CZEK, ENGL, RUSS. Authors' summary.*

### Anatomical description of the female sexual system of nutria (*Myocastor coypus*).

Vaclav Kulisek, Ivor Jakubicka, Milan Barta, Lubomir Zavodny, Igor Zemanovic.

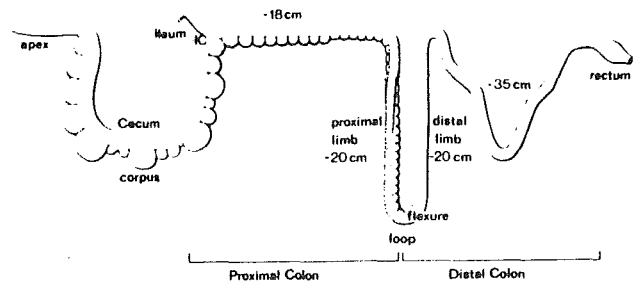
In the paper, the authors aimed at the anatomical description of female sexual system organs in nutrias, namely at the levels of microscopy as well as light microscopy. They have described the structure of ovaries, oviducts, uterus and vagina. A special findings is that uterus has two horns, is totally divided and no symptoms of ovulation or different stages of yellow corporcles were seen in the ovaries of sexually mature females.

*Polnohospodarstvo*, 34, 7, 655-660, 1988. 5 references. In *SLOE. Su. ENGL, RUSS. Authors' summary*.

### Regional differences in hindgut structure and function in the nutria, *Myocastor coypus*.

R.L. Snipes, H. Hörnicke, G. Björnhag, W. Stahl.

Morphologically the large intestine of the nutria resembles that of other caviomorphs, notably the guinea pig. The cecum is voluminous: 8.6% of the total intestinal length and 12.7% of the total intestinal surface area (considering the surface enlargement factor). It contains 27-32% of the wet ingesta and 20-23% of the dry matter in the gastrointestinal tract. In the colon the corresponding figures are: 21.8% of length, 12.6% of surface area. 16-21% of wet ingesta, and 16-40% of dry matter. The colon can be subdivided both structurally and functionally into two sections, the proximal and the distal colon, the border between the two being the apical flexure of a long parallel loop. The proximal colon (42% of colonic length) displays on the mucosal surface of its mesenteric side a narrow furrow bordered by ridges, which is absent in the distal colon. The ridges contain subepithelial accumulations of coiled tubuloalveolar mucoid glands, entwined by bundles of muscle fibers. Determinations of nitrogen in the contents near the furrow suggest a concentration of bacteria in



**Fig. 1.** Schematic drawing of the large intestine of the nutria. Nomenclature used in the text for the various subdivisions is given. Lengths in cm are approximations. *Shaded area* portion of the colon possessing ridges and furrow internally. *IC* ileocolical junction

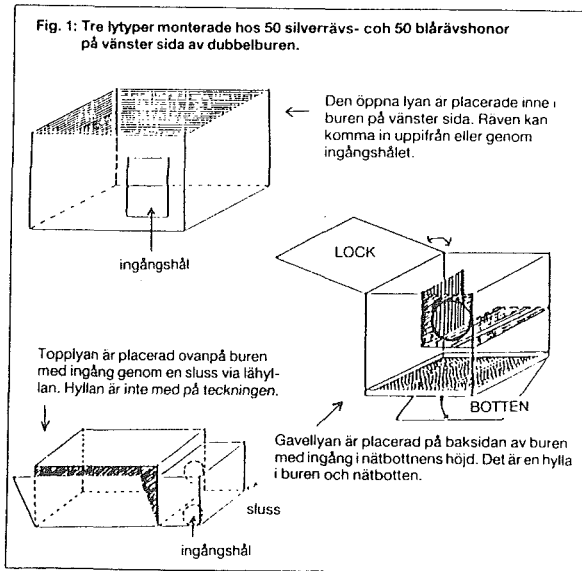
this part of the lumen. It is hypothesized that the structural differentiations of the proximal colon provide mechanisms for the transport of bacteria from the proximal colon back into the cecum to maintain the fermentation function. The slopes of the longitudinal profiles for dry matter and for concentrations of sodium, potassium and calcium in the luminal contents change at the tip of the parallel loop. The electrical potential difference "intestinal lumen - blood" is particularly large in the proximal colon, indicating active electrogenic ion transport in this region.

*Cell Tissue Res.*, 252, 435-447, 1988. 4 tables, 12 figs., 33 references. *Authors' summary*.

### Use of different types of nest box for foxes.

Vivi Pedersen.

From before mating to the end of the whelping period, 50 silver fox and 50 blue fox females were allowed access to cages with (1) an open nest box (2) a covered nest box placed behind the cage, with access from the side and (3) a nest box placed on top of the cage, with access from above. The use of the 3 types of nest box was monitored for 20 h each month. The nest box placed on top of the cage was the most popular choice ( $P < 0.05$ ), in particular for silver fox females. Choice of nest box was significantly affected



by the type of box in which the female had been reared, except in Nov.-Mar., when all females preferred the nest box on top of the cage. There were no significant differences between the 3 types of nest box in litter size at birth or weaning. Data are presented in 5 graphs and 1 table.

*Våra Pälsdjur*, 60, 4, 123-15, 1989.  
1 table, 5 figs. In SWED. CAB-abstract.

**Trials using screens for young mink females.**

*Maria Neil.*

Of 58 mink females, half were placed in cages next to empty cages on 27 Jan., and the remainder were placed in cages adjacent to other females (controls). There were no significant differences between the 2 groups of females in litter size at birth (6.3 and 6.2 resp. for isolated females and controls), litter size at 42 days of age (5.2 and 5.3) or kit mortality to 42 days (16 and 13%). Isolated females mated an average of 36 h earlier than controls, and approx. 67% of the former mated as soon as a male was introduced vs. 50% of the latter.

*Våra Pälsdjur*, 60 4, 120-121, 1989.  
2 tables, 7 references. In SWED.  
CAB-abstract.

**Behaviour of the nutria (*Myocastor coypus*) in pens with and without water basins.**

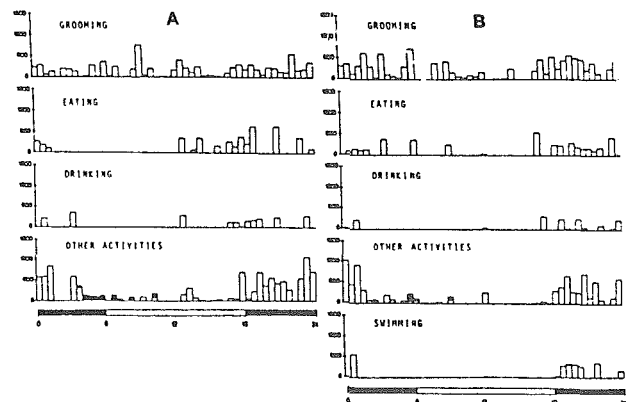
*Andrea Schürg, H. Hörnicke.*

Introduction.

The nutria or coypu was originally confined to southern South America where its habitat is semiaquatic. It has been widely introduced as a fur-producing animal in Europe and North America. Some aspects of its behaviour have been described on the basis of observations in the field (*Gosling et al. 1980; Kohli, 1980*) and in penned animals (*Lomnicki, 1957; Gosling, 1979*). Nutria farming systems with and without water basins are used with equal success. The present investigations was aimed toward a more complete description of the behaviour of penned animals. In addition it was studied how to complete deprivation of swimming facilities affects the behaviour of this water-loving animals.

Conclusions.

The behaviour changes induced by depriving nutrias of swimming water were not very profound. Animals which could swim spend more time for grooming to remove the water and to grease their fur. Younger animals deprived of swimming water used more time in gnawing, play and social interaction.



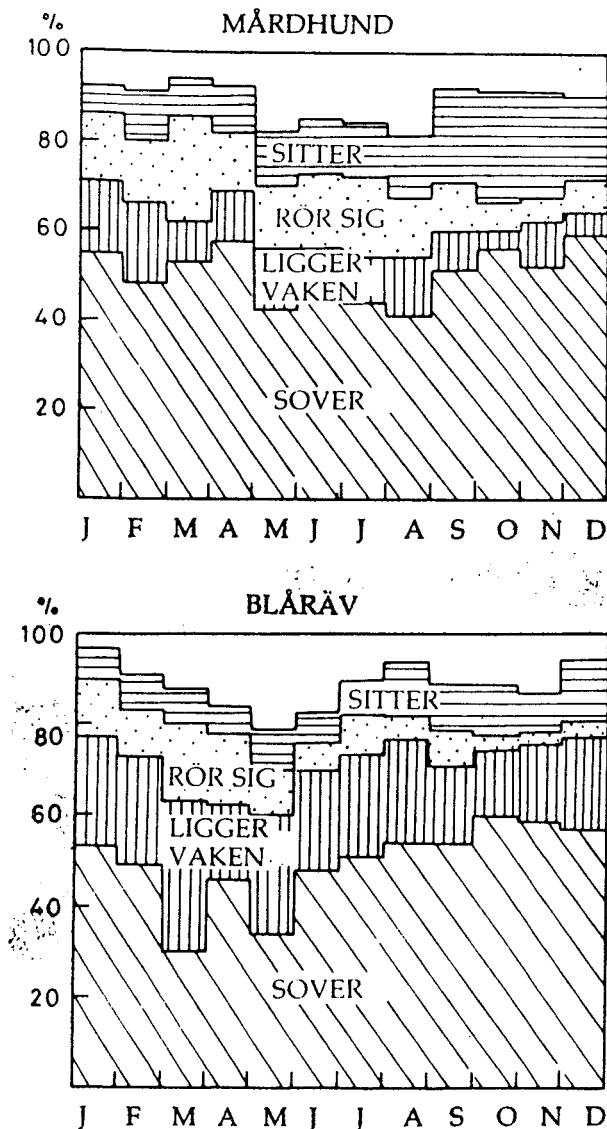
*Proc. International Congress on Appl. Ethology in Farm Animals, Kiel, 1984, 295-297.*  
2 tables, 1 fig., 4 references.  
Authors' introduction and conclusions.

### Behaviour of blue foxes and raccoon dogs.

*Hannu Korhonen, Mikko Harri, Liisa Nurminen, Jaakko Mononen, Ritta Tirkkonen, Ritva Inkinen.*

An account is given of seasonal, social and sexual behaviour in blue foxes and raccoon dogs in Finland.

Bild 3.  
Sjubbens och rävens viktigaste beteendefunktioner under året.



*Finsk Pälstidskrift, 23, 4, 128-129, 1989.  
3 figs., 1 reference. In SWED. CAB-abstract.*

### Stress in farmed fur animals.

*Leif Lau Jeppesen.*

Correlation between a number of behavioural and physiological reactions and imposed experimental and naturally occurring strains in the life of farmed fur animals were examined. Level of adrenal cortex hormones in the blood showed a short-lived increase in response to a single stress-treatment, and short-lived and steadily diminishing increases in response to repeated stress-treatments. Along with a great diurnal variation this pattern of reactivity means that the response of the adrenal cortex, as reflected by a single blood sample, is difficult to use as a practical measure of long-term stress. In farmed mink the level of eosinophile leukocytes turned out to reflect imposed strain much more reliably: It was reduced by short-term strain and increased by daily repeated strains, long-term strain. Exposure to long-term strain was also unveiled by low levels of aggression and high levels of fear, as measured by reaction to a stick placed in the cage by an experimenter. Crowding of growing pups, pregnancy and improper time of weaning were among the aspects of caged life, which were found to increase stress. High levels of stress, as measured by eosinophil leukocytes, were shown to increase pup mortality and rate of infection with naturally occurring coccidians.

*Proced. International Congress on Appl. Ethology in Farm Animals, 88-94, 1988.  
1 table, 12 references. Author's abstract.*

### A chronic jugular catheterization for remote blood sampling in freely moving mink.

*C. Bonnefond, L.G. Fouche, L. Martinet.*

The cannulation method consists of implanting a silastic catheter in the jugular vein. Passing subcutaneously, the catheter emerges on the back between the scapulae. It is protected by a spiral spring and anchored on a support outside the wire pen. Two swivels, the first one at the point of subcutaneous

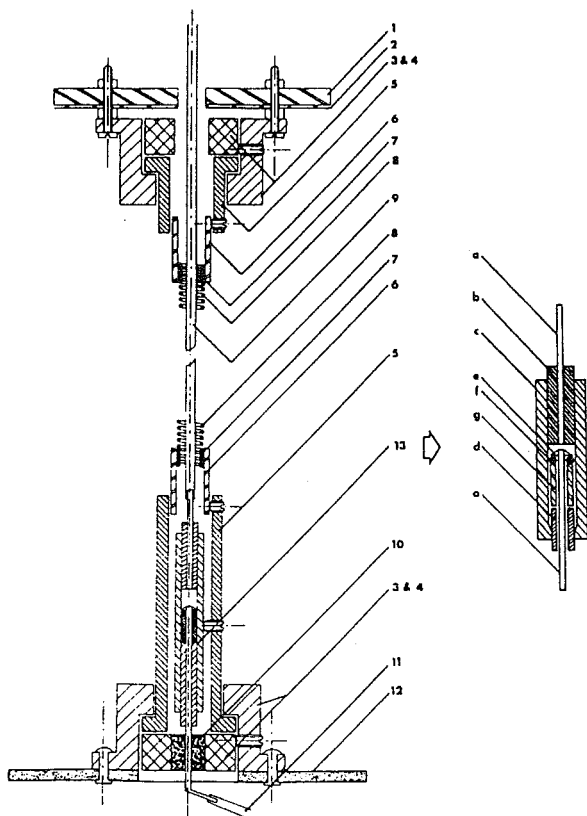


FIG. 1. Tethering system and swivel: 1) Sheet of stainless steel; 2) Grating of the cage; 3 and 4) Integral pieces; 5) Swivelling part; 6) Stainless steel tubing; 7) Soldering; 8) Spring; 9) Polyethylene tubing; 10) Glue; 11) Silastic tubing; 12) Leather; 13) a—20 gauge stainless steel tubing, b—Plastic tube i.d. 0.635 mm, c—Plastic tube i.d. 2.286 mm, d—Plastic tube i.d. 1.016 mm, e—Dental cement, f—Rubber gasket, g—Plexiglas tubing i.d. 1.016 mm.

entry of the catheter on the mink, the second one on the emerging catheter at the top of the cage, allow movements of the mink without twisting up the catheter. Using this chronic cannulation system, the effects of handling and anesthesia on concentrations of plasma PRL and LH have been studied.

*Physiology & Behaviour*, 44, 1, 141-146, 1988. 4 figs., 1 table, 12 references. Authors' abstract.

### Vitamin B<sub>12</sub> in blood plasma of blue and silver foxes.

Romuald Rajs.

The level of vitamin B<sub>12</sub> in blood plasma of full-grown (6 months old) blue and silver foxes was assayed by CPBA. The level of cobalamine was significantly higher in blue foxes than in silver foxes.

*Zeszyty Naukowe*, 153, *Zootechnika*, 17, 5-9, 1988. 1 table, 17. references. In POLH. Su. ENGL, RUSS. Authors' summary.

### Amino acid composition of hair protein of growing polar foxes.

Romuald Rajs.

The amino acid composition of hair proteins of growing blue polar foxes (2 weeks to 6 months old) was tested by the high voltage electrophoresis and ascending paper chromatography method. During winter hair synthesis, changes in the level of some amino acids were observed. The level of cystine with cysteine increases from 16% to 20%.

*Zeszyty Naukowe* 153, *Zootechnika*, 17, 11-17, 1988. 2 tables, 10 references. In POLH. Su. ENGL, RUSS. Author's summary.

### Blood values of chinchilla.

Monika Spann, H. Kraft.

Blood sampling from chinchillas is described. Small amounts (1 ml) can be obtained from the ear vein of individual animals. With farmed chinchilla or those for experimental use, larger amounts (4-5 ml) can be sampled from anaesthetized animals by cardiac puncture or retrobulbar vein plexus. 81 blood samples from 79 chinchilla were studied for blood picture, clinico-chemical values (bilirubin, urea, creatinine, glucose, total proteins) and enzyme activities (alanine and aspartate aminotransferase, alkaline phosphatase, glutamate dehydrogenase and gamma glutamyl transferase). Blood gas analyses of arterial blood were done on 15 animals. Blood values are tabulated and discussed.

*Berliner und Münchener Tierärztliche Wochenschrift*, 101, 10, 344-347, 1988. 3 tables, 20 references. In GERM. Su. ENGL. CAB-abstract.

### Hematology and serum biochemistry of captive swift foxes (*Vulpes velox*).

S.A. Mainka.

Blood samples were taken from 23 swift foxes (*Vulpes velox*) which were to be used in

a reintroduction program. The foxes originated from two different captive breeding programs: one at the Calgary Zoo (CZ) and one at the Wildlife Reserve of Western Canada (WRWC). Several differences between swift fox and domestic canine hematology were seen, including an increased number of smaller red blood cells and lower absolute leukocyte counts in swift foxes. Serum glutamic pyruvic transaminase was higher than in the domestic canine normal range while serum creatinine values were lower. Hemoglobin, serum potassium, total protein, globulin in the two groups (CZ and WRWC) were statistically different as were male versus female mean corpuscular volume values.

*Journ. of Wildlife Diseases*, 24, 1, 71-74, 1988. 2 tables, 5 references. Author's abstract.

#### Exotic pet medicine.

*J.E. Harkness.*

The eleven papers in this issue review the biology, husbandry, nutrition and diseases and their treatment of rabbits, guinea pig, small rodents (gerbil, hamster, mouse, rats), pigeons, quail, mink, ferret, primates and reptiles. There are also papers on the economic considerations of establishing an exotic pet practice, and anaesthesia and surgery of laboratory animals.

*Vet. Clinics of North America, Small Animal Practice*, 17, 5, 981-1233. *Index Veterinaria*.

#### Repeatability of grading scores for colour and body size in silver foxes.

*Hilkka Kenttämies.*

Coat colour and body size of 248 silver foxes were evaluated by 5 judges on a 1-5 scale in 3 successive trials involving 3720 observations. Colour score averaged  $3.01 \pm 0.83$  and body size score  $3.17 \pm 0.76$ . There were

significant differences between males and females for colour score and between scores awarded by different judges. The repeatability of grading scores was 69.4% for colour and 46.2% for body size, repeatabilities among judges were 68-82% for colour and 51-59% for body size.

*Proceedings, WAAP-88, Genet 4.139, pp. 550, 1988. Only abstract received. CAB-abstract.*

#### Mink.

*Farol N. Tomson.*

This paper has short sections on the reproduction, nutrition and physiology of mink.

*Vet. Clinics of North America, Small Animal Practice*, 17, 5, 1145-1153, 1987. 33 references. *Index Veterinarius*.

#### Biology and medicine of the ferret.

*Cynthia L. Besch-Williford.*

This review includes consideration of the anatomy, reproductive physiology and husbandry of *Mustela putorius furo*.

*Vet. Clinics of North America, Small Animal Practice*, 17, 5, 1155-1183, 1987. 3 tables, 101 references. *Index Veterinarius*.

#### First record of the raccoon *Procyon lotor* (L., 1758) in Belgium.

*R.M. Libois.*

The first record of the raccoon in Belgium is briefly reported. Since the species is well established for a long time close to the Dutch and the German boundaries, its presence in Belgium is not very surprising.

*Cahiers d'Ethologie Appl.*, 7, 2, 140-142, 1987. 1 table, 5 references. In *FREN. Su. ENGL, FREN. Author's summary.*

### The otter: an endangered animal?

*Annegrete Schimmer.*

A decline in numbers of otter *Lutra lutra* (L.) has been observed in most European countries. This decline has continued despite of conservation. Until now it is unknown how the Danish otter population has developed since the species was conserved in 1967.

In the summer 1979 an investigation was set up to find the actual occurrence of otter and to look at the effects of some environmental factors on the otter population in Denmark. It is done by an intensive investigation in 3 parts of the country and by an extensive investigation covering the whole country.

Preliminary results from part of the extensive investigation covering inquiries to 516 fish pond farmers indicate a 50% reduction in numbers of otter in Jutland from 'before 1974' until '1974-78'.

The field work is expected to end in late 1980.

*Fredningsstyrelsen, Copenhagen, Denmark, 241-245, 1982. 6 references. In DANH. Su. ENGL. Author's abstract.*

A field study of ocelots (*Felis pardalis*) in Peru.

*Louise H. Emmons.*

A population of ocelots was followed by radio-tracking in a Peruvian rain forest. Two resident adult males, two adult females, and three subadults were radio-collared, as well as two transients. Ocelots were active at any time of day, but usually they rested in the morning, became active in mid - to late - afternoon, and continued activity until after dawn the following morning, with one rest period during the night. They spent an average of 9.6 hours walking per night.

Breeding females occupied mutually exclusive territories, but an old female was tolerated on their territories by her former

neighbours when the latter had no dependent young. Apparent direct territorial defence by females was recorded four times. Adult males occupied large territories that overlapped three or more female ranges.

Circumstantial evidence indicated that females on the study area produced young about every other year. A lactating female increased her daily activity to a maximum of 133% above normal, to 93% of the time, before losing her litter. It is conjectured that she was unable to sustain the foraging demands of lactation.

An 80% grown subadult female was already wandering, but two 80% grown males occupied small ranges within their presumed mother's territories. The disappearance of an old adult male and establishment of another coincided with changes in the status of all collared residents. Although ocelots hunted, traveled, and usually denned alone, they often met: 37 encounters between collared cats were recorded during radio-tracking.

*Rev. Ecol. (Terre Vie), 43, 2, 133-157, 1988. 6 tables, 4 figs., 32 references. Su. FREN. Author's summary.*

Fur trade in Canada: An econometric analysis.

*Roselyne Joyeux.*

Much attention has been given during the 20th century to the 10-year cycle in the population of forest fur-bearing animals in Canada and its effect upon the fur trade and wild life generally. This paper investigates the relationship between the quantity of furs sold at the annual London auctions and the prices achieved at the auctions. Using bivariate time-series techniques equations relating price and supply are estimated and are then employed to answer the following questions:

(1) Are there cycles in prices due to fashion, business conditions or any other factors,

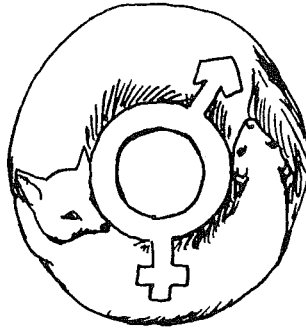


which might have caused the cycles in quantities?

(2) Are supplies sold in one period influenced by prices obtained in previous periods?

It is found that most animals, and in particular for lynx and muskrats, there is no statistical evidence that the cycles in supply have been induced by cycles in prices.

*Ecological Modelling, 27, 139-152, 1985. 5 tables, 9 references. Author's summary.*



GENETICS

**Silver fox gene mapping: conserved chromosome regions in the order Carnivora.**

*N. Rubtsov, A. Graphodatsky, V. G. Matveeva, S.I. Radjabli, T.B. Nesterova, N.A. Kulbakina, S. Zakian.*

Twenty-three silver fox x hamster somatic cell hybrid clones were used to assign 15 fox genes: GPI to chromosome 1; PGD to chromosome 2; MDH2 to chromosome 3; ESD to chromosome 6; LDHB to chromosome 8; NP to chromosome 10; LDHA to chromosome 11; APRT, ENO1, and PGM1 to chromosome 12; IDH1 and MDH1 to chromosome 16; and GLA, G6PD, and HPRT to the X chromosome. High-resolution G-banding of human, cat, mink, and fox chromosomes containing homologous regions (according to genetic maps) revealed regions of putative homology. The results lend support to the suggestion that the most considerable karyotypic reorganization of the ancestral genome in the order Carnivora occurred during Canidae formation. The details of karyotypic evolution in mammals are discussed.

*Cytogenet. Cell Genet., 48, 95-98, 1988. 5 figs., 17 references. Authors' abstract.*

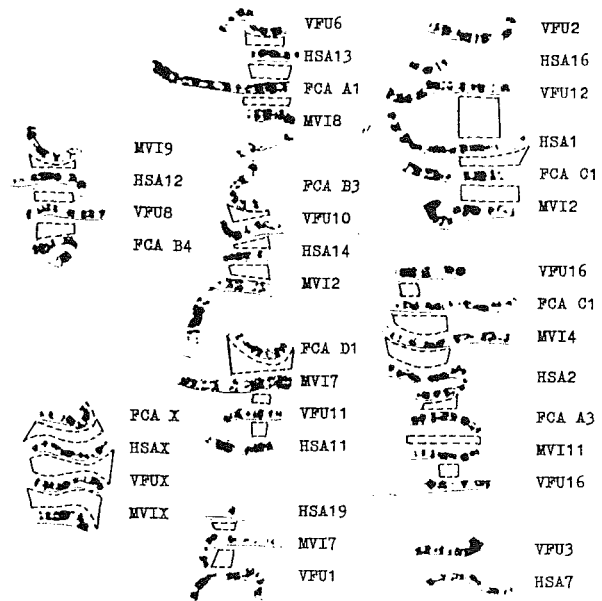


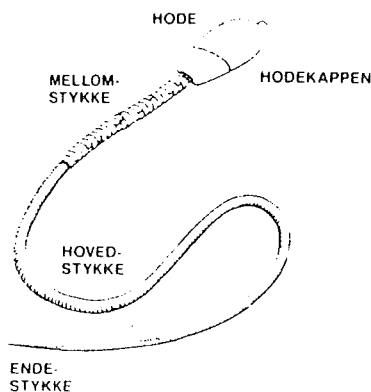
Fig. 5. Human, mink, cat, and fox chromosomes arranged according to the assignment of homologous genes in these species. Chromosomal regions with similar banding patterns are indicated with dashed lines. To demonstrate banding homology, some chromosomes have been placed upside down.

**Frozen semen in fox breeding.**

*Peer Ola Hofmo.*

An account is given of the freezing of fox semen, with special reference to conditions in Norway, and of sperm damage due to the freezing process.

Figur 1  
Skjematisk tegning av en sædcelle



*Norsk Pelsdyrblad*, 63, 2, 8-9, 1989.  
4 figs. In *NORG. CAB-abstract*.

**Failure of fertilization following abbreviated copulation in the ferret (*Mustela putorius furo*).**

*Brian J. Miller, Stanley H. Anderson.*

In the first experiment, copulations in 10 domestic ferrets were interrupted 5 minutes after penetration. Ten control females were bred without interruption to the same males. Both control and experimental animals were rebred in the same manner to the same males 24 hours later. Sperm were present in all postcoital washes. We allowed all females from the first experiment to proceed to their expected date of parturition. All females who had been interrupted during copulation failed to conceive, whereas all controls produced litters. In a second experiment, the same procedure was followed; however, in this experiment, ferret oviducts and uteri were flushed 10 days after copulation. Nine control females (one failed to ovulate) averaged 5.2 blastocysts (range 2-10; S.D. = 5.8)

per animal. Of nine interrupted copulation ferrets (one failed to ovulate), only one animal produced a single blastocyst. The interrupted copulation group averaged 4.4 unfertilized eggs (range 2-10; S.D. = 5.0) per female. Although ferrets ovulated during short copulations, those eggs are not likely to be fertilized.

*Journ. of Expt. Zoology*, 249, 85-89, 1989.  
2 tables, 5 figs., 20 references.  
*Authors' abstract.*

**Evidence implicating aromatization of testosterone in the regulation of male ferret sexual behavior.**

*R.S. Carroll, C.E. Weaver, M.J. Baum.*

We compared the effects of the aromatase inhibitor, 1,4,6-androstatriene-3, 17-dione (ADT) and castration on the expression of mating behavior in adult male ferrets which were in breeding condition. Males implanted SC with Silastic capsules containing

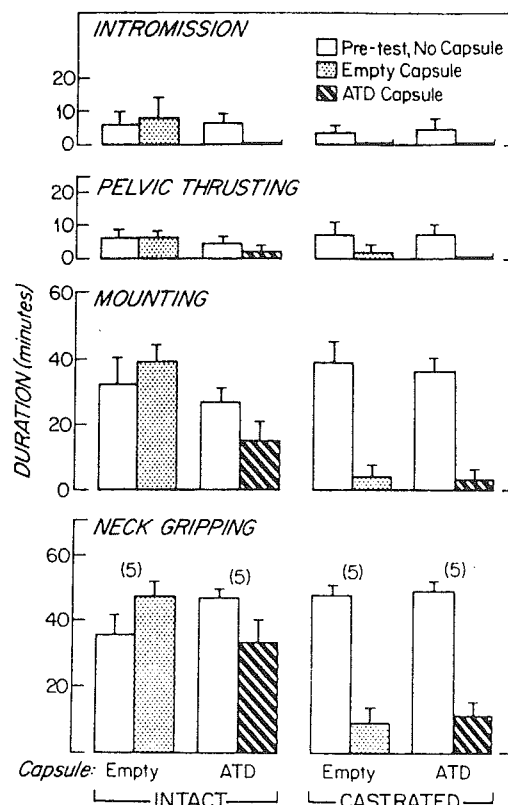


FIG. 1. Duration (mean  $\pm$  SEM) of different parameters of masculine sexual behavior displayed by groups of male ferrets which were tested with estrous females before (pre-test, no capsule) and after castration or sham-operation (intact) and SC implantation of Silastic capsules containing the aromatase inhibitor, ATD, or nothing. The number of ferrets in each group is given above the bars.

ATD displayed significantly less neck gripping, mounting and intromittive behaviour than intact males which received empty capsules, although the ATD-induced reductions in behavior were not as large as those seen after castration. ATD had no effect on mating behavior in castrated males. As reported in another publication, brain aromatase activity was significantly reduced in both the intact and castrated males treated with ATD in the present study. Plasma estradiol ( $E_2$ ) levels were uniformly low in intact and castrated males, regardless of whether they received ATD or no steroid. As expected, plasma testosterone (T) levels were significantly lower in castrated than in intact males, and ATD treatment did not affect these values. These results suggest that  $E_2$  formed via the neural aromatization of T contributes to the activation of masculine sexual behavior or intact male ferrets in breeding conditions.

*Physiology & Behaviour*, 42, 5, 457-460, 1988.  
1 fig., 34 references. Authors' abstract.

#### Fertility of muskrat (*Ondatra zibethica*) in cages.

Frantisek Kukla.

In co-operation with the KARA national enterprise the cage rearing of muskrats started in 1977. Animals trapped in free nature were placed into cages 165 cm long and 50 cm wide with a small reservoir, walk area and a box. Later on, they were kept in cages 90 x 50 cm with a part of water reservoir situated under the box. The animals were mostly kept in pairs put together to the end of winter.

Animals were fed on concentrates (30 g) or bread and forage in summer or root crops and hay in winter. This feeding rations was supplemented with 1-2 g of protein, vitamins and minerals. Once per week they were offered twigs of deciduous trees to prevent the overgrowth of teeth.

Parturitions were observed as early as in the first year of experiment in 3 of 18 females. The best results were obtained in 1981 when 17 of 33 females (51.5%) produced offsprings. In this year, 6 females produced two litters (18.2% of the whole herd or 35.3% of fertile females).

The average number of youngs per litter ranged from 3.7 to 4.3 in 1979-1982. The maximum number of youngs was 7 per litter. The highest number of youngs per female and period of reproduction was 12. Losses of youngs ranged from 10.7 to 37.7%.

In 1978 and 1979, only females trapped in free nature produced offsprings. In 1980, one of 5 females born on the farm produced youngs and in 1981, 8 of 13 (61.5%). The first parturition was recorded on May 13, the last one on September 15. The maximum number of parturitions took place within the period from June 1 to July 15; second litters were observed from July 1 to August 15. Of all females, 5 to 18% produced two litters; of fertile females, the corresponding value was 23 to 42%. Interval between the 1st and the 2nd parturition ranged from 28 to 74 days.

The experiment with polygamic keeping (2 females and 1 male) in cages with a common box was completely unsuccessful.

Fertility and viability of experimental animals were negatively affected by the occurrence of tapeworm *H.tacniaciformis* in liver which was recorded also in animals born in cages.

*Acta Universitatis Agriculturae, Brno*, 34, 2, 317-325, 1986. 5 tables, 1 fig., 27 references.  
In CZEC, Su. ENGL, GERM, RUSS.  
Author's abstract.

#### Whelping results in 1988.

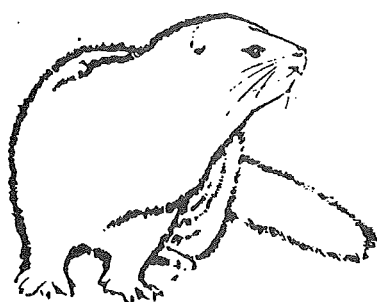
Kaj Lindh.

In 1988, for 984,241 mated mink females at 1793 farms in Finland, the percentage of infertile females was 23.8, and the number of kits born per mated female averaged 3.71.

For 16,404 polecats, 380,393 blue foxes, 160,795 silver foxes and 8609 raccoon dogs, the percentage of infertile females was 14.61, 28.24, 32.54 and 34.91 respectively, and the number of young born per mated female

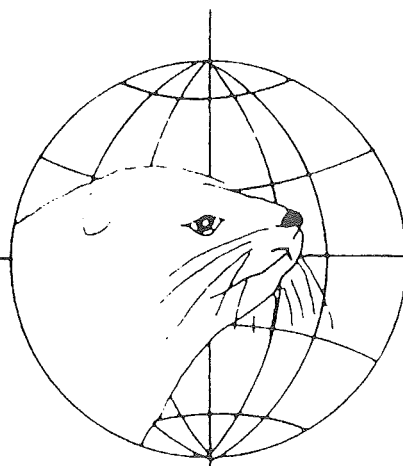
averaged 5.68, 5.40, 2.82 and 4.50. Results are compared with those in 1987.

*Finsk Pälstidskrift*, 22, 9, 376-377, 1988.  
1 table. In SWED. CAB-abstract.



**Scientifur**

&



**IFASA**

---

THE GUARANTI FOR INTERNATIONAL COMMUNICATION AND COOPERATION IN  
FUR ANIMAL PRODUCTION

---

**YOUR FULL SUPPORT IS NEEDED IN ALL RESPECTS**

SAME ADRESS : P.O.BOX 13, DK-8830 TJELE, DENMARK  
SAME PHONE NUMBER : +45 86652500, LOCAL NUMBER 4501  
SAME FAX NUMBER : + 45 86652912

AT THE SAME PLACE YOU CAN ORDER FORMER VOLUMES OF SCIENTIFUR, THE  
SCIENTIFUR INDEX AND THE BOOKS MINK PRODUCTION, BEAUTIFUL FUR ANI  
MALS AND THEIR COLOR GENETICS AND HEMATOLOGY AND CLINICAL CHEMI  
STRY OF FUR ANIMALS, ---PLEASE DO'NT FORGET US IN THE NEW YEAR, ,

Original Report.



## Weight gain and fur length in nutria fed three balanced diets of 16, 21 and 27% of crude protein, without green forage.

Oscar N. Di Marco \*, German Garrido

Agricultural Sciences College (University of Mar del Plata) and Experimental Station (National Institute of Agricultural Technology), Balcarce, Argentina.

\*) Ph. D in Nutrition, CC 276. Dto Animal Prod. INTA. 7620 Balcarce, Argentina.

### Summary.

Weight gain and fur length (German type mold) were measured in 65 Greenland and Silver males nutrias, fed in conventional corrals balanced, rations (16%, 21% and 27% of crude protein, F1, F2 and F3, respectively) as only feed for 118 days. Additionally, the relationship between final weight and fur length was studied in other 153 males and 46 females. Results showed that gain rate was best described by a linear function ( $R^2 = .98$ ) from an average initial weight of .75 kg to a final weight of 4.5 kg. And, the highest rate was promoted by F2 (30 g/d) although differences were not significant ( $P < 0.1$ ) from F1 (27 g/d, 11%) and F3 (28 g/d, 5%). Finally, the relationship between weight (kg) and fur length (cm) was:  $y = 46 + 6x$ , without differences by sex. It was concluded that diets promoted good gain rates without affecting fur length directly; the highest protein level was not better than the medium level, and fur length related to weight was similar in males and females.

*Key words:* Weight gain, fur length, balance diets, nutria, protein level.

### Introduction.

Formulation of well balanced feed, for nutria raised in corrals or cages, requires care of protein level and quality. Unfortunately, there is not enough experimental information about how dietary protein affects rate of growth, neither how body weight relates to fur length. For these reasons, an experimental project was started with the aim to generate experimental knowledge about nutria nutrition and feeding.

The objectives of the experiment, part of the project, reported in this paper were:

- 1) To study the effect of three diets with different level and quality of protein, on nutria weight gain and fur length.
- 2) To quantify the relationship between body weight and fur length in males and females.

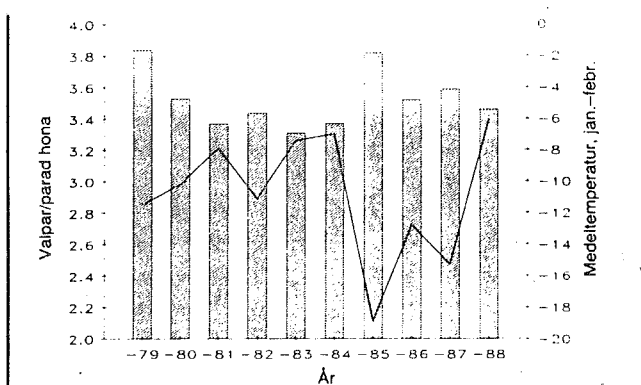
### Materials and methods.

A feeding trial was carried out from July the 11th to November the 5th (Winter and Spring) of 1987 to measure weight gain and

**Effect of nutrition on whelping results in mink.**

*Ilpo Pölönen.*

An account is given of the effects of air temperature on body condition in mink, the effect of body weight on reproductive performance of males and females, and the effect of flushing and feed quality on conception rate and litter size. Data are presented in 2 tables and 3 graphs.



Figur 3. Medeltemperatur under januari-februari uppmätt på väderobservationsstationer i Österbotten (Kronoby, Kauhava, Vasa och Etseri) åren 1979-88 (kurvan) och det genomsnittliga valpresultatet för hela landet hos Scanblackmink (staplar).

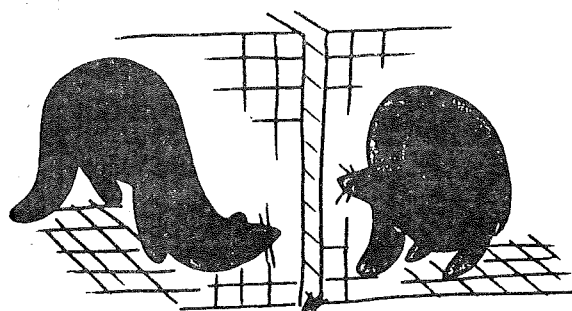
*Finsk Pälstidskrift, 23, 2, 45-47, 1989. 2 tables, 3 figs. In SWED. CAB-abstract.*

**Aiming for better whelping results.**

*Tuula Dahlman.*

An account is given of trials carried out at Maxmo and Kyrkslatt experimental fur farms in Finland on the effects of feeding on reproductive performance of mink. For females fed a diet containing 40% protein, 38% fat and 22% carbohydrates in 1988, the percentage of infertile females, the number of kits born per mated female and kit body weight on 23 June averaged 9.1, 5.02 and 364 g resp. vs. 12.2, 4.63 and 324 g for females fed a standard diet (43% protein, 40% fat and 17% carbohydrates). For females fed a diet of 47% protein, 37% fat and 16% carbohydrates + 1.5% molasses + 11.5% barley, the percentage of infertile females was

19.4% and the number of kits born per mated female averaged 3.90 vs. 16.3% for females given the same diet without the molasses + barley supplements.



- Finns våra namn i böckerna, vad tror du? Snart har vi ju valparna här!

*Finsk Pälstidskrift, 23, 4, 118-119, 1989. 2 tables, 2 figs. In SWED. CAB-abstract.*

**The effects of streptococcus faecum as an additive to fox pellets.**

*Hans Kolbein Dahle, Gudmund Holstad.*

An attempt was made to assess the ability of a freeze-dried culture of *Streptococcus faecium* to prevent the reputed occurrence of poor thrift among blue foxes reared solely on pellets. The criteria used to measure the animals' well-being were rate of growth, faecal consistency and general state of health. In addition, the intestinal flora was studied. No differences were registered, however, between the control and treatment groups, and all the animals remained in good health during the study.

*Norsk Veterinærtidsskrift, 100, 10, 715-717, 1988. 1 table, 1 reference. In NORG. Su. ENGL. Authors' summary.*

**Prevention of urolithiasis in the ferret (*Mustela putorius furo*) with phosphoric acid.**

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

Struvite uroliths predominate among urinary calculi reported in mink (*Mustela vison*) ferrets (*Mustela putorius furo*), and other weasels of the Mustelidae. The main con-

stituent of struvite ( $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$ ) tends to crystallize in alkaline urine but is highly soluble at a pH of 6.6 or less. The 6-wk study was conducted to determine the acceptability, efficacy as a source of phosphorus (P), and safety of phosphoric acid ( $\text{H}_3\text{PO}_4$ ) additions to a beef- and cereal-based diet when used to control urine pH. Twenty-four male ferrets (12 were 18 mo old and 12 were 5 mo old) were blocked by age and randomly assigned to diets supplemented with 0, 0.75, 1.86 or 2.98% concentrated (85%)  $\text{H}_3\text{PO}_4$ . This resulted in approximately 0.4, 0.6, 0.9 or 1.2% P in dietary dry matter. Dietary calcium (Ca) concentration was maintained constant at 0.6% of dry matter. Food intake was normal but was consistently greater when  $\text{H}_3\text{PO}_4$  supplements were used. By 6 wk, urine pH values were 7.31, 6.43, 6.03, and 5.86, respectively, and differed significantly ( $P < 0.001$ ). In addition, urine volume was greater ( $P < 0.05$ ) when  $\text{H}_3\text{PO}_4$ -supplemented diets were consumed as compared to that of animals fed the unsupplemented diet. Urine Ca concentrations were unaffected by treatment, while urine P concentrations increased in relation to  $\text{H}_3\text{PO}_4$  supplementation. At 6 wk, average daily urine Ca losses were 2.8, 3.6, 4.2 and 3.2 mg, respectively, and were not different ( $P > 0.05$ ), while daily urine P losses were 81, 530, 774 and 1,462 mg and were significantly different ( $P < 0.01$ ). Based on these data, the diet containing 0.9% P and 0.6% Ca increased urine volume and decreased urine pH to values that should minimize struvite urolith formation. This diet was palatable and did not induce excessive urine Ca loss. Thus,  $\text{H}_3\text{PO}_4$  additions to ferret diets can be safely and effectively used (at least acutely) to create conditions within the urinary tract that may prevent or dissolve struvite calculi.

*Journ. of Zoo and Wildlife Medicine*, 20, 1, 12-19, 1989.

Only abstract received. Author's abstract.

#### Grain feeds in the diet for polecats.

T.I. Kazakova, L.A. Lutova, Yu I. Gladilov, V.V. Shutov.

Rearing young, male, first-generation pole-

cats on diets containing 48 to 50% grain feeds had no adverse effect on their body weight or breeding ability. Addition of grain feeds to the diet at up to 50% dietary energy during the breeding season depressed fertility by 1.0 to 1.6 young per dam. Rearing second generation male polecats on diets containing 45 to 50% grain feeds did not depress body weight at slaughter. The cost of rearing first-and-second-generation polecats fell by 10% when the diet contained 40% grain feeds.

*Zverovodstva i Krolikovodstva*, 33, 49-57, 1986. 8 tables, 4 references. In RUSS. CAB-abstract.

#### Crown vetch (*Coronilla varia* L.) poisoning of the coypu.

G. Salyi, V. Sztojkov, Magda Hilbertne Miklovics.

Mass incidence of fatal poisoning has been reported in coypu stocks after feeding a forage containing wild-growing crown vetch (*Coronilla varia* L.). The affected animals showed incoordinated movement, lied down on their side, showed muscular spasm and dyspnoea. In less acute cases, paralysis of the posterior body half also developed. The pathological examinations revealed rounded heart, ascites, hydrothorax, pulmonary oedema and emphysema.

Similar symptoms were observed in three of four coypus experimentally fed with crown vetch containing 4.1% of NPA (3-nitro-propionic acid), calculated for the dry matter of the feed, and died within 26 hours. The pathological changes were comparable with those of natural cases. The fourth coypu (showing paralysis of the posterior body half) was exsanguinated at the 96th hour. The histological examination revealed degeneration of Purkinje's cells, pulmonary oedema, degeneration of parenchymatous organs and haemorrhagic diathesis.

On the basis of the authors' comprehensive investigations and results of the feeding experiment, the cause of the fatal disease of

the coypu has been traced back to crown vetch poisoning.

*Magvar Allatorvosok Lapja*, 43, 5, 313-316, 1988. 2 figs., 12 references. In HUNG. Su. ENGL, GERM, RUSS. Authors' summary.

Use of krill for feeding arctic foxes.

A.A. Khudyakova, V.K. Yudin.

Arctic foxes given a diet containing krill (amino- and ammonia-nitrogen (AAN) content 161 to 238 mg/100 g) and beef heads (bullhead, *Myoxocephalus scorpus*?) each contributing 50% total animal protein, grew faster and produced high-quality (quality mark 120.6%) pelts, compared with those given a diet without krill. A diet containing krill (with AAN 161 to 238 mg/100 g to provide 30% animal protein), fish meal, bone byproducts and sunflower oilmeal was used to rear arctic foxes to 6.9 - 7.0 kg and obtain pelts of 110-112% quality mark. Krill with AAN content of 300 to 380 mg/100 g when given to the foxes depressed growth by 6 to 8% and decreased pelt quality by 9 to 15 percentage units. Pregnant vixens fed in winter and spring on a diet with krill (AAN content 228 to 322 mg/100 g) 30, liver 5, horse meat 5, fish meal 20, bone byproducts 20 and meat byproducts 20% protein whelped on average 8.4 young.

*Zverovodstva i Krolikovodstva*, 33, 21-26, 1988. 3 tables, 3 references. In RUSS. CAB-abstract.

Squid meal in diets for arctic foxes.

Yu A. Samkov, N.V. Molchanova.

The results of a feeding trial indicated that it is possible to rear young arctic foxes from birth to slaughter on diets containing squid meal at 35 to 50% digestible animal protein. Each 100 g squid meal contained protein 53, fat 5, nitrogen-free extract 3 g and metaboli-

zable energy 329 kcal.

*Zverovodstva i Krolikovodstva*, 33, 18-20, 1986. 3 tables. In RUSS. CAB-abstract.

Effect of feeding hide wastes on protein metabolism in blood of mink.

A.D. Sobolev, O.A. Komov, E.A. Romanovskii.

A meal obtained from hide scraps contained moisture 10.4, protein 62.5, fat 7.9 and ash 19.2%. The protein resembled that of lucerne with regard to amino acid composition. In a feeding trial mink were in 3 groups and given a basal diet containing meat and fish feeds or that diet with 20 or 30% protein from the meat and fish feeds replaced with the hide meal. There were no significant differences between the groups in serum total protein and protein fractions or in activities of alanine-aspartate aminotransferase.

*Referativnyi Zhurnal*, 1987, 10.58.138. 2 tables. In RUSS. CAB-abstract.

Effect of feeding mink with hide wastes on their liver lipids.

A.D. Sobolev, E. A. Romanovskii.

Mink in 3 groups were fed on a basal diet or that diet with ground wastes from the hide industry added to replace 20 or 30% of the digestible protein from meat and fish feeds. Given at 20% digestible protein, the hide meal had no effect on lipid metabolism in the liver, but at 30% it induced slight changes in liver lipid fractions. In general, hide meal had no adverse effect on liver lipid metabolism.

*Referativnyi Zhurnal*, 1987, 10.58.122. 1 table. In RUSS. CAB-abstract.



# Mink Vaccines

## Distemper tc<sup>®</sup>

*Distemper tc is an injectable distemper vaccine of tissue culture origin that has been proven effective in millions of mink over more than 20 years.*

## Distox<sup>®</sup>

*A combination of three vaccines for preventing Distemper, Virus Enteritis, and Type C Botulism with a single injection.*

## Distox-Plus<sup>®</sup>

*Two Components—to be mixed immediately prior to usage: (1) a lyophilized distemper vaccine grown in chick embryo tissue culture. (2) a diluent containing an inactivated mink enteritis virus grown in a feline tissue culture cell line, combined with Clostridium botulinum Type C bacterin-toxoid, and a Pseudomonas aeruginosa bacterin.*

## Entox-tc<sup>®</sup> &

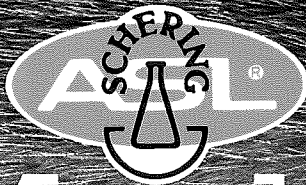
## Entox-Plus<sup>®</sup>

*Entox-tc tissue culture mink virus enteritis-botulinum toxoid Type C combination vaccine is the product of over 20 years of botulism-enteritis research.*

*Entox-Plus will immunize your mink against three major health problems: hemorrhagic pneumonia, enteritis and botulism.*



Schering Corporation, USA



# Mink Vaccines

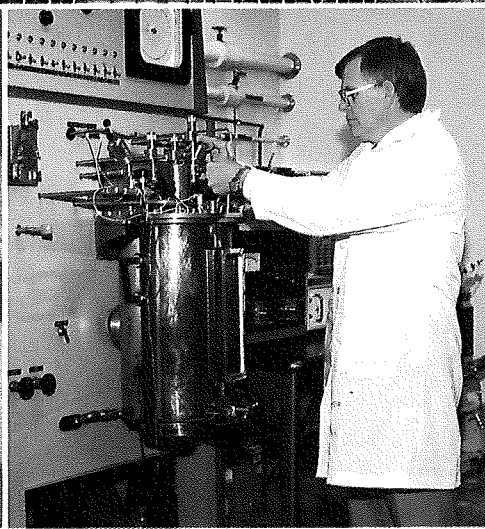
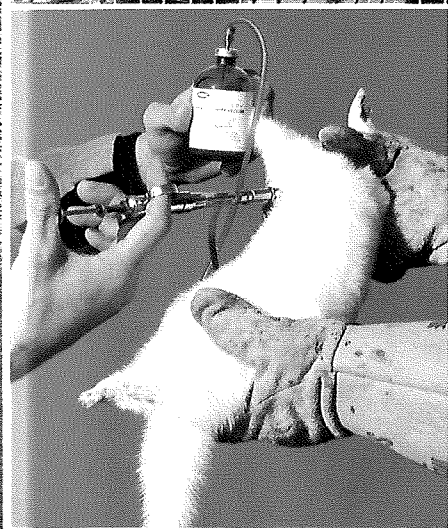
Quality.  
Research.  
Technical  
Service.

On these three pillars, ASL has built the family of proven mink vaccines. It is not surprising, therefore, that so many mink ranchers worldwide have in the past relied upon ASL for their basic vaccination needs . . . or why today they look first to ASL for state of the art health protection for breeding stock and kits.

Technical Service is one of our most important commitments to you. We support our products and we support the people who use them—YOU. Our technical service veterinarians and microbiologists are ready to help you with your problems and recommend the best possible solutions.

The leadership and professional acceptance demonstrated by our success in several areas of veterinary medicine are your assurance that you will always get the newest and most efficacious vaccines from ASL.

For additional information, please contact our International Animal Health Department at:



**Essex Chemie AG**

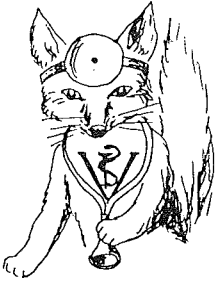
Topferstrasse 5  
6080 Lucerne 6, Switzerland

Telex: 868160 ESSEXCHEMIE  
Tel: (241) 50-1122

**Schering Corporation, USA**

1011 Morris Avenue  
Union, New Jersey 07083, USA

Telex: 138445 SCHPOGH UNON  
Tel: (201) 820-8225



**A case of uterine torsion in a blue fox vixen.**

*Wenche Farstad, Nina Valberg, Gunnar Hagen.*

Uterine torsion in a one-year-old blue fox vixen is described. The vixen was mated naturally on May 5, 1988, and whelping was expected June 26. This vixen belonged to a group of vixens allocated to a research project involving blood sampling weekly during pregnancy and at parturition. Vixens were fixed by a metal collar and held upside down in their tail with a foreleg stretched for blood sampling in the cephalic vein.

The pregnancy of this particular vixen proceeded uneventfully until the 48th day of pregnancy (22/6) when she delivered one dead cub prematurely. Blood sampling was carried out as described, and abdominal palpation was attempted to assess whether any fetuses were left. Since this was difficult to ascertain, the vixen was left for another four days during which she showed no signs of distress or disease. However, the 5th day (27/6) she was found dead.

Autopsy revealed a 180° torsion of the cranial 3/4 of the left uterine horn. Three dead fetuses were found in the distended part of

the horn cranial to the site of torsion. In the right horn, which had normal non-pregnant dimension and position, remnants of 8 placental sites were found.

*Norsk Veterinærtidsskrift, 100, 12, 881-883, 1988. 1 fig., 6 references. In NORG. Su. ENGL. Authors' summary.*

**Indirect immunofluorescent detection of oocysts of *Cryptosporidium parvum* in the feces of naturally infected raccoons (*Procyon lotor*).**

*Daniel E. Snyder.*

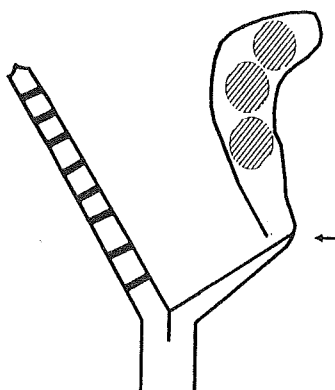
Fecal samples from 100 wild raccoons were examined for the presence of oocysts of *Cryptosporidium parvum* using a commercially available indirect immunofluorescent detection procedure. Thirteen (13%) of the samples were positive for oocysts. All positive samples were from juvenile raccoons. Over 61% of the infected samples contained moderate to large numbers of oocysts. Raccoons may serve as potential reservoirs for transmission of *C. parvum*.

*J. Parasit. 74, 6, 1050-1052, 1988. 14 references. Author's abstract.*

**Serological investigations for brucellosis in farm-bred foxes.**

*J. Gorski, J. Wawrzkievicz.*

By the agglutination reaction, the authors tested silver, platinum, and blue foxes (dogs) of the "Z" Fur Farm in the Lublin province. In this farm there had been sporadic abortions of unknown etiology. Using plate agglutination, 18 positive results from serum were obtained out of 122 tested, i.e. 13.6%. Accepting the criteria used in the appraisal of serological examination for brucellosis in dogs, the authors found 7 (i.e.



*Figur 1: Figuren viser 180 graders dreining av det meste av venstre uterus horn, sett fra ventralsiden. Pilen markerer dreiningspunktet. Skraverte sirkler representerer retente foster. Implantasjonssoner i høyre uterus horn er vist med tverrgående streker.*

approx. 5.3%) animals to have clearly positive reactions (i.e. ever 100 i.m.). There were 6 doubtful cases (40-80 i.u.) and 119 negative (90.1%).

*Med. Weter.* 20, 10, 585-588, 1964.

Prepared for the OICD, APHIS, United States Dept. of Agric. by Mrs. Geti Saad, 21-A, Muhammad Ali Society, Karachi-8, Pakistan, 1986.

1 fig., 36 references. Translated from Polish to ENGL. Authors' summary.

### Encephalitozoon infection of blue Arctic foxes.

*Miroslav Persin, Jiri Dousek.*

Forty-four of 50 blue fox cubs from 8 vixens died after being listless, inappetent, gaunt and showing central nervous signs, such as paddling, poster for paralysis, clonic convulsions, strabismus, nystagmus and mydriasis. Dehydration was found PM with nephritis, hepatic hyperaemia, focal hepatitis, hyperaemia of cerebral membranes and increased volume of cerebrospinal fluid. Histologically, focal to diffuse non-purulent meningoencephalitis, acute interstitial nephritis and nodular polyarteritis were detected with E. cuniculi found by staining (Gram, Goodpasture, PAS). The authors emphasized the necessity to distinguish encephalitozoonosis from toxoplasmosis by their different lesions and staining properties; serological tests for toxoplasmosis were negative. The foxes were probably infected by eating uncooked dead rabbits, which they were given with dead cats and poultry.

*Veterinarstvi*, 38, 7, 326-329, 1988.

5 figs. In CZEC. CAB-abstract.

### Necrotic dermatitis in mink.

*A.M. Litvinov.*

During 3 years (1983/85) necrotic dermatitis caused by *Staphylococcus aureus* (and other bacteria) was most prevalent between February and April, affecting 70-80% of mink aged

3-4 months, with 20-40% mortality. Infertility was a common sequel in the survivors. It was attributed to stressors associated with intensive husbandry.

*Krolikovodstvo i Zverovodstvo*, 4, 48, 1988.

1 fig. In RUSS. CAB-abstract.

### Viral enteritis of mink and disinfection procedures.

*N.F. Chertovich.*

Suitable disinfectants were sodium hydroxide, formaldehyde, glutaraldehyde, chloramine B, calcium hypochlorite and freshly prepared bleaching powder suspension, which were allowed to act for 3 hours at 18-20 deg. C (except for the first two, which were applied as hot solutions).

*Krolikovodstvo i Zverovodstvo*, 5, 24-25, 1988.

1 table. In RUSS. CAB-abstract.

### Passive transfer of antiviral antibodies restricts replication of Aleutian mink disease parvovirus in vivo.

*Søren Alexandersen, Steen Larsen, Anders Cohn, Aase Uttenthal, Richard E. Race, Bent Aasted, Mogens Hansen, Marshall E. Bloom.*

When mink kits were infected neonatally with a highly virulent strain of Aleutian disease virus (ADV), 100% of both Aleutian and non-Aleutian genotype mink died of interstitial pneumonia characterized by permissive ADV infection of alveolar type II cells. Treatment of infected kits with either mink anti-ADV gamma globulin or mouse monoclonal antibodies against ADV structural proteins reduced mortality by 50 to 75% and drastically reduced the severity of clinical signs. Interestingly, mink kits that survived the acute pulmonary disease all developed the chronic form of immune complex-mediated Aleutian disease. Thus, the antibodies directed against ADV structural proteins were capable of modulating the in vivo pathogenicity from an acute fulminant

disease to a chronic immune complex-mediated disorder. The mechanism of this modulation was examined by strand-specific *in situ* hybridization. We found that the number of ADV-infected type II cells was the same in both untreated and antibody-treated kits. However, in the treated kits, viral replication and transcription were restricted at the cellular level. These data suggested that antibodies prevented acute viral pneumonia by restricting the intracellular level of viral replication and that the relevant antigenic determinants were contained within the viral structural proteins. The restricted levels of viral replication and transcription seen in antibody-treated mink kits resembled the levels observed in infected adult mink and suggested a role of antiviral antibodies in development of persistent infection and chronic immune complex disease.

*Journ. of Virology*, 63, 1, 9-17, 1989.  
2 tables, 2 figs., 54 references.  
Authors' abstract.

### Raccoon dog and blue fox parvoviruses.

*Pirjo Veijalainen.*

This thesis is based on the following original publications which will be referred to in the text by their Roman numerals.

- I. *Neuvonen, E., Veijalainen, P.M.-L., Kangas, J., 1982.* Canine parvovirus infection in housed raccoon dogs and foxes in Finland. *Vet. Rec.* 8: 448-449.
- II. *Veijalainen, P.M.-L., 1986.* A serological survey of enteric parvovirus infections in Finnish fur-bearing animals. *Acta vet. scand.*, 27, 159-171.
- III. *Veijalainen, P.M.-L., Neuvonen, E., Niskanen, A., Juokslahti, T., 1986.* Latex agglutination test for detecting feline panleukopenia virus, canine parvovirus and parvoviruses of fur animals. *J. Clinic. Microbiol.* 23, 556-559.
- IV. *Veijalainen, P.M.-L., Smeds, E., 1986.* Experimental infections of blue fox kits and pregnant vixens with blue fox parvovirus. Accepted for publication in the *Am. J. Vet. Res.*
- V. *Veijalainen, P.M.-L., 1987.* Biological and antigenic characterization of blue fox and raccoon dog parvoviruses: A monoclonal antibody study. Accepted for publication in the *Veterinary Microbiology.*

In this report different methods were developed and applied for the detection of parvoviruses in infected fur-bearing animals. These methods include the HA, the ELISA and the LA tests, and isolations in cultured cells. The specificity and sensitivity of all the tests were good (>90%, III). Isolation in cell cultures was the most reliable technique for the detection of small amounts of virus in organs other than the intestine. The best method for laboratory diagnostics appears to be the ELISA test. It can be easily modified with specific antisera, i.e. monoclonal antibodies, to overcome possible inconclusive results. The simplicity and rapidity of the LA test permit its use in circumstances where special instrumentation is not available; in small laboratories and in the field. The HA test is mainly used for scientific purposes to measure the virus content in cell harvests. The correct timing of sample collection is important. Viral shedding is often short in duration, and ceases when the clinical signs become evident. The samples should be collected at the onset of the disease (if possible before the onset).

Serological methods, the HI test (*Appel et al., 1979*) and the competitive serological ELISA have been successfully used to monitor the spread of new parvoviral infections in Finnish fur animal populations, to measure the immunological status of females on fur farms, and to estimate the response to vaccination. The ELISA test proved to be very sensitive and suitable for detecting traces of antibodies in vaccinated animals.

Two new parvovirus strains have been discovered, one in farm-reared raccoon dogs and the other one in blue foxes.

A pathological condition identical to parvoviral enteritis in dogs was found in young

raccoon dogs in 1980. Young animals were affected the most. The mortality rates have varied between 1 and 50 per cent. The biological and antigenic characteristics of raccoon dog parvovirus are closely related to CPV but not identical. It was possible, using monoclonal antibodies, to define antigenic epitopes, specific to raccoon dog parvovirus, on the virion surface. Observations made in the field have suggested that the differences are such that a homologous vaccine provides more efficient protection against the disease than those prepared from viruses of other species. The vaccine has been developed and tested for efficacy with satisfactory results. On infected farms the kits of positive females receive maternal antibodies via colostrum. This passively derived immunity suppresses the response to vaccination. Despite vaccination, a number of kits ( $\leq 5\%$ ) become infected when the maternal antibodies decline.

The blue fox parvovirus infection was found on a few farms during the serological survey in 1981. The clinical signs have been mild or inapparent. The virus, however, seems to be able to cross the placenta and infect fetuses. Reproductive failures have been observed in the field when the infection was introduced on the farms in the spring. Experimental infections of pregnant vixens also strongly suggested that the virus plays an important role in reproductive losses.

In contrast to viruses of other canids, the blue fox parvovirus appeared to be more closely related to FPV/MEV than to CPV. Monoclonal antibodies could not discriminate it from the representatives of type 2 MEVs. Further investigations are needed to discover the origin of blue fox parvovirus and to validate the question about whether foxes and mink can serve as infection reservoirs for each other.

To prevent transplacental transmission of the infection, breeding animals have been vaccinated with an inactivated homologous preparation or with 3 mink doses of inactivated MEV product just before mating time. There is no need to vaccinate kits since blue fox parvovirus is of little import-

ance among young fox diseases.

*Thesis. National Veterinary Institute, Helsinki, Finland. 1987. 7 tables, 106 references, 82 pp. Author's summary.*

#### Canine parainfluenza virus-induced encephalitis in ferrets.

*W. Baumgärtner, S. Krakowka, J.R. Gorham.*

Young seronegative ferrets were intracerebrally inoculated with a neurotropic strain of canine parainfluenza (CPI) virus and serially killed at intervals after infection for subsequent viral immuno-peroxydase, light microscopical and scanning electron microscopical evaluation. The CPI virus infection resulted in a self-limiting non-suppurative ependymitis and choroiditis with associated ependymal cell degeneration. These changes were accompanied by paraventricular and perivascular cellular infiltrates of lymphocytes and monocytes, predominantly in the fourth ventricle and the cervical spinal cord and less frequently in the lateral ventricles and Sylvian duct. The inflammatory lesions were first detected on post-inoculation day (PID) 8 and had largely resolved after PID 22. Two animals showed multifocal axonal degeneration in the mesencephalon and vestibular nucleus, respectively. Immuno-histochemistry showed that virus replication was restricted to ependymal and subependymal cells and was most prominent on PID 4. No prominent residual lesions were present in convalescent animals. Virus-neutralizing CPI antibodies developed by PID 9 and increased slowly thereafter.

*J. Comp. Path., 100, 1, 67-76, 1989.*

*1 table, 8 figs., 28 references.*

*Authors' summary.*

#### Aujeszky's disease in fur bearing animals.

*P.N.G.M. van Beek.*

In North Brabant (Netherlands) Aujeszky's disease has occurred sporadically among mink (and also some foxes and raccoons) on

15 premises since 1985. Infection from the feed was ruled out, and airborne infection from piggeries seemed probable. Attempts to immunize foxes with two inactivated vaccines failed.

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

**A study on the epizootology of coccidiosis in nutria.**

*P. Zourliiski.*

This article offers the results of epizootological studies on the coccidiosis in nutria. It is found out the invasion in the nutria depends on the following:

- the season of the year, with all its values being 62% in summer, 55.1% in autumn, 31.1% in spring, and 7.5% in winter.
- the age: the maximum one is up to three months - 56.9%, up to six months - 31.7%, up to one month - 26.5%, and over six months - 18.8%.

*Veterinarna Sbirka*, 86, 5, 44-45, 1988.

3 tables. In RUSS. Su. ENGL.

Author's summary.



**Immunity to *microsporium canis* in fur bearing animals.**

*T.V. Chuchina.*

When 27 silver-grey foxes (*Vulpes vulpes*) and 24 arctic foxes (*Alopex lagopus*) developed ringworm at 17-24 days of age, the lesions took 93-117 days to heal. Subsequently these animals resisted experimental infection with *Microsporium canis* for at least 14 months. This immunity lasted for only 6 months in rabbits.

*Krolikovodstvo i Zverovodstvo*, 4, 47, 1988.

In RUSS. CAB-abstract.

The use of repeated treatment with Ivomec and Neguvon spray in the control of murine fur mites and oxyurid worms.

*V. Baumans, R. Havenaar, H. van Herck.*

In a previous study, a single external treatment with Ivomec appeared to be more effective than Neguvon treatment. In this study the anti-endoparasitic qualities of external application of Ivomec were investigated, together with the effectiveness of a combined Neguvon and Ivomec treatment. After 3 treatments, all mice were mite- and worm-free: they remained free of ectoparasites until 18 weeks after the last treatment; eggs of endoparasites reappeared 9 weeks after the last treatment.

*Laboratory Animals*, 22, 246-249, 1988.

2 tables, 3 references. Authors' summary.

**The coypu (*Myocastor coypus* Molina) as a rodent reservoir of leptospirosis.**

*S.W. Wanyangu, Sheena A. Waitkins.*

The coypu (*Myocastor coypus* Molina) is an aquatic rodent which was introduced into Great Britain in 1929 for fur farming but later escaped into the wild. Coypu are found mainly in East Anglia. During 1982 and 1983 there was an increase in the incidence of human leptospirosis in this area; particularly serogroup *Hebdomadis serovar hardjo*. No relevant occupational risk factors could be attributed to these cases. Because of the coypu's association with water and its location we decided to study the animal as a possible reservoir of leptospirosis.

A total of 30 coypu were trapped and examined by standard bacteriological and serological methods for the presence of leptospirosis. The results obtained were matched for age, sex and territorial location of the animals. Twenty-four percent (7/30) of all coypu showed a positive titre to leptospirosis using the Microscopic Agglutination Test (M.A.T.) as a reference method. Eighty-six percent of those positive results

showed serological evidence of *Icterohaemorrhagiae* while 43% had serological reaction towards *Hebdomadis hardjo*. Of the thirty coypus examined two (7%) were found to be culture positive, both isolates were found in urine and one in the kidney only. The isolates were identified as strains *L. interrogans* serogroup *Icterohaemorrhagiae* and *L. interrogans* serogroup *Hebdomadis*. Significantly, the coypu which was culture positive for serogroup *Hebdomadis* also had histological evidence of carriage but no antibodies detected in the serum.

There was no age, sex and territorial prevalence for both serological and cultural incidences.

*Tropical and Geographical Medicine*, 39, 1, S6, 1987. *Proceed. of the fifth meeting of European Leptospira workers Amsterdam, Oct. 1985. Only abstract received.*

Comparison of the nucleoprotein genes of a chicken and a mink influenza A H 10 virus.

*U. Reinhardt, C. Scholtissek.*

The base sequences of the coding region of the nucleoprotein (NP) genes of two H 10 influenza A viruses, one avian (virus N) and one mink virus, have been determined by primer extension. When the NP genes and the NP sequences derived from the only open reading frame of the two H 10 viruses were compared with those of other human and avian influenza A viruses, it turned out that the mink virus NP was highly related to that of other avian strains, but differed from that of the human strains. Comparison of the NP genes of the mink and avian strains of European origin suggests a direct lineage between them. Since the NP plays a major role in species specificity, it is assumed that an avian influenza virus had directly invaded the mink population.

*Arch. Virol.*, 103, 139-145, 1988.  
1 table, 2 figs., 17 references.  
*Authors' summary.*

Diseases in fur bearing animals 1986.

*Central Bureau of Statistics, Norway.*

During 1986 the following outbreaks of notifiable diseases were reported in fur bearing animals: salmonellosis (2), trichinosis (2), mink viral enteritis (2), fox scab (58) and fox encephalitis (4). A total of 2104 fur bearing animals were treated by veterinarians. Wounds/injuries/abscesses (563) and sterility (380) were the problems treated most frequently.

*Veterinärstatistik 1976, 17, 37, 1988.*  
16 tables. In *NORG. CAB-abstract.*



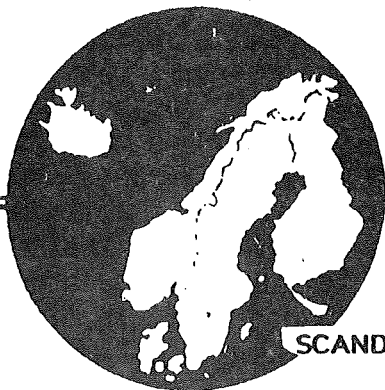
Occurrence of distemper in fur animals in Finland 1985-1987.

*Taina Loikala, Jouni Kangas.*

Before 1985 canine distemper was last diagnosed in fur animals in Finland in 1977. 1985, the first outbreaks of distemper occurred on four quarantine farms that had received imported foxes from Canada a few weeks earlier. Canine distemper was diagnosed on 13 different farms during 1985. In spite of the intensive vaccinations of fur animals against distemper had took place 1986-1987 there were 31 and 24 distemper outbreaks on different fur farms during 1986 and 1987 respectively. Most of the outbreaks occurred in regions where the fur animal density is highest in Finland, namely in Uusikaarlepyy and in the neighbouring communities.

*Suomen Eläinlääkärilehti*, 94, 11, 516-524, 1988. 2 figs., 5 tables. In *FINN. Su. ENGL. Authors' summary.*





**NORDISKE  
JORDBRUGSFORSKERES  
FORENING**

SCANDINAVIAN ASSOCIATION OF AGRICULTURAL SCIENTISTS

**MEETING IN SCANDINAVIAN ASSOCIATION OF AGRICULTURAL SCIENTISTS  
DIV. OF FUR ANIMALS**

**ABSTRACTS FROM**

**N.J.F. SEMINAR No. 170**

**FUR ANIMAL PRODUCTION 1989**

**STOCKHOLM, 29. Sept.- 1. Okt. 1989.**

The reports given at the seminar are written in local languages. Copies can only be achieved by contact direct to the author. Addresses in the list of addresses at the end of this issue.

Proceeding will be published in the series of NJF-reports.

The report number and the address for ordering will be given in the next issue of Scientifur.

**NJF. UTREDNINGER - RAPPORTER**

### Development and use of feed optimisation technique in the production of feed for fur animals in Norway.

*Halgeir Sterten, Åshild Longva Eldegard.*

In 1987, the Norwegian fur breeders cooperative feed supply organization introduced feed optimisation as a special offer to feed kitchens in the planning of feed production. The offer was meant to give assistance in composing feed mixtures with optimal nutritional characteristics and minimal expense. Thirteen feed kitchens use at present this technique. Optimisation in composing feed mixtures was introduced on the Department of Animal Science last year, as a tool in the development of experimental diets. After having tested feed optimisation both in the practical feed production and in research, we are beginning to obtain a general knowledge of the possibilities and limitations of this method. Experiences from the practical production of feed for fur animals show that there are great possibilities for lowering the price of ready-made feed mixtures. By comparing the optimised feed prescriptions with the non-optimised, we have obtained price differences of up to 10 øre per kilo and 5-6 øre per Mcal. As many basic facts as possible have to be available in order to make the right optimisation. Frequent encountered problems in finding the exact prices of raw materials include storage and handling costs. There are considerable extra expenses in using frozen raw materials compared with dry raw materials and silage.

Over time, the nutritive value of some raw materials vary considerably. Therefore raw materials have to be closely controlled. The calculated contents of energy and digestible nutrients in the optimised prescriptions will frequently differ a little from the control-laboratory's analyses and calculations. This can be due to miscalculation of the raw materials or be connected to the fact that digestibility is evaluated on a different basis.

Feed ingredients with high fat content are in general cheap in Norway, whilst protein and carbohydrate are relatively expensive. There-

fore, the optimisation calculations result in feed mixtures with a high fat content, within the allowed limits, and low contents of protein and carbohydrate. The feed is also often mixed with too much water, resulting in a poor consistency. It is possible to fix the energy content and energy distribution in order to obtain feed mixtures that are practical to handle and work with. The quantity of water must also be adjusted to obtain a usable consistency.

Optimisation often gives untraditionally high quantities of certain raw materials, e.g. fish with high fat content and fish silage. We must, in such cases, rely on research to find quantities that are acceptable from a nutritional point of view.

*NJF Seminar 170, Stockholm, 1989. 2 figs., 5 pp. In NORG. Authors' abstract.*

### Diagnosis of iron deficiency in mink.

*Jouko Työppönen.*

The most common cause of iron deficiency in mink is the poor absorption of iron from certain fish-based feeds. The most critical period for the development of anemia is the early growth period (July-August). At this time the growth rate of the animals is high and iron stores in the liver and spleen are at a low level.

It is important to find the decreasing iron status of the growing mink as early as possible. Anemia during the early growth period leads to "cotton-fur" at the late growth period. The currently used routine measurement of hemoglobin has shown to be a poor indicator of latent iron deficiency. Hemoglobin values decrease only when the body iron stores are totally depleted.

The content of ferritin in serum is a good indicator of body iron status but the method is not suitable for routine work and is not available for mink. Serum iron content and the total iron binding capacity are somewhat better indicators for iron stores as compared to hemoglobin.

The measurement of erythrocyte protoporphyrin content is a good screening method for decreasing iron stores in humans (1). The content of free protoporphyrin increase at the early stage of negative iron balance and can be measured easily with a hematofluorometer (*Aviv Biomedical Inc. Lakewood, N.J., U.S.A.*). The hematofluorometer appear to be a useful instrument in predicting decreasing iron stores in mink. The method is cheaper, faster and more reliable than the traditional measurement of hemoglobin.

*I. Schiffman, R.B., Rivers, S.L., Finley, P.R. & Thies, C., 1982. RBC zinc protoporphyrin to screen blood donors for iron deficiency anemia. JAMA, 248, 2012-2015.*

*NJF Seminar 170, 1989. 13 figs., 8 refs., 8 pp. In SWED. Author's abstract.*

#### **Biochemical investigations concerning fur quality in mink and fox.**

*Søren Michaelsen, Hilmer Sørensen.*

Fur quality and normal development of hair and fur are important for optimal production of mink and fox. The biochemical basis and reasons to differences in fur quality are poorly understood at present. This and a general interest in knowledge of the physiological and biochemical background of hair and fur development in mink and fox are considered to be important for further progress towards homogenous and high quality fur production.

Development and adjustment of analytical techniques to compounds of special interest for formation and quality in mink fur have been the aim of the present study. The compounds comprise several types of proteins, the enzyme tyrosinase, amino acids and carbohydrates.

The amino acid investigations have comprised protein hydrolysis, group separation and HPLC analysis based on OPA and dansylchloride derivatives of the amino acids.

These HPLC methods of analysis are rela-

tively fast and simple. Possibilities and limitations of the methods have been studied in relation to the problems of fur quality evaluation. Among the analytical problems are determination of lysine derivatives, proline, 4-hydroxyproline and separation of chiral amino acids.

The glycosaminoglycan and carbohydrate investigations have comprised methods of hydrolysis, group separation, spectrophotometric, and chromatographic methods for identification of products formed after hydrolysis. Glycuronic acids have not been obtained from glycosaminoglycans, even when gentle methods of hydrolysis have been used.

Intact proteins, including the enzyme tyrosinase, have been extracted from skin. The results obtained showed the presence of glycoproteins in skin. Typical patterns of various proteins from the different samples were found by isoelectric focusing. Several proteins with molecular weights (MW) 15 to 90 kD were found by SDS-PAGE. Determination of the relative amount, pI, MW, and the composition of the extracted intact proteins can thus be performed.

Different methods of tyrosinase extraction have been tested. Appreciable differences in enzyme yield were found depending on the applied methods. Skin from kits of different ages and full-grown minks showed a decrease in the activity of tyrosinase at increasing age. The decrease in activity can be connected to the stage of fur development, and/or tighter binding of tyrosinase in skin of older animals. In all cases tyrosinase was only found in relatively small amounts in skin melanocytes. Development of a more sensitive assay is therefore wanted to measure the activity in small samples with limited amounts of tyrosinase.

*NJF Seminar 170, 1989. 4 tables, 7 figs., 6 references. In DANH. Authors' abstract.*

#### **Aging and dressing properties of mink and blue fox skins.**

*Kirsti Rouvinen, Esa Mäntyselä.*

The influence of fatty acid composition in mink and blue fox skins on their storage aging and dressing properties was studied. The parameters clarified were changes in the fatty acid composition of the skins during one year's cold storage (+8 °C, 70% RH), swelling, tannin fixation and such mechanical characteristics as tensile strength and tearing strength in fresh and one-year-old raw skins. The changes in the fatty acid compositions of the skins were significantly influenced by the animals' dietary background and the differences between the dietary groups were maintained during storage. In addition, the duration of storage and animal species had a marked effect. The fat of the blue fox skins was more unstable in all dietary groups compared to mink skins. Skin thickness and tannin fixation increased with aging but percentage of elongation at break decreased. Shrinkage temperature of the dressed blue fox skins was significantly lowered by aging and it also varied considerably from one skin area to another, indicating unequal aging. Dietary fat, and thus the fatty acid composition of the dried raw skins, is not of importance as regards the dressing properties. On the other hand, rancid herring offal in mink diet deteriorated tearing strength of the skins. If blue fox skins must be stored in skin condition for longer periods of time, pretanning should be performed. It prevents fat peroxidation, which is the main cause for storage damages in the raw skins.

*NIF seminar 170, 1989. 3 tables, 3 refs., 6 pp. In SWED. Authors' abstract.*

### **The use of carbohydrates in mink feed during the breeding season.**

*Tuula Dahlman, Ilpo Pölönen, Jaakko Mäkelä.*

#### Introduction.

In Finland cereal is a relatively cheap feed ingredient in fur animal feeds and attempts to increase the use of cereal also in the breeding feed have been made. Since 1985 one of the experimental subjects at the Finnish Fur Breeders Association's experimental

department has been to study the effects of different quantities of carbohydrates and fiber on the production results of mink. This report presents the results concerning the breeding season. The purpose of the experiments has been to examine if there is a possibility to raise the present recommendations of carbohydrates. After all, cereal is a safe feed ingredient of good quality which is particularly important during the breeding season.

#### Material and methods.

Carbohydrate amounts higher than recommended by the Finnish Fur Breeders Association were studied in 1986-1988. The use of lower amounts of carbohydrates than recommended as well as the use of fiber (by-products from sugar and starch industries) were studied in 1985 and 1986. In the feed with high levels of carbohydrates the amounts of carbohydrates varied between 22-24% of the metabolizable energy (ME), in the groups with low levels the amounts varied between 0-10%, respectively. In the fiber groups 1.5-2.0% sugar beet pulp and 1.0-1.5% distillers' grain (barley) was added to the feed. The raw fiber content in sugar beet pulp was 15.3% and in the distillers' grain (barley) 7.8% of the dry matter.

#### Results.

The high level carbohydrate group gave every year a whelping result at least as good as the control group (whelps/mated female): in 1986 it was exactly the same as in the control group, in 1987 0.74 whelps better and in 1988 0.39 whelps better than in the control group. A similar result was achieved in the fiber group both the years: in 1985 the whelping result was 0.93 and in 1986 0.29 whelps better than in the control group. In the low level carbohydrate group the result varied, however, on both sides of the control: in 1985 it was 1.01 whelps poorer but in 1986 0.30 and 0.44 whelps better than in the control group (two experimental groups).

According to the achieved results it seems apparent that the good result in the high level carbohydrate and fiber groups were due

to the good quality and lowered energy content in the feed caused by carbohydrates and fiber. According to these experiments the amount of carbohydrates in the breeding feed can be recommended to be raised at least to 20% of the ME.

*NJF seminar 170, 1989. 4 tables, 7 refs., 7 pp. In SWED. Authors' abstract.*

### The nest box as a thermal environment for newborn foxes and raccoon dogs.

*Jaakko Mononen, Mikko Harri, Kimmo Haapanen, Hannu Korhonen.*

An unwarmed nest box does not produce any heat. Heat, which enables newborn foxes and raccoon dogs to keep their body temperature constant, is provided by the mother. The vixen is their source of heat and insulation. When the vixen leaves the nest box (insulated or not) the box cools very quickly and the heat stored in the newborn pups begins to be transferred to the colder environment. The body temperatures of the pups fall.

A living pup differs thermophysically from a dead body mass of equal weight in two very important ways: 1) blood circulation transfers heat from inner parts to the surface of the body thus increasing heat loss and 2) vital functions produce heat. Behaviour is also utilized in order to lower heat loss: pups gather together and form a larger mass that cools more slowly (huddling). A pup by oneself cools twice as fast as a huddling one.

A one-day-old blue fox (*Alopex lagopus*) pup weighs 60-85 g and a raccoon dog (*Nyctereutes procyonoides*) of the same age weighs 75-110 g. A blue fox cub weighing less than 65 g cools faster than a dead rat of equal weight. In other words: heat loss caused by blood circulation is greater than the heat produced by the pup's metabolism. Corresponding limit for the raccoon dog is 90 g. Below this limit even a minor difference in body weight has a major effect on body cooling. So, the smaller the cub the

less it can tolerate the vixen's absence. At +10 °C a 60 g blue fox pup's body temperature falls from 37 °C to 20 °C in 30 min, at -10 °C the same temperature drop takes only 15 min. Raccoon dog pups cool slightly faster than blue fox pups. On the other hand, pups of both species tolerate hypothermy very well: a pup with body temperature below +25 °C is fully vital.

Structure of the nest box (additional insulation, tunnels etc.) has no direct influence on keeping the pups warm. Instead, the behaviour of the vixen - the time she spends outside the nest box and not keeping the pups warm - is critical. The structure of the nest box may affect this behaviour.

*NJF seminar 170, 1988. 4 figs., 2 refs., 5 pp. In SWED. Authors' abstract.*

### Thermal environment of year-round nest boxes for farmbred foxes and raccoon dogs.

*K. Haapanen, Mikko Harri, J. Mononen, Hannu Korhonen.*

Nest boxes have many functions. The main purpose of the year-round nest box is to protect animals from extreme weather conditions. But do foxes and raccoon dogs benefit from nest boxes as much as believed? The temperature of the nest box depends on how much heat is produced and how much heat

is transferred away from the nest box. In this aspect nest box differs from human housing-conditions. Due to the fact that tropical climate is maintained by massive consumption of external energy, human being live under constant tropical conditions. For this reason man does not need massive insulation which in a case needed would be provided by clothing. Heat produced by foxes metabolic activities is equivalent to a heater with 15 W capacity. Besides fox has a very warm fur coat. For this reason temperature inside the box is only a few degrees higher than outside the box.

Heat loss can be measured when there is temperature gradient across the wall, floor

and roof. If there is only a few degrees temperature gradient across the wall, extra insulation does not decrease heat loss.

The nest box floor thermophysically differs from other constructions of the box. The compression of the fur underneath the lying animal reduces its thermal resistance. Temperature of the floor under the animal arises to 20 °C and so the temperature gradient between the inner and outer surface of the floor is a few degrees (in the corner) or as high as 30 degrees (under the animal).

The heat flow through the nest box floor was greater than what would be expected from its surface area (40% against 19%). This is not only due to the compression of the fur underneath the lying animal that considerably reduces its thermal resistance, but also to a large contact area which increases the proportion of conductive heat transfer.

If extra insulation is placed in the nest box the effectiveness of extra insulation is in its maximum on the floor, can barely be measured on the wall and is almost negligible on the roof.

Because of the low air temperature inside the boxes, heat loss through ventilation was small, even with a wind effect. The calculated contribution of ventilation to the heat loss of nest box was only 1% under calm conditions. For the same reason different tunnel entrances or covering the nest box entrance with a cloth perform poor effects on the total insulation of the nest box.

*NJF seminar No. 170, 1988. 6 figs., 6 pp. In SWED. Authors' abstract.*

**Raising fur animals in barns - the present situation in Finland.**

*Fjalar Fors, Kjell Nydahl, Jarmo Lehtinen.*

According to an inquiry from 1988 only a few farmers in Finland raise fur animals in so called open houses with several cage rows or in closed barns. Particularly barns have been appearing in recent years as a result of

a farmer's own innovations or as a product of local development projects. The purpose of these projects has been to create product units which are easy to manage and have the capability to compete; also the environments have been taken into consideration already in planning stage.

One house (fox) and three barns (2 mink barns + 1 fox barn) were more closely inspected after they were measured and drawn in scale. Information on building material, fixture details, functions and costs are recorded. In summer 1989 the study was completed by measuring the close physical environments of the animals; temperature, air humidity, ventilation, light conditions and noise level. Also the contents of ammonia, carbon dioxide and hydrogen sulphide were stated by two - four measuring points inside the barns. In gas measurements the Dräger-diffusion ampoules were used for long time measurings; the reading by 6 h is valid as a result.

In one-storey buildings the temperature on the animals' living level was identical with the shade temperature outside. There were no significant differences in air humidity inside and outside. The ten-storey mink barn showed drastic temperature increase in the higher stories while air humidity was inclined to decrease.

The ventilation in the investigated buildings was functioning satisfactorily. The limit value NH<sub>3</sub> 25 ppm was exceeded by one measuring point in both of the mink barns. The content of carbon dioxide did not exceed 900 ppm, and hydrogen sulphide could not be found in any fur animal building.

*NJF seminar No. 170, 1989. 4 tabs., 10 figs., 1 ref., 9 pp. In SWED. Authors' abstract.*

**Perinatal mortality in farmed fur bearing animals.**

*Characteristics of the perinatal kit; perinatal mortality as affected by dietary composition and specific infections.*

*Anne-Helene Tauson, Lena Englund.*

"Perinatal mortality in farmed mink and foxes" is a Nordic research project in which the following experiments have been carried out in Sweden: Description of the perinatal mink kit involving birth weight data, growth rate in the lactation period, weight of liver and digestive tract in relation to body weight, and chemical composition of the body. The weight of stillborn kits was significantly lower and more varying than that of live born kits. Relative growth rate per day was about 20% from birth to 3 days, 10% from day 10-21, and 5% from 21 to 42 days. During the first days of life the weight of the liver in relation to body weight tended to increase as did the content of liver glycogen. Also the weight of the digestive tract tended to increase its percentage of body weight, which was explained by an increased content of digesta. In kits that died the first days, the digestive tract was small and looked empty. Also liver glycogen was low in stillborn kits and kits who died within the first day. The body fat content was about 1% in newborn kits, and even lower in stillborn kits and in kits dead the first day. The fat content of the body increased rapidly during the first days of life, whereas the protein content remained constant.

Viral analyses on liver, spleen and intestine from kits representing normal mortality in farms where perinatal mortality was normal were negative with respect to parvovirus and rotavirus. Specific growth of aerobic bacteria from liver samples could not be detected.

Experiments were carried out at the research fur farm and at a private farm into the effects of varied main fat source on feed quality and perinatal mortality. There were no differences in neither chemical nor hygienic quality between diets based on cattle- and poultry offal, poultry offal or rape seed oil in the research farm experiment. There were no differences in reproductive results and perinatal mortality between groups. Milk samples from some females were analysed regarding bacteriological quality. No evidence was found that any of the sampled females suffered from mastitis. Data from the field experiment could not be used for com-

parison with the results from the station experiment due to extreme kit losses in the beginning of the whelping period. Yearling females lost more kits than did adults, and for females whelping on May 5 and later kit losses were normal. Possible reasons for the problems are being evaluated.

*NJF seminar 170, 1989. 5 tables, 1 fig., 6 refs., 8 pp. In SWED. Authors' abstract.*

#### **Experimental parvovirus infection of pregnant blue fox vixens.**

*Clinical findings, blood parameters and foetal losses.*

*Astrid Indrebø, B. Hyllseth.*

The experiment was carried out during the whelping season in 1987 and 1988, and included 46 blue fox vixens which were all seronegative for parvovirus antibodies. Antibody titers (HIT) of <40 were considered as negative. The animals were divided into three groups. Group 1 was inoculated both

intravenously and per os with cell culture harvested parvo-virus on day 17 or 18 after the last mating. Group 2 was given harvest from non-infected cell culture in the same manner. Group 3 received no inoculum.

Blood samples were collected twice a week for the first 2 weeks after inoculation, and once a week the following two months. Blood samples were then collected once a month until pelting of the inoculated animals. All animals were examined clinically daily for the first 2 weeks, and then once a week. In November the inoculated animals were pelted and the placental zones in the uterus were counted. Abdominal laparotomy was carried out on the animals in group 2 and 3 and the uterus was examined for placental zones.

The animals showed no clinical signs of illness. Serum from 6 animals in each group in 1987 was examined for white blood cells, haematocrit and haemoglobin and for 25 biochemical parameters (enzymes, proteins, minerals and ions as well as glucose,

creatinine, cholesterol, bilirubin and urea nitrogen). There was a statistically significant reduction in white blood cells, particularly lymphocytes, in group 1 about one week after inoculation when compared with groups 2 and 3. There was, however, no significant difference in haematocrit or haemoglobin or in the biochemical parameters.

There was a rise in antibody titer (HIT) to parvovirus in serum of the animals in group 1 about 3 days after inoculation. The average titer increased from <20 to about 10000 within 2 weeks, and then declined slowly to about 2500 at the time of pelting.

The number of zones in the uterus was compared with the number of cubs born. The results showed no statistically significant difference in foetal losses after day 17 between group 1 and the two control groups.

*NJF Seminar 170, 1989. 4 figs., 7 references, 7 pp. In NORG. Authors' abstract.*

#### **Improvement of cage and nestbox system for farmed foxes.**

*Vivi Pedersen.*

Nestbox-choice experiments in which 50 blue- and 50 silver fox vixens have free access to an open, a side-mounted and a top-mounted nestbox have revealed that foxes do use nestboxes all year round. They prefer the top-mounted box for resting and hiding and the open box for defecation, but do not defecate much in boxes once they have been accustomed to them. Planned experiments will estimate the stress-sensitivity of vixens with and without all year nestboxes, and unravel reasons for the clear preference for the top-mounted box.

*NJF Seminar 170, 1989. 5 figs., 5 references, 7 pp. In DANH. Author's abstract.*

#### **Humoral immune response in mink.**

*Henrik Falkenberg.*

A divergent selection experiment for humo-

ral immune response was started in the fall 1988 on the Danish research station "SYD".

190 pastel females and 60 males were immunized with 1 mg bovine serum albumine (BSA) and the specific immune response was measured 22 days later with an ELISA assay.

There were a great individual variation and a clear difference between sexes and the response wasn't perfect normal distributed.

The heritability estimated with an analysis of variance was 0.35.

In the spring 1989 pregnant females were immunized with BSA 6-14 days before whelping, and the specific immune response from the kits were measured 2 and 5 days after whelping.

The results showed that a transfer of antibodies did occur in the beginning of the lactation period but we were unable to demonstrate a transfer of antibodies in the late gestation period. The immune response was fully developed 3 weeks after whelping.

*NJF Seminar 170, 1989. 3 tables, 2 figs., 4 references, 10 p. In DANH. Author's abstract.*

#### **The possible influence of recent vaccination on the serological reactions in mink against Aleutian disease virus antigen.**

*Christian Munck.*

Antibodies against Aleutian disease virus (ADV) are determined at the Danish Fur Breeders Laboratory in the Counter current immune electrophoresis test (CEP). About 4 mio samples are carried out a year.

Testing is part of a voluntary AD eradication programme. The CEP test has a very high specificity and a good sensitivity. False positive reactions in the AD test accounts on an average for less than one per thousand samples. Some unexpected positives are however confirmed as true positives at a later test. The few false positives are of a great incon-



venience to disease eradication and to the farmers economy when they occur on a negative farm; otherwise they are of little importance. Some case stories have indicated a possibility of false positive reactions following recent vaccination. A trial was carried out to investigate whether vaccination and boosting with 3 common mink vaccines could influence the CEP test.

408 mink (AD free on an A-farm) were vaccinated one, two or three times with one of the following vaccines from ASL: Distem-TC (distemper), ENT-TC (virus enteritis) or Distox (distemper, virus enteritis and botulism).

All animals were bled on day 0, 5, 15 and 30 for CEP test. At pelting time post mortems were carried out and histopathological examinations were done on sections from liver and kidney.

False positive reactions were provoked in 5 animals during the trial, all of them followed re-vaccination. The positive ones were all found in the groups inoculated with vaccines containing virus enteritis antigen.

The positive reactions were confirmed in the counter current line absorption electrophoresis (LIE).

These reactions however were not persistent and after a period of 7-15 days all 5 mink proved negative again.

No pathological changes could be demonstrated by histological examinations.

#### Conclusion.

Mink should not be bled for CEP test 30 days following vaccination.

*NJF Seminar 170, 1989. 2 tables, 5 pp. In DANH. Author's abstract.*

**Euthanasia of mink by means of carbon dioxide, carbon monoxide and nitrogen.**

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

Mink can be euthanatized by different me-

thods, which may be classified into three groups according to their basic principle, i.e. inhalation of gas, injection of suitable preparations, and physical methods. Regardless of the method, unconsciousness must be accomplished quickly with the least possible discomfort for the animal. An unconscious animal cannot feel pain because the cerebral cortex is not functioning; therefore, the time required to produce loss of consciousness is essential.

The purpose of the present work was to describe the behavioural pattern of mink euthanatized with carbon dioxide (CO<sub>2</sub>) 100% and 70%, carbon monoxide (CO) ≥ 7%, and nitrogen (N<sub>2</sub>) 100%. The work included recording of the time passing between the animal's placement in the glass box and the first symptoms of incoordination (Phase I), then the period till the loss of consciousness (Phase II), and, finally, the coma phase until cessation of respiration (Phase III).

The animals, 10 pastel males, were euthanatized in a glass box with a lid of plexi-glass, to make possible a video recording with indications of time. The following analysis is based on those recordings.

Phase I differed considerably for the three types of gas, ranging from 14 seconds (s) for CO<sub>2</sub>, 31 s for N<sub>2</sub>, and 49 s for CO. In Phase II the difference was even more pronounced, being 5 s for CO<sub>2</sub>, 15 s for CO, and 76 s for N<sub>2</sub>. In Phase III, the time was 59 s for N<sub>2</sub>, but 134 s and 151 s for CO<sub>2</sub> and CO, respectively.

Hence, the critical period from the time when the animals were placed in the glass box till unconsciousness occurred (Phase I + Phase II) was 19 s for CO<sub>2</sub>, 64 s for CO and 76 s for N<sub>2</sub>. In the present experiment the total course of euthanasia was 153 s for CO<sub>2</sub>, 215 s for CO, and 134 s for N<sub>2</sub>.

In practice, it is of great importance to know the time required to produce death in order to judge when it is safe to remove the animals from the gas chamber. It is, therefore, necessary to allow for a wide safety margin

when considering the present mean times because of the individual differences between animals. This safety margin may be calculated on the basis of the standard deviation and a subsequent addition to the mean values found in the experiment. For the gases and concentrations tested here, the following minimum times will be required: CO<sub>2</sub> and N<sub>2</sub>: 5 minutes, and for CO: 6.5 minutes.

A supplementary experiment was carried out, involving a mixture of 70% CO<sub>2</sub> and 30% atmospheric air. Unlike the results found for other species, it was not possible within the allotted time to kill adult male mink with this mixture. The experimental group of 5 animals all survived a period of at least 15 minutes in the gas chamber. One of the animals died 6 minutes after being taken out, whereas the other 4 animals lived, apparently unaffected, for 2 months after completion of the experiment.

Muscular contractions occurred to a varying degree in all the animals euthanatized with CO<sub>2</sub> and N<sub>2</sub> and in 6 out of the 10 animals killed with CO. But it should be pointed out, however, that this muscular activity was recorded in Phase III. Hence, it is solely a question of aesthetic importance, since the animal could experience no pain at this stage.

*NJF Seminar 170, 1989. 2 tables, 13 references, 7 pp. In DANH. Authors' abstract.*

**Profiles of progesterone and estradiol-17 $\beta$  and follicular development during the estrous cycle in mink.**

*Gabrielle Lagerkvist, Einar J. Einarsson, Mats Forsberg, Hans Gustafsson.*

Plasma levels of estradiol-17 $\beta$  and progesterone were studied in yearling mink females mated according to different systems or not subjected to mating. Blood samples were collected during the period 2/3 - 13/4. The females were mated according to the 1+1 system, early or late in the season, or according to the 1+9 system. Histological studies

were performed in ovaries collected from females not subjected to mating, from the end of the mating season. Estradiol-17 $\beta$  peaks were recorded on the day of first mating and in connection with the growth of the second wave of follicles in early mated females. A third peak was recorded early in April, just after the estimated time for implantation. Significant rises in plasma progesterone were recorded 17/3 - 21/3. The rise seemed slightly delayed in females mated late according to the 1+1 system. The number of active follicles exceeded the number of degenerated or luteinized follicles until 7/4. At this point of time the number of degenerated follicles increased rapidly. Degeneration was followed by luteinization. On the 15/4, the last day ovaries were collected, no active follicles were apparent, but on average 15 luteinized and 9 degenerated follicles. Also elevated plasma progesterone levels were recorded (43 nmol/l).

*NJF Seminar 170, 1989. 2 tables, 37 references, 8 pp. In SWED. Authors' abstract.*

**Artificial insemination with frozen semen in the fox.**

*Effect of different sperm number on whelping rate and litter size.*

*Wenche Farstad, Jan A. Fougner.*

The aim of the present investigation was to reduce the number of sperm cells/ml inseminate from the standard dose of 150 mill/ml to one half and one fourth i.e. 75 mill/ml and 37.5 mill/ml and test the effect of reduction of sperm number on whelping rate and litter size.

Semen was collected from silver fox males kept at Follidal Insemination Centre during the previous breeding season. Freshly collected semen with min. 250 mill sperm/ml, min. 70% progressive motility and less than 10% morphologically abnormal cells was diluted to a concentration of 150 mill/ml with TRIS-fructose-citric acid (pH 6.8) containing 20 vol% egg yolk and 6 vol% glycerol. Samples were collected on this concentration to serve as standard control.

The semen samples were further diluted to concentrations of 75 and 37.5 mill/ml, respectively, cooled and equilibrated for 2 h at 5° C, and frozen horizontally in 0.5 ml PVC straws in an automatic programmable freezer.

The following freezing regime was used (Hofmo, 1988):

- 2°C/min from + 4°C to - 7°C  
- 50°C/min from - 7°C to -100°C  
- 25°C/min from -100°C to -180°C.

The semen was stored at -196° C until use. Thawing was done in a water bath at +70°C for 8 sec immediately prior to insemination.

In Oppdal, Norway, 272 blue fox vixens from 4 different farms were allocated to 3 groups to be inseminated with 1 ml inseminate containing either 150 mill sperm/ml (Group A, n = 45), 75 mill sperm/ml (Group B, n = 118) or 37.5 mill sperm/ml (Group C, n = 113). The vixens were chosen randomly within each farm. Inseminations were all performed by the same technician on 2 consecutive days, 1. and 2. day after the maximum registration of electrical resistance of the vaginal mucosa. The semen was deposited intrauterine by passing a catheter through the cervical canal (Fougner and Cas-sou, 1988).

The whelping rates were 82%, 77%, and 68% in groups A, B and C, respectively. There was no significant difference in whelping rates between groups ( $p > 0.05$ , Fisher-Irwin test). The litter size per inseminated vixen was  $6.3 \pm 4.3$  ( $X \pm SD$ ) for group A,  $4.7 \pm 4.2$  for group B, and  $4.3 \pm 4.0$  for group C. Litter size was significantly larger in group A than in the two other groups ( $p < 0.05$ , Student's t), however, there was no difference in litter size between groups B and C ( $p > 0.05$ ).

*NJF Seminar 170, 1989. 5 references, 4 pp. In NORG. Authors' abstract.*

**Bacteriological status of the fox semen and its effect on the pregnancy.**

*Liisa Jalkanen.*

### Introduction.

In Finland about 200,000 fox females are yearly inseminated and for this purpose about 60,000 ejaculates are used. The results have on the average been good, but there are some problems with uterine infections and poor pregnancy results which is supposed to depend on certain males or even certain ejaculates. In this paper we have studied the bacteriological quality of the fox semen and the extenders used compared to the breeding result.

### Material and methods.

In March 1989 bacteriological samples were taken of 70 for routine insemination meant ejaculates. The semen was collected by an experienced technician by hand manipulation from 34 males into sterile cups. 25  $\mu$  of the semen was immediately after collecting cultured in blood agar and another sample was taken of the same ejaculate after having been diluted before the insemination.

EDTA-extender, which contains neomycin, was used for dilution of the semen. Also citrate without antibiotic was used for dilution. After 24 hours incubation at 35°C the bacteria were counted and classified.

### Bacteriological results.

The ejaculates were classified into four groups according to the amount of bacteria. Almost 30% of the samples of native semen were practically pure (under 200/ml) while 20% contained more than 10,000 bacteria/ml. The extender had a great influence. EDTA decreased the amount of bacteria drastically, but the citrate had no effect. The most common bacteria in the semen were different types of staphylococci (46% of all samples of native semen) but there were also streptococci (14%), *Proteus mirabilis* (11%), *E. coli* (7%), *Klebsiella* (1%) etc. Mixed growth of different types was common. After dilution with EDTA there was mostly strotococci.

### The bacteriology of the semen of single males.

From 14 males more than one ejaculate was taken. Half of the males showed all through the period rather high amounts of bacteria in the semen, but the types varied with the

same male. Only streptococci seemed to stay longer with the same animal.

#### Whelping results.

Results concerning the whelping were reported from 203 females corresponding to 57 ejaculates. The conception rate of silver fox females was 73% and the whelping result 2.16 whelps and in cross-bred 86% and 5.46 respectively. Semen diluted with citrate gave equal results in every bacteria group. The ejaculates, in which there after dilution with EDTA-extender were bacteria, gave a result of 1.56 whelps for silver fox females. With bacteria free EDTA-semen the result was 2.25.

#### Discussion.

The amounts of bacteria in the semen described in this paper are surprisingly high. It would be interesting to study where the bacteria come from. The types found are not typically pathogenic, rather saprophytes. The semen from healthy males contains often bacteria that do not effect the whelping result. This shows that semen is an optimal environment for bacteria and that it therefore is important to maintain a good insemination hygiene to avoid contamination of pathogenic bacteria.

*NJF Seminar 170, 1989. 4 tables, 4 pp. In SWED. Author's abstract.*

#### **Fox mating circles in Norway.**

*Experiences and results from progeny testing of male foxes.*

*Kai-Rune Johannessen.*

#### Introduction.

A national plan pointing out the principles of breeding strategies of fur animals in Norway was put forward in 1983. Since then the Norwegian Fur Breeders Association has developed a field recording system as a major breeding activity. This system includes the possibility for fox ranchers to organize in fox mating circle systems, designed to utilize AI for progeny testing of male foxes. The system is based upon central processing of data collected from the farm regarding reproductive and liveability traits, and from

the pelt grading systems at the auction houses where Norwegian skins are sold.

Progeny testing indices have been developed both for reproductive traits and for pelt quality, all data collected through the field recording system. The indices include recordings for the reproduction performance of the males daughters, and the pelt quality of all the males offspring that is pelted and sold. A male fox may be progeny tested when he is 2 1/2 years old, thus allowing him to get an "elite"-status before he enters his 3. mating season.

#### Results.

In 1989 some 13 foxes mating circles are active. In 1988 these circles had 209 member farms, and they used 5347 breeding females in the progeny testing program, distributed on 3456 silverfoxes and 1891 bluefoxes. Four of the circles had been active for only one season, and therefore no males are tested yet. In 1988 a total of 177 silverfox males and 117 bluefox males were tested (they were born in -85 and -86), and only 18 reached the elite status.

The genetic gain from the work in the fox mating circles is difficult to estimate so far. The first progeny testing indices were presented in 1987, and most of the circles selected their first "elite" males in 1988. The effect also varies, depending on how well the different circles have carried out their breeding strategies. In some cases it is already possible to point out a considerable progress in pelt quality and reproduction. Statistical analyses will be carried out on these datas when the -89 season is ended.

The fox mating circles have a social/professional effect that may help stabilizing the breeding work, and they might become important suppliers of good quality, fresh or frozen semen to farmers that will not be able to join or start fox mating circles.

*NJF Seminar 170, 1989. 5 tables, 1 fig., 4 references, 7 pp. In NORG. Author's abstract.*

### Inter specific hybrids in the estimation of breeding value.

*Hilkka Kenttämies.*

The production of inter specific hybrids between silver and blue fox (*Vulpes vulpes* and *Alopex lagopus*) has increased as the insemination of foxes has become more common. In 1987 one million hybrids were produced in Finland. A remarkable proportion of the total semen obtained from silver fox has been used for the production of hybrids. The purpose of this study was to investigate the usefulness of sorting data of the bluefrost and golden island skins in progeny testing of silver fox males.

Data was obtained from an insemination project in the Juuka parish, which started in 1987. About 30 males were bought to an insemination station, and these were used together with some of the own males in more than 20 farms. An adviser managed the inseminations, identification of the animals, grading of live animals and the collection and reporting of data. About 4000 hybrids were produced in the first year. The present study is concerned with bluefrost (n = 993) and golden island (n = 1318) colour types. The following skin traits were studied: size, darkness and cleanness of colour and quality. The traits were coded on a scale of 1, ..., 3 or 4, where 1 represents the slightest or least and the largest number the best or greatest category. The colour scale was 1, ..., 7, where 1 means darkest and 7 lightest. The quality categories IA and IB were combined with category I. The material was edited and analyzed using the WSYS-program

Coefficients of variation were 24-46% in bluefrost, and 20-28% in golden island, apart for shade of colour in golden island animals, there was 6% variation. Differences between farms were highly significant for each trait. These were, however, not taken account in genetic analyses, as a part of variation between males was included in the variation between farms. Before analyzing heritability estimates the traits were corrected for the effects of litter size and/or type of dam.

In the genetic analyses there were 915 bluefrost skins from 60 sires and 290 dams (15.1 skins/sire) and 1253 golden island skins from 70 sires and 366 dams (17.7 skins/sire).

Heritabilities and standard errors were for bluefrost (golden island) as follows: skin size  $0.11 \pm 0.08$  ( $0.29 \pm 0.09$ ), quality  $0.36 \pm 0.12$  ( $0.48 \pm 0.12$ ), colour  $0.59 \pm 0.15$  ( $0.48 \pm 0.12$ ), and cleanness  $0.23 \pm 0.10$  ( $0.22 \pm 0.08$ ). The fairly large heritabilities indicate that it is possible to utilize hybrids for the estimation of breeding value and selection of breeding animals.

*NJF Seminar 170, 1989. 4 tables, 7 references, 7 pp. In SWED. Author's abstract.*

### Heritability of body length and body weight in mink and the influence of litter size and age on size development.

*Outi Lohi, Bente Krogh Hansen.*

One of the factors having great influence on the pelt price is the size. The positive development of size, which has taken place during the period of effective fur farming, is due to improved feeding, management and breeding work. Selection in order to improve the size is normally based either on a subjective grading of the size or on body weight. The aim of this study was to calculate the heritability of different size parameters and to evaluate which effect the date of birth and litter size have on the size development from weaning until pelting.

The results are based on 313 scanblack male kits deriving from 33 fathers and 122 mothers. The kits were weighed seven times: 6/7, 25/7, 15/8, 5/9, 4/10, 24/10, and at pelting. The body length from the nose to the tail root was measured under anaesthesia four times 6/7, 15/8, 5/9, and at pelting.

Both the body length and the body weight were influenced by age and litter size until the 15th of August, i.o.w. to the average age of 13 weeks. The influence of the age then decreased and by the 5th of September the late born kits had reached the same body

length and on the 4th of October the same weight as the ones born before the 6th of May. Kits from middle size litters (2 to 7 kits per litter) showed the most favourable development. Kits from big litters (8 kits or above) were slightly lighter and about 1 cm shorter at pelting time.

Heritability of body weight measured at different ages showed variation from  $h^2=0.05$  to  $h^2=0.54$ , the weight on the 24th of October giving the highest value. The heritability of body length was generally higher varying from  $h^2=0.37$  to  $h^2=0.74$ . The highest value was calculated on the data from the 5th of September. A strong positive correlation was detected between the body weight and the pelt size (from September onward  $r > 0.80$ ). The correlation between body length and pelt size was lower but yet highly significant (max. correlation,  $r=0.74$  in October). There was a significant and increasing negative correlation between body weight and pelt quality from weaning to pelting but a lower and non significant negative correlation between body length at different times and pelt quality.

*NJF Seminar 170, 1989. 8 tables, 4 references, 9 p. In DANH. Authors' abstract.*

#### Heritability and breeding of the litter size on blue fox.

*Kari Saarenmaa.*

Finnish recording scheme for fur animals was studied. The scheme contained more than 40,000 records of blue fox females of different ages and colour types. Only blue fox records were analysed.

The heritability calculated by parent-offspring regression was 0.16. The heritabilities calculated by half-sib correlation were 0.17 and 0.05, for dam and sire variance components respectively. The repeatabilities of litter size of the recorded population were .174 for first to second whelping and .188 for second to third whelping. The age of female and the time of whelping season had statistically significant effect on litter size. Selec-

tion made by farmers is mainly aimed against proportion of empty females.

*NJF Seminar 170, 1989. 5 tables, 1 fig., 9 references, 6 pp. In SWED. Author's abstract.*

#### A curley hair defect in silver foxes.

*Raija Ingo, Leena Blomstedt, Jouko Työppönen, Jouni Kangas, Maija Valtonen.*

By 1985 increasing number of silver foxes were reported to be afflicted with varying degree of dry, brittle, wavy or curley guard hair and discolouration and abnormal texture of underfur. The hairs were short and in microscopical studies abnormal swellings, narrowings and broken hair surface was seen. The hair scales were loose and unevenly scattered around the hairs. Affected animals appeared only in some litters of a farm but often in several cubs of the same litter. Sometimes the defect was not apparent in foxes until nearing prime or it was not evident before the animal grew older. To evaluate the cause of this fur abnormality about 50 affected silver foxes from various farms were examined clinically, the hair was evaluated, blood, tissue and carcass samples were taken and analysed along with samples from unaffected farms for various haematological and clinico-chemical parameters. From about half of the examined animals liver samples were analysed for A-vitamin content and mineral content was determined from samples from liver skin and hair.

Despite of the disturbances in hair development the foxes appeared healthy. At necropsy no signs of illness could be detected but at histological examination slight eosinophilic infiltration in intestine and slight liver changes with lipid accumulation was regularly seen.

Blood analysis revealed considerable individual variations especially in the affected animals. Only in samples taken in autumn during the rapid growth phase of winter fur significantly higher values of serum alkaline phosphatase (AP) were found in affected animals. At that time serum ceruloplasmin

levels also increased and were slightly higher in affected than unaffected foxes. Liver and skin analyses did not reveal any differences in mineral composition between affected and unaffected animals but the defected hair had significantly lower zinc content than the hair of normal animals. These findings along with the results of A-vitamin content of liver which was slightly higher in the defected animals indicates that the hair defects may be caused by zinc deficiency. This deficiency is probably a result of unefficient zinc absorption in the intestine. The specific hair changes could not be provoked by feeding trials with mycotoxins. The condition appeared only in animals that were born with this defect. The heredity of the curly hair defect has been proved in controlled crossing experiments.

*NJF Seminar 170, 1989. 13 tables, 9 references, 10 pp. In SWED. Authors' abstract.*

#### The inherited curly fur form of silverfox (*Vulpes vulpes*).

*Kari Saarenmaa, Paavo Niemelä.*

The inheritance of silverfoxes' curly fur form was tested. Five different test crosses were set up. The crosses were:

- 1) curly x curly
- 2) curly x normal
- 3) curly x curly heterozygote
- 4) curly x bluefox female
- 5) curly heterozygote x bluefox female.

Crosses 1 and 2 showed that curly is recessive, inherited trait and the curly foxes are recessive homozygotes. Test 3 is under work. Test 4 and 5 yielded only normal intergeneric offspring. In this experiment it indicates that normal genes of bluefox dams could complete the defect of curly gene from silverfox sire.

*NJF Seminar 170, 1989. 1 pp. In SWED. Authors' abstract.*

#### Reticulocytosis is normal in mink.

*Veli-Mikko Niemi, Minna Liinamaa.*

Polychromatophilic macrocytes are usually seen in peripheral blood films of mink. To study whether this is due to real reticulocytosis we collected blood samples from 19 adult, healthy minks. Blood samples were supravitaly stained for reticulocytes. Other hematological variables determined were RBC, PCV, MBC, Hb, platelets and free erythrocyte protoporphyrin (FEP).

PCV	Hematological values of mink.					
	WBC	Platelets	RBC	Hb	FEP	Reticulo-
%	$10^9/l$	$10^9/l$	$10^{12}/l$	g/l	umol/g heme	cytes %
56±6	10.4±5.6	530±170	9.5±1.0	199±18	35±8.0	1.7±0.8

The results show that there are normally reticulocytes in the peripheral blood of mink. Our results are comparable to the previous results of *Kubin & Mason (Cornell Vet., 38, 79-85, 1948)* who found reticulocytes 1.5-10% in the blood of mink. Reticulocytosis in adult animals is also seen in other carnivores as dog and cat. Reticulocytosis in mink reflects to its high level of erythropoiesis. Reticulocytosis may have some impact on iron metabolism in mink since about 1/3 of the hemoglobin is synthesized at reticulocytes.

*NJF Seminar 179, 1989. 2 tables, 1 fig., 10 referendes, 4 pp. In ENGL. Poster. Authors abstract.*

#### Some factors causing mortality among female minks during the puerperium and lactation periods.

*Raija Ingo, Martti Luoma, Ilkka Virtanen.*

The purpose of this study, in which the farm was used as the statistical unit, was to clarify factors affecting mink mortality in farm conditions. Mortality was studied on the basis of

individual and environmental factors. These factors included, among others, variables describing feed composition and quality, the amount and variation of which were used as explanatory variables. Other explanatory variables applied on the study included farm size and age. Factor analyses were performed for variables of feed composition and quality in order to condense the variable information and to facilitate the selection of explanatory variables. This report presents a preliminary regression model having factors describing feed level and variation, and farm size, as explanatory variables.

*NJF Seminar 170, 1989. Poster. Authors' abstract.*

#### Feed factors and perinatal mortality in blue fox (*Alopex lagopus*).

*Ilpo Pölonen, Jouko Työppönen.*

Kit mortality in mink and blue fox ranges between 10-15% and 25-30% respectively. The purpose of this experiment was to find out if some feed factors cause perinatal mortality in blue fox. The experiment was a part of a Scandinavian project on reasons for perinatal mortality in mink and blue fox.

In this field experiment feed samples from two 'feed kitchens' were collected weekly in four fur farms during the breeding season, from April 14 to June 6. In addition to chemical composition and the quality of fat and protein minerals (Na, K, Ca, Mg, P and Se) were also defined. After mating 20 females were chosen randomly and observed closely on each farm.

On the basis of analyses the both feeds corresponded with recommendations for breeding season given by Finnish Fur Breeders Association. However, statistically significant differences were noticed in the following parameters feed 1 and feed 2 respectively (Mean  $\pm$  SD, % and g in DM): pH ( $5.82 \pm 0.10$ ,  $6.29 \pm 0.10$   $p < 0.001$ ), ash ( $11.09 \pm 1.16$ ,  $12.71 \pm 1.13$   $p < 0.01$ ), fat ( $19.01 \pm 2.04$ ,  $16.41 \pm 2.14$   $p < 0.01$ ), ME density MJ ( $16.9 \pm 0.53$ ,

$15.9 \pm 0.66$   $p < 0.001$ ), percentage of ME from fat ( $39.41 \pm 3.18$ ,  $36.01 \pm 3.51$   $p < 0.01$ ), fat quality according to peroxides mekv.  $O_2$ /kg fat ( $35.20 \pm 12.11$ ,  $6.20 \pm 2.08$   $p < 0.001$ ), total volatile nitrogen (TVN) % ( $1.29 \pm 0.08$ ,  $1.55 \pm 0.11$   $p < 0.001$ ) Mg % ( $0.14 \pm 0.01$ ,  $0.17 \pm 0.01$   $p < 0.001$ ) and Se mg/kg ( $1.08 \pm 0.07$ ,  $1.23 \pm 0.07$   $p < 0.01$ ).

Breeding results were better in feed 1 ( $8.9 \pm 4.03$ ) than in feed 2 ( $5.5 \pm 5.40$ ). The main reason for the poorer results in feed 2 was a large number of empty females (whelpings 38/40 feed 1, 25/40 feed 2). No differences between feeds were observed in litter size. In kit mortality results were partly contradictory and it is difficult to draw any clear conclusions.

As the differences between the two feeds were small and contradictory to breeding results (e.g. fat quality) it is difficult to find factors in feed 2 that would have caused the poor results. In one week (April 10) free fatty acids were elevated in feed 2 (25% from fat) but on average fat quality was better in this feed. The differences in average breeding results of all the animals on the farms (feed 1: 6.7, feed 2: 5.7) were smaller than between experimental groups. It seems that other factors than feed have disturbed the results.

*NJF Seminar 170, 1989. Poster. Authors' abstract.*

#### Repeatability of grading in mink and bluefox pelts.

*Hilkka Kenttämies, Kerstin Smeds.*

The purpose of this study was to evaluate the actual reliability of pelt grading. It is well established that grading the exterior traits of living animals is very difficult. On the other hand, it has often been assumed that pelt grading is exact and reliable. To study the reliability on pelt grading a repeatability test was done at Fur Center consisting of 112 standard male mink pelts and 95 blue fox pelts. Three advisers from the Finnish



Fur Animal Breeders Association graded the pelts three times each. At each grading the following traits of the mink pelts were examined in the given order: quality, underfur density, guardhair density, colour, cleanness and metallic sheen. The bluefox pelts were graded as follows: quality (at the same it was recorded whether the pelts were heavy quality or not), colour, cleanness, occurrence of woolliness (and degree of difficulty) and silvery hairs. There were model pelts for quality and colour at the judges' disposal. The sizes were measured by three other persons. When the samples were analyzed, the repeatabilities were calculated for the size in cm's as well as for the size classes.

It appears to be more difficult to grade mink pelts than bluefox pelts. When grading the quality of mink pelts, one of the judges followed a much stricter scale than the others. The repeatability for quality was on average 46% (the repeatability for the different judges varied from 57% to 60%). The repeatabilities for density of underfur and guardhair density were 51% (56-68%) and 42% (48-63%) respectively. Colour is the trait, apart from size, which produced the best repeatability with 63% (54-72%). The most difficult traits to grade seems to be cleanness and metallic sheen, which gave repeatabilities of 40% (38-62%) and 39% (42-54%) respectively. The repeatabilities for size in cm's were 97% (95-99%) and in size classes 88% (92-94%).

The repeatabilities for all traits apart from size, were better for bluefox pelts than for mink pelts. The repeatability on quality for fox pelts was 71% (66-79%). Colour was, also for the mink pelts, the trait which was easiest to grade, the repeatability was 72% (77-90%). Cleanness and heavy type were among the most difficult traits to grade, the repeatabilities were 55% (54-66%) and 44% (49-64%) respectively. When grading woolliness and silvery hair the judges followed very different scales, the repeatabilities were 58% (53-77%) and 24% (42-46%) respectively. The repeatabilities for size in cm's were 84% (78-88%) and in size classes 77% (71-83%).

None of the judges produced much better results than the others, all the judges got the best results for some traits and the worst ones for some other traits.

*NJF seminar 170, 1989. 2 tables, 4 figs.. In SWED. Poster. Authors' abstract.*

### Curly fur forms of the silverfox.

*Kari Saarenma, Raija Ingo.*

Curly is a skinfault in silverfox and intergeneric fox hybrids. The pelt is usually small and massless and its guard hairs are coarse and frizzy. These pelts are practically valueless. Test crosses shows that the curly foxes are recessive homozygotes. To describe different forms of the curly trait total number of 164 silverfoxes from two commercial fur farms were examined.

The graded features were:

- 1) classification of curly types,
- 2) intensity of the faulty,
- 3) distribution of the faulty at pelt.

Curly was classified into three types:

- A) waves and curles,
- B) coarse guard hairs,
- C) coarse guard hairs and waves/curles.

First of all, different types of faulty can be found at the same pelt. The most common type of the faulty was type A, coarse guard hair. The overall proportions of different types were: A) waves and/or curles = 27%, B) coarse guard hair = 47%, and C) coarse fur found with waves/curles = 27%.

Intensity of the faulty was classified to three classes (1-3, 1 being the weak intensity). Type A faulty (waves and curles) coincide with the lowest intensity of the faulty but the overall distribution was symmetric.

The distribution of faulty over the pelts were graded to three parts: 1 = the faulty is found only at hips, 2 = the faulty is found at the whole backpart, 3 = the faulty is found all-

over the pelt. The type 3 distribution showed to be most common.

The connection between the distribution and intensity was studied with regression. Regression equation  $Y = 2.21 + 0.22 * \text{Intens.}$  ( $R^2 = 0.04$ ,  $F = 8.37$ ) declared the overall variation badly but intensity had a statistically significant positive effect to distribution.

So, typical curly can be found as coarse guard hairs distributed all over the pelt and there is variation in intensity. Additionally can be suggested that the more severe faulty is, the greater parts of pelt is damaged.

*NJF Seminar 170. Poster. Authors' abstract.*

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

Tove Nørgaard Clausen, Søren Wamberg.

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

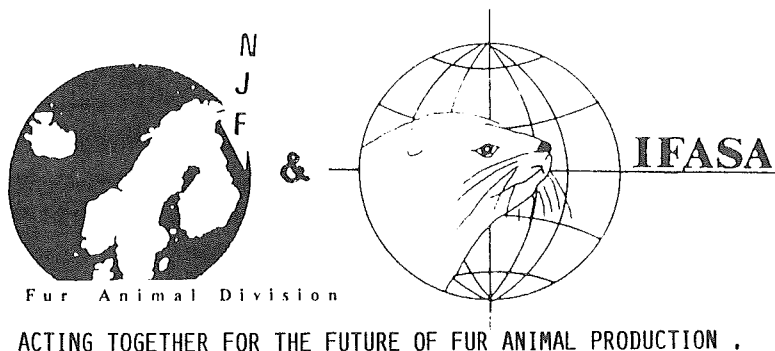
Clinically, the ailment is characterized by an extreme loss of body mass, diminishing appetite, progressive weakness and staggering

gait. In the advanced stage, severe dehydration, lethargy and non-ketotic stupor or coma precedes death.

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

The present investigation was planned and started in spring 1989 in order to evaluate the factors involved in the development, pathogenesis and maintenance of nursing sickness in mink. Preliminary results obtained from our study in nursing mink with large litters in the 1989 breeding season clearly demonstrate that nursing sickness is associated with distinct changes in water, electrolyte and acid-base metabolism. Whole blood glucose and serum potassium concentrations increased by 200-400% and 200%, respectively, whereas that of sodium in serum decreased by 20%. The concentration in urine of potassium was low, and that of sodium was extremely low, suggesting a high extracellular aldosterone activity. Furthermore, low values of whole blood base excess and plasma bicarbonate were found, with or without increased concentrations of plasma lactate, indicating variable degrees of metabolic acidosis. The absence of ketonemia and ketonuria clearly demonstrated that classical metabolic disturbances such as diabetes mellitus or ketosis can be excluded as causal factors in the development of nursing sickness.

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



2. Internationales Pelztiersymposium.  
Leipzig, 8. bis 10. April 1986.

## 2. INTERNATIONALES PELZTIERSYMPIOSIUM

*Proceeding, 202 pages, 32 reports. In GERM.*

The proceedings can be obtained at:

*Sektion Tierproduktion und Veterinärmedizin*

*der Karl-Marx-Universität Leipzig*

*7010 Leipzig, Johannisalle 21, DDR*

*att. Prof. Dr. sc. H. Pingel/ Doz. Dr. sc. H. Hattenhauer.*

(Vorträge)

Publication: III-12-12-L 1393/86. Price unknown.

The symposium has been mentioned in *Scientifur*, Vol. 10, No. 2, pp. 136-137. The titles are given in the Contents of this issue of *Scientifur*.

The next (3rd) International Symposium will be held in Leipzig, April 1990.

Abstract: G. Jørgensen.

### List of addresses.

Adamescu, P., Centrala pentru productia avicola, Bucuresti, Romania.

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

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

Allen, Arthur W., National Ecology Center, U.S. Fish and Wildlife Service, Drake Creekside Building One, 2627 Redwing Road, Fort Collins, CO 80526-2899, USA.

Anke, M., Karl-Marx-Universität Leipzig, Johannisalle 21, DDR 7010 Leipzig, DDR.

Asari, M., Dept. of Anatomy, Azabu University School of Veterinary Medicine, Sagamihara, Kanagawa 229, Japan.

Aulerich, R.J., Dept. of Animal Science, Michigan State University, East Lansing, MI 48824, USA.

Baumans, V., Dept. of Laboratory Animal Science, Vet. Faculty, State University, P.O. Box 80166, 3508 TD Utrecht, The Netherlands.

Baumgärtner, W., Inst. für Veterinär-Pathologie, Universität Giessen Frankfurterstrasse 96, 63 Giessen, Fed. Rep. Ger. (Present address: 1989).

Beek, P.N.G.M. van, Stichting Gezondheidsdienst voor Dieren in Noord-Brabant, Postbus 4, 5280 AA Boxtel.

Berestov, V.A., Inst. of Biology of the Karelian Branch of the Academy of Sciences of the USSR, 11 Pushkinskaya St., Petrozavodsk, USSR.

Bernacka, Henryka, Zaklad Hodowli Owiec i Koni ATR, Zaklad Genetyki Zwierzat ATR, ul. H. Sawickiej 28, 28-084 Bydgoszcz, Poland.

Besch-Williford, Cynthia L., Research Animal Diagnostic and Investigative Laboratory, College of Veterinary Medicine, University of Missouri, Columbia, Missouri 65211, USA.

Besedoma, G.G., USSR.

Bondar, A.A., Inst. of Cytology and Genetics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk, USSR.

Bonnefond, C., Dept. de Physiologie Animale, Inst. Natl. de la Rech. Agronomique, 78350 Jouy en Josas, France.

Bouchardy, C., 85, avenue de Wagram, F-75017 Paris, France.

Brandt, Asbjørn, Natl. Inst. of Animal Science, P.B. 39, DK 8830 Tjele, Denmark.

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

Carroll, R.S., Boston University, Dept. of Biology, 2 Cummington St., Boston, MA 02215, USA.

Chertovich, N.F., USSR.

Choleva, R., Agricultural University, Poznan.

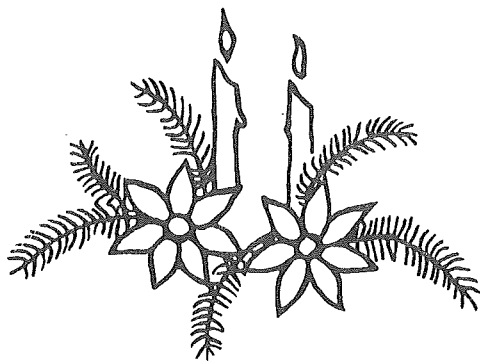
Chuchina, T.V., Moscow, USSR.

Clarkson, M.J., University of Liverpool, Dept. of Veterinary Clinical Science, Vet. Field Station, "Leahurst", Neston, Great Britain.

- Clausen, Jesper, Danish Fur Breeders Association, 60, Langagervej, DK 2600 Glostrup.  
 Clausen, Tove Nørgaard, Forsøgsfarm Vest, 112 Herningvej, Tvis, DK 7500 Holstebro, Denmark.  
 Cotea, C., Inst. Agronomic, Iasi, Romania.  
 Dahle, Hans Kolbein, Dal forsøksgård, N 1380 Heggedal, Norge.  
 Dahlman, Tuula, Finlands Pälsdjuruppfödarens Förbund r.f., PB 5, 01601 Vanda 60, Finland.  
 Edfors, Cathrine H., Dept. of Animal Science, Michigan State University, East Lansing, Michigan 48824, USA.  
 Egen, H., Hannover, Fed. Rep. Germ.  
 Einarsson, Einar J., P.O. Box 73, N-1430 Ås, Norway.  
 Emmons, Louise H., Smithsonian Institution, Div. of Mammals, Washington DC 20560, USA.  
 Falkenberg, Henrik, Forsøgsfarm "Syd", Lindknudvej 35, DK 66550 Brørup, Denmark.  
 Farstad, Wenche, Dept. of Reproduction and Forensic Medicine, Norwegian Coll. of Veterinary Medicine, POB 8146 Dep., N 0033 Oslo 1, Norway.  
 Fors, Fjalar, Maxmo Research Farm, SF 66640 Maxmo, Finland.  
 Frindt, Andrzej, Inst. for animal husbandry and technology, Agricultural University of Warsaw, Poland.  
 Gabrisch, K., Hannover, Ger. Fed. Rep.  
 Glem-Hansen, N., Dansk Pelsdyravlerforening, 60, Langagervej, DK 2600 Denmark.  
 Gorski, J., Pulawy, Michalowka 5/6, Poland.  
 Haapanen, K., Dept. of Applied Zoology, University of Kuopio, P.O. Box 6, SF 70211 Kuopio, Finland.  
 Hansen, N. Enggaard, The Royal Vet. and Agric. University, 13, Bülowsvej, DK 1870 Frederiksberg C.  
 Harkness, J.E., Coll. of Vet. Med., State Univ., Mississippi State, MI 39762, USA.  
 Hattenhauer, H., Karl-Marx Universität, Sektion Tierproduktion und Veterinärmedizin, Arbeitsgruppe Pelztierzucht 7030 Leipzig, Helenstrasse 24, DDR.  
 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.  
 Hyldgaard-Jensen, Chr., Lillerupvej 15, DK 8410 Rønne, Denmark.  
 Indrebø, A., Norwegian College of Vet. Med., Box 8146 Dep., N-0033 Oslo 1, Norway  
 Ingo, Raija, Finnish Fur Breeders Association, P.O. Box 5, SF-01601 Vanda 60, Finland  
 Jalkanen, Liisa, Finnish Fur Breeders Association, SF 80200 Joensuu, Finland.  
 Jepsen, Leif Lau, Inst. of Population Biology, University of Copenhagen, Universitetsparken 15, DK 2100 Copenhagen Ø, Denmark.  
 Joelsson, Frank, Klostergården Chinchilla, Sweden.  
 Johannessen, Kai-Rune, Norges Pelsdyrslag, Økern torgvei 13, 0580 Oslo 5, Norge.  
 Johannsen, U., Karl-Marx-Universität Leipzig, Johannissalle 21, DDR 7010 Leipzig, DDR.  
 Jorgensen, Gunnar, Inst. of Animal Science, Dept. of Fur Animals, Box 39, DK 8830 Tjele, Denmark  
 Joyeux, Roselyne, Economics Dept., University of Otago, Box 56, Dunedin, New Zealand.  
 Juneja, R.K., Dept. of Animal Breeding and Genetics, Swedish Univ. of Agric. Sciences, Box 7023, s 750 07 Uppsala 7, Sweden.  
 Juokslahti, Tapio, Finnish Fur Breeders Association, P.B. 5, SF 01601 Vanda 60, Finland.  
 Kazakova, T.I., USSR.  
 Kenttämies, Hilka, University of Helsinki, Department of Animal Breeding, Viikki, SF-00710 Helsinki, Finland.  
 Khudyakova, A.A., USSR.  
 Kochan, Ewa, Department of Animal Anatomy, University of Agriculture, Krakow, Poland.  
 Korhonen, Hannu, Dept. of Applied Zoology, University of Kuopio, P.O. Box 6, SF 70211 Kuopio, Finland.  
 Krieg, R., Karl-Marx-Universität Leipzig, Johannissalle 21, DDR 7010 Leipzig, DDR.  
 Kukla, Frantisek, katedra zoologie a chovu drobných hospodarských zvirat, AF VSZ v Brne, Zemedelska 1, 613 00 Brno, Czechoslovakia.  
 Kulisek, Vaclav, Katedra fyziologie, morfologie a prevencie hospodarských zvierat VSP, 949 76 Nitra, Lomonosovova 2, Poland.  
 Kuznetsov, K.V., USSR.  
 Körner, E., Tiergesundheitsamt der Landwirtschaftskammer Rheinland, Bonn, GFR  
 Lagerkvist, Gabrielle, The Swedish 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.  
 Libois, R.M., Laboratoire d'Ethologie, Université de Liège, Inst. de Zoologie, 22 quai Van Beneden, B-4020 Liège, Belgique.  
 Lindh, Kaj, Finlands Pälsdjuruppfödarens Förbund PB 5, 01601 Vanda 60, Finland.  
 Litvinov, A.M., USSR.  
 Livinov, O.B., USSR.  
 Lohi, Outi, Inst. of Animal Science, Dept. of Fur Animals, Box 39, DK 8830 Tjele, Denmark  
 Loikala, Taina, Valtion eläinlääketieteellinen laitos, Hämeentie 57, 00550 Helsinki, Finland.

- Löhle, K., Humboldt University Berlin, Section TV, Inst. for Poultry and small animal Breeding, Berlin.
- Maciejowski, J., Inst. for biological conditions of animals production, Agricultural Academy Lublin, Poland.
- Mainka, S.A., Veterinary Services, Calgary Zoo, P.O. Box 3036, Stn. B., Calgary, Alberta, Canada T2M 4R8.
- Majorov, A.I., USSR.
- Marco, Oscar N. Di, Agricultural Sciences College, University of Mar del Plata, CC 276, Dto. Animal Prod. INTA. 7620, Balcarce, Argentina.
- Michaelsen, Søren, Chemistry Dept., Royal Vet. and Agric. University, Thorvaldsensvej 40, DK 1871 Frederiksberg C, Denmark.
- Miller, Brian J., U.S. Fish and Wildlife Cooperative Research Unit, Dept. of Zoology and Physiology, University of Wyoming, Laramie, Wyoming 82071, USA.
- Mononen, Jaakko, Dept. of Applied Zoology, University of Kuopio, POB 6, SF 70211 Kuopio 21, Finland
- Munck, Christian, Danish Fur Breeders Laboratory, 60, Langagervej, DK 2600 Glostrup, Denmark.
- Neil, Maria, Swedish Univ. Agric. Sci., Dept. of Animal Nutrition and Management, Funbo-Lövsta Research Station, S-75597 Uppsala, Sweden.
- Neubert, A., Inst. für Impfstoffe Dessau im Stembetrieb des VEB Kombinat Veterinärimpfstoffe Dessau.
- Niedzwiadek, Stanislaw, Zaklad Hodowli Drobnego Inwentarza Instytutu Zootechniki, 32-083 Balice k. Krakowa, Poland.
- Niemi, Veli-Mikko, Dept. of Food and Environmental Hygiene, Coll. of Vet. Med., POB 6, SF-00581 Helsinki, Finland.
- Nyukhalov, A.P., Moscow, USSR.
- Pedersen, Vivi, Nordjysk Pelsdyrforsøgsfarm, Hundelevej 75, Nr. Rubjerg, DK 9480 Løkken, Denmark.
- Persin, Mirosław, Statni veterinarni ústav, U sila 310, 463 11 Liberec 30, Vratislavice, Poland.
- Pingel, H., Karl-Marx-Universität Leipzig, Johannisalle 21, DDR 7010 Leipzig, DDR.
- Pischel, B., Karl-Marx-Universität Leipzig, Johannisalle 21, DDR 7010 Leipzig, DDR.
- Polonen, Ilpö, Finlands Pälsdjurruppödares Förbund r.f., P.B. 5, 01601 Vanda 60, Finland.
- Rajs, Romuald, Katedra Fizjologii i Anatomii Zwierzat ATR, ul. H. Sawickiej 28, 85-084 Bydgoszcz, Poland.
- Rasmussen, Anders Maltha, Vildtbiologisk Station, Rønde, Denmark.
- Rasmussen, Palle, Natl. Inst. of Animals Science, P.B. 39, DK 8830 Tjele, Denmark.
- Reinhardt, I., Bezirksinstitut für Veterinärwesen Leipzig - DDR, Goethesteig, DDR 7030 Leipzig.
- Reinhardt, U., Inst. für Virologie, Justus-Liebig-Universität Giessen, Giessen, Fed. Rep. Ger.
- Rouvinen, Kirsti, Agric. Res. Ctr., Fur Farming Res. Station, SF-69100 Kannus, Finland.
- Rubtsov, N.B., Inst. of Cytology and Genetics, Siberian Branch of the USSR, Academy of Sciences, Novosibirsk, USSR.
- Saarenmaa, Kari, Agricultural Res. Ctr., Animal Breeding Section, SF 31600 Jokioinen, Finland.
- Salyi, G., T'bornok u. 2, 1149 Budapest, Hungary.
- Samkov, Yu A., USSR.
- Sava, Ovidiu, Statiunea de cercetare pentu animalele de blana, Tirgu Mures, Romania.
- Sava, Speranta, Statiunea de cercetare pentu animalele de blana, Tirgu Mures, Romania.
- Scheuring, Witold, Dyrekcja Wojewódzkiego Zakladu Weterynarii, 65-218 Zielone Góra, Poland.
- Schimmer, Annegrete, Fredningsstyrelsen, Copenhagen, Denmark.
- Schult, G., Landwirtschaftskammer, Hannover, Germany F.G.
- Schürg, Andrea, Universität Hohenheim, Inst. für Zoophysiology, Stuttgart, Fed. Rep. Germ.
- Schöneboom, A., Karl-Marx-Universität Leipzig, Johannisalle 21, DDR 7010 Leipzig, DDR.
- Selås, Vidar, Avd. Zoologi, Biologisk Institutt, Universitetet i Oslo, Norge.
- Seo, K.D., ?
- Shi, Liming, Lab. of Cytogenetics, Kumming Inst. of Zoology, The Chinese Academy of Sciences, Kumming, The People's Republic of China.
- Skrede, Anders, Dept. of Poultry and Fur animal Research, Agricultural University of Norway, Box 25, N 1432 Ås-NLH, Norge
- Smith, R.A., Toxicology Laboratory, Alberta Agric., O.S. Longman Building, 6909-116 Street, Edmonton, Alberta, Canada T6H 4P2.
- Snipes, R.L., Institut für Anatomie und Zytobiologie der Justus-Liebig-Universität Giessen, Aulweg 123, D-6300 Giessen, Fed. Rep. Germ.
- Snyder, Daniel E., Animal Parasite Research Laboratory, U.S. Dept. of Agric., Agric. Research Service, P.O. Box 952, Auburn, Alabama 36831-0952, USA.
- Sobolev, A.D., Moscow, USSR.
- Spannl, Monika, Käutzchenweg 11, D-8000 München 42, Fed. Rep. Germ.
- Sterten, Halgeir, Institutt for husdyrfag, Norges Lantbrukshøgskole, Box 25, N 1432 Ås-NLH, Norge.
- Tauson, Anne-Helene, Swedish University of Agricultural Sciences, Department of Animal Nutrition and Management, Fur Animal Division, Funbo-Lövsta, S-755 90 Uppsala, Sweden.
- Tennessee, T., N.S.A.C., Dept. of Animal Science, P.O. Box 550, Truro, N.S. Canada B2N 5E3.
- Tomson, Farol N., Laboratory Animal Resources Center, College of Veterinary Medicine, Washington State University, Pullman, Washington 99164-1165, USA.

Tornow, U., Government Veterinary Collective Practice of small domestic and fur animals, Oranienburg.  
Tothz, A., Industrial Mink Production, Plau-Appelburg.  
Työppönen, Jouko, Coll. of Vet. Med., Dept. of Biochemistry, P.O. Box 6, SF-00581 Helsinki, Finland.  
Veijalainen, Pirjo, Natl. Vet. Inst. and Dept. of Genetics, University of Helsinki, P.O. Box 368, SF 00101 Helsinki, Finland.  
Wanyangu, S.W., WHO/FAO Collaborating Centre for Research & Reference on Leptospirosis and PHLS Leptospira Reference Unit, Hereford, England.  
Yudin, V.K., USSR.  
Zejda, Jozef, Inst. of Systematical and Ecological Biology, CSAV, Kvetná 8, 603 65 Brno, CSSR.  
Zimmermann, Horst, R.-Petershagen-Allee 1, Greifswald, 2200, DDR.  
Zunft, P., Karl-Marx-Universität Leipzig, Johannisalle 21, DDR 7010 Leipzig, DDR.  
Zuorliiski, P., Region Veterinary Station, Varna, Bulgaria.



## WORLD FAMOUS DANISH FUR ANIMALS

FOR SALE FOR REASONABLE PRICES  
FROM ONE OF THE LARGER FARMS IN DENMARK

### MINK

FINE QUALITY AND VERY SILKY MINK IN THE FOLLOWING TYPES:

**DARKS, PASTELS, PEARLS AND FARMED-WILD**

### FOX

WE ALSO OFFER VERY GOOD **BLUE, SHADOW AND SILVER** FOXES

ALL ANIMALS ARE **ID** FREE AND HAVE HIGH REPRODUCTION RECORDS

### ARVAD MINK I/S

IS A MODEL FARM FOR BOTH MINK AND FOX BREEDING, WHICH HAS ATTRACTED A  
LARGE NUMBER OF INTERNATIONAL VISITORS

FOR MORE INFORMATION CONTACT: JACOB LARSEN, ARVAD MINK I/S, GRARUPVEJ 3,  
7330 BRANDE, DENMARK. PHONE: 45-7-182339.