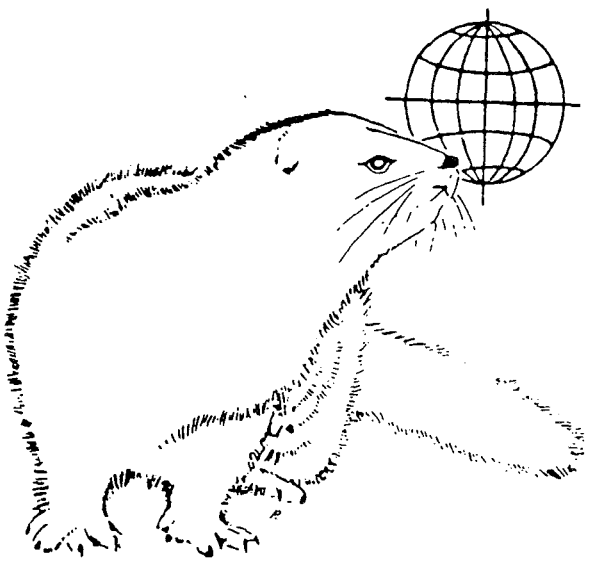


SCIENTIFUR
ISSN 0105-2403
Vol. 19, No. 2
May, 1995

Published by IFASA

INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

1. Contents 77

2. Notes 85

3. Multidisciplinary

Changes in behavioural traits of the silver fox (*Vulpes vulpes*) under domestication and specific genotype-environment interactions. *L.L. Vasilyeva. Original Report. Code 11-4-10-F.* 87

The effect of melatonin on advancing the priming of winter fur coat in blue foxes. *S.J. Jarosz, O. Szeleszczuk. Original Report. Code 3-2-F.* 95

The relationship between feed consumption, weight gain, and skin length. *Peer Berg, Georg Hilleman. Original Report. Code 2-4-6-12-M.* 101

Concentration of some macroelements in fur of Greenland nutria during ontogenesis. *E. Hanusová, D. Mertin, K. Sügegová, V. Stepanok. Original Report. Code 2-3-14-O.* 107

Genetic and environmental determination of reproduction results in the polecat. *G. Jezewska, J. Maciejowski, J. Tarkowski. Original Report. Code 4-5-10-O.* 111

Analysis of dansyl amino acids in feedstuffs and skin by micellar electrokinetic capillary chromatography. *Søren Michaelsen, Peter Møller, Hilmer Sørensen. Code 3-2-7-M-F.* 114

Age-related effects of Triphenyl Phosphite-Induced Delayed Neuropathy on Central Visual Pathways in the European Ferret (Mustela putorius furo). *Duke Tanaka, Jr., Steven J. Bursian, Richard J. Aulerich. Code 8-2-O.* 114

Contaminants in Fishes from Great Lakes-Influenced Sections and above Dams of Three Michigan Rivers. II: Implications for Health of Mink. *J.P. Giesy, D.A. Verbrugge, R.A. Othout, W.W. Bowerman, M.A. Mora, P.D. Jones, J.L. Newsted, C. Vandervoort, S.N. Heaton, R.J. Aulerich, S.J. Bursian, J.P. Ludwig, G.A. Dawson, T.J. Kubiak, D.A. best, D.E. Tillitt. Code 9-8-11-14-M.* 115

Use of clinical analysis for the improvement of production in mink. *Birthe M. Damgaard. Code 3-12-14-M.* 116

Fur biting in mink. *G. Lagerkvist. Code 11-2-M.* 116

Morphological investigations of hair and pelts from fur bearers. *Palle V. Rasmussen. Code 2-14-M-F-O.* 116

Sprinkling of mink may prove interesting at high temperatures. *Steen Møller, Steffen W. Hansen. Code 10-12-5-14-M.* 116

The influence of temperature on energy and behaviour pattern of mink in the winter period. *H. Korhonen, P. Niemelä. Code 10-11-6-14-M.* 117

Growth and reproduction in farmed martens. *H. Korhonen, P. Pyyvaara, P. Niemelä. Code 2-5-14-O.* 117

Assessment of the welfare of farmed foxes on the basis of behavioural and physiological parameters. *Vivi Pedersen. Code 11-10-3-F.* 117

Shelf trials with blue foxes during the winter and the breeding season in January-July 1993. *H. Korhonen, P. Niemelä. Code 10-11-12-14-F.* 118

Importance of the growth curve in Standard mink. *A. Baumgarten. Code 6-2-5-M.* 118

Danish breeders should aim for larger mink. *Iwan Santin. Code 2-13-12-14-M.* 118

Whelping results in the Sampo scheme in 1993. *K. Smeds. Code 4-5-13-M-F.* 118

Results of the pelt quality recording scheme for fur bearers. *Anonymous. Code 13-2-M-F.* 119

Scanning electron microscopic study on collagen fibrils in the mink dermis during the hair cycle and growth. *Jae In Pak, Fumio Nakamura, Kazuaki Takenouchi, Keiji Kondo. Code 2-M.* 119

The daily rhythm of locomotor activity in silver foxes (*Vulpes Fulvus* Desm.), its changes during domestication. *I.Z. Plyusnina, L.N. Trut, N.M. Selina. Code 4-3-11-F.* 120

Would raccoon dogs benefit from hibernation? *S. Pasanen, J. Asikainen, H. Korhonen. Code 3-5-6-14-O.* 120

Breeding raccoon dogs in a combination of a cage and an enclosure. *H. Korhonen, S. Alasuutari. Code 10-11-12-14-O.* 121

A summary of the shelf trials at the experimental farms in 1992. *H. Korhonen, P. Niemelä, J. Mäkelä, J. Asikainen, S. Alasuutari. Code 10-11-14-F.* 121

Trials on the provision of shelves for blue foxes during the rearing period. *H. Korhonen, P. Niemelä. Code 10-11-14-F.* 122

Blue fox shelf trials in winter. *S. Alasuutari. Code 10-11-5-F.* 122

Age and context affect the stereotypies of caged mink. *Georgia J. Mason. Code 11-10-14-M.* 122

The influence of weight, sex, birthdate and maternal age on the growth of weanling mink. *Georgia J. Mason. Code 2-13-M.* 123

Effects of different post-weaning handling procedures on the later behaviour of silver foxes. *Vivi Pedersen. Code 11-10-5-F.* 123

Titles of other publications - not abstracted

Survey of Danish fur-bearing animals 1993. *Jens Groot. Dansk pelsdyravl, Vol. 56 (6), pp. 216-218, 1993. 6 tables. In DANH. Code 13-M-F-O.*

Farming fur bearing animals in northern circumstances. *Hannu Korhonen, Sakari Alasuutari, Pentti Korhonen. Finsk Pälstidskrift, Vol. 26 (12), pp. 284-289, 1992. 10 refs. In SWED. Code 10-11-12-14-M-F-O.*

Reduces gauge of wire in the feeding areas, can reduce the feed consumption. *Ulla Lund Nielsen. Dansk Pelsdyravl, Vol. 56 (9), pp. 318-319. In DANH. Code 6-10-12-14-M.*

Behaviour and welfare in farmed mink. *Steffen W. Hansen. Jord og Viden, Vol. 139, No. 19, pp. 22-24, 1994. In DANH. Code 11-10-12-14-M.*

The Biology of the Icelandic mink population. *K. Skírnisson. Semiaquatische Säugetiere, Wiss. beitr. Univ. halle, pp. 277-295, 1992. In GERM. Code 1-10-11-14-M.*

Element concentrations in brains of natural dark mink. *R.J. Aulerich. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 3-6-M.*

Mink ears in biomedical research. *S.M. Stejskal, R.J. Aulerich. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 2-3-4-14-M.*

4. Genetics

Genetic and phenotypic parameters for fur characteristics in Chinchilla lanigera (*Chinchilla laniger*). *C.A. Cappelletti, F.M.B. Rozen. Original Report. Code 4-2-O.* 125

Genetic models for the inheritance of the silver colour mutation of foxes. *Flemming Skjøth, Outi Lohi, Alun Thomas. Code 4-2-F.* 129

Effect of selection on digestibility and carcass composition in mink. *Gabrielle Lagerkvist, Anne-Helene Tauson. Code 4-3-2-6-M.* 129

Embryonic development of endocrine system in silver fox after long-term selection for domestic behaviour. *L.V. Osadchuk, T.A. Schurkalova. Code 4-3-11-F.* 129

DanMink - the new way of mink breeding. *J. Claussen. Code 4-M.* 129

Colour genetics in foxes. *E.M. Koldaeva. Code 4-F.* 130

A new breeding plan. 1. background and previous experiences. *K.R. Johannessen. Code 4-12-M-F.* 130

A new breeding plan. 2. Breeding aims and initiatives. *K.R. Johannessen. Code 4-12-M-F.* 130

A gene bank for furbearing animals of different colour types. *H. Kenttämies. Code 4-M-F-O.* 130

A further chapter in the Mahogany saga. *Janne Hansen. Code 4-M.* 131

cDNA clones encoding mink immunoglobulin λ chains. *A.M. Najakshin, J.S. Belousov, B.Yu. Alabyev, S.S. Bogachev, A.V. Taranin. Code 4-3-M.* 131

Effect of the "star" gene on the rate of migration of melanoblasts in silver fox (*Vulpes vulpes*) embryos. *L.A. Prasolova, L.N. Trut. Code 4-5-F.* 131

Inheritance models of North American red fox coat color. *Donald R. Johnson, Pall Hersteinsson. Code 4-F.* 131

The effect of the S gene on fertility and embryo mortality in foxes. *A.I. Zhelezova. Code 5-4-F.* 132

Comparative analysis of the level of heteroygosity for glucose phosphate isomerase (GPI) locus in silver foxes (*Vulpes vulpes*) of domesticated and control populations. *L.N. Trut, T.B. Nesterova, S.M. Zakian. Code 3-4-11-F.* 132

5. **Reproduction**

Periovulatory endocrinology, oocyte maturation, fertilization and fertility in the female blue fox (*Alopex lagopus*). *Wenche Farstad. Code 5-3-2-F.* 133

Relationship between gonadotrophin, inhibin and sex steroid secretion during the periovulatory period and the luteal phase in the blue fox (*Alopex lagopus*). *M. Mondain-Monval, W. Farstad, A.J. Smith, M. Roger, N. Lahlou. Code 5-3-F.* 134

Structural aspects of oocyte maturation in the blue fox (*Alopex lagopus*). *P. Hyttel, W. Farstad, M. Mondain-Monval, K. Bakke-Lajord, A.J. Smith. Code 5-3-2-F.* 134

Fertilization and early embryonic development in the blue fox (*Alopex lagopus*). *W. Farstad, P. Hyttel, C. Grøndahl, M. Mondain-Monval, A.J. Smith. Code 5-3-2-F.* 135

Fertilization *in vitro* of oocytes matured *in vivo* in the blue fox (*Alopex lagopus*). *W. Farstad, P. Hyttel, C. Grøndahl, A. Krogenæs, M. Mondain-Monval, A.L. Hafne. Code 5-3-F.* 136

Testosterone production in fetal testes of the silver fox. *L.V. Osadchuk. Code 5-3-F.* 136

Steroidogenesis in the silver fox fetal adrenal gland. *L.V. Osadchuk. Code 3-5-F.* 136

Matings should begin when mink females want them. *Janne Hansen. Code 5-12-M.* 137

Semen quality is important for AI results. *H. Kenttämies, K. Petersen-Waris. Code 5-F.* 137

Insemination of foxes in 1993. *Erik Smeds. Code 5-13-F.* 137

Birth of martens at Kannus. *H. Korhonen, P. Niemelä. Code 5-10-11-14-O.* 137

Is the whelping performance in foxes affected by that of females in adjacent cages? *H. Korhonen, P. Niemelä. Code 5-11-10-14-F.* 137

Species differences in fertility after artificial insemination with frozen semen in fox pure breeding. *W.K. Farstad, J.A. Fougner, K.A. Berg. Code 5-4-F.* 138

Plasma progesterone during the luteal phase and pregnancy in parturient and barren blue fox vixens. *N.M. Valberg, W. Farstad. Code 5-3-F.* 138

In vitro techniques in fox reproduction. *W. Farstad, A. Krogenæs, E. Nagyová, A.L. Hafne, P. Hyttel. Code 5-3-2-F.* 139

The effect of changes in the light regime on endocrine function of the gonads in silver foxes. *L.V. Osadchuk. Code 5-3-10-F.* 139

Titles of other publications - not abstracted

Reproduction in the blue fox vixen (*Alopex lagopus*). *Wenche Farstad. In: Reproduction in Carnivorous Fur Bearing Animals. Tauson A.H. & M. Valtonen (eds.). Nordiska Jordbruksforskares Förening. NJF-utredning/-rapport Nr. 75, Jordbruksförlaget, Copenhagen 1992, pp 119-133. Code 5-F.*

Effects of domestication on the hormonal function of gonads in reproductive cycle and prenatal development of silver foxes. ***Ludmila Osadchuk.*** *NJF-Workshop, Viborg, Denmark, April 29th, 1993. Stenciled Report (Review), 23 pp. Code 4-5-11-14-F.*

6. Nutrition

Responses of growing mink to supplemented dietary copper and biotin. *C.R. Bush, J. C. Restum, S.J. Bursian, R.J. Aulerich. Original Report. Code 6-2-3-M.* 141

High dietary level of polyunsaturated fatty acids and varied vitamin E supplementation in the reproduction period of mink. *Anne-Helene Tauson. Code 6-3-5-M.* 148

Plasma thyroxine concentration in non-pregnant and lactating mink, and effect of dietary rapeseed oil in the reproduction period. *Anne-Helene Tauson, Maria Neil. Code 3-6-5-M.* 148

Litter size of raccoon dog in relation to nutrition during the winter. *J. Asikainen, H. Korhonen, S. Pasanen. Code 6-5-2-O.* 148

Particle size analysis of ground mink feeds. *A. Alden. Code 7-6-14-M-F-O.* 149

Inclusion of oxidized fish oil in mink diets. 1. The influence on nutrient digestibility and fatty-acid accumulation in tissues. *C.F. Børsting, R.M. Engberg, K. Jakobsen, S.K. Jensen, J.O. Andersen. Code 6-7-3-M.* 149

Inclusion of oxidized fish oil in mink diets. 2. The influence on performance and health considering histopathological, clinical chemical, and haematological indices. *R.M. Engberg, C.F. Børsting. Code 6-7-3-M.* 149

Retinoic acid regulates retinol metabolism via feedback inhibition of retinol oxidation and stimulation of retinol esterification in ferret liver. *Xiang-Dong Wang, Norman I. Krinsky, Robert M. Russell. Code 3-6-O.* 150

The effects of nitrate, nitrite, and n-nitroso compounds on animal health. *Colleen S. Bruning-Fann, Johan B. Kaneene. Code 6-7-8-9-M-F-O.* 150

Distribution of ß-carotene and vitamin A in lipoprotein fractions of ferret serum. Effect of ß-carotene supplementation. *J.D. Ribaya-Mercado, J. Lopez-Miranda, J.M. Ordovas, M. C. Blanco, J.G. Fox, R.M. Russell. Code 6-3-O.* 151

Intestinal uptake and lymphatic absorption of ß-carotene in ferrets: a model for human ß-carotene metabolism. *Xiang-Dong Wang, N.I. Krinsky, R.P. Marini, Guangwen Tang, Jing Yu, R. Hurley, J. G. Fox, R.M. Russell. Code 3-6-O.* 151

Influence of dietary sources of fat on lipid syntehesis in mink (*Mustela vison*) mammary tissue. *S. Wamberg, C.R. Olesen, H.O. Hansen. Code 6-3-M.* 152

Titles of other publications - not abstracted

Utilization of opportunity feedstuffs in Atlantic Canada - use of silver hake and herring in growing-furring diets for mink. *K. Rouvinen, D.M. Andersen, S. Alward. Stenciled Report, 1993, 5 pp. Code 6-7-M.*

Histopathologic lesions in sea otters exposed to crude oil. *T.P. Lipscomb, R.K. Harris, r.B. Moeller, J.M. Pletcher, R.J. Haebler, B.E. Ballachey. Vet. Pathol. 30, pp. 1-11, 1993. Code 9-10-O.*

The role of biotin in mink reproduction. *R.J. Aulerich, C.R. Heil, A.C. Napolitano. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 6-5-M.*

The role of selenium in mink nutrition. *R.J. Aulerich, A.C. napolitano. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 6-5-3-8-M.*

Toxicity of dietary heptachlor to female mink (*Mustela vison*). *J. Crum, R.J. Aulerich, S.J. Bursian, D. Polin, I. Su. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 6-8-5-M.*

Effects of zearalenone and other mycotoxins on mink. *J.K. Cameron, S.J. Bursian, R.J. Aulerich. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 8-14-M.*

Effects of zearalenone on male mink reproductive performance. *J.K. Cameron, S.J. Bursian, R.J. Aulerich. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 8-5-14-M.*

Subacute dietary toxicity of deoxynivalenol (vomitoxin) and zearalenone to mink. *J.K. Cameron, S.J. Bursian, R.J. Aulerich. Fur Bearing Animal Research, 1993. Animal Science Department, Michigan State University, East Lansing, MI 48824-1225. Code 8-14-M.*

Effect of supplemental copper on mink kit hemoglobin concentration. *R.J. Aulerich, A.C. Napolitano. Mink and Poultry Research 1990. Research report from the Michigan State University Agricultural Experiment Station, East Lansing (USA), no. 509, pp. 38-45, January 1991. Code 6-3-M.*

7. **Veterinary**

The electrophoretic pattern of serum proteins in silver and polar foxes. *J. Cofta, K. Kostro, M. Sobieska, K.E. Wiktorowicz. Original Report. Code 3-F.* 153

Seroprevalence of *Toxoplasma gondii* in Danish farmed mink (*Mustela vison* S.). *P. Henriksen, H.H. Dietz, Aa. Uttenthal, M. Hansen. Code 9-M.* 156

A study on the predilection sites of *Trichinella spiralis* muscle larvae in experimentally infected foxes (*Alopex lagopus, Vulpes vulpes*). *Chr. M. Kapel, Sv. Aa. Henriksen, H.H. Dietz, P. Henriksen, P. Nansen. Code 9-F.* 156

Acute interstitial pneumonia in mink kits inoculated with defined isolates of Aleutian mink disease parvovirus. *S. Alexandersen, S. Larsen, B. Aasted, Å. Uttenthal, M.E. Bloom, M. Hansen. Code 9-M.* 156

Estradiol-17ß-secreting adrenocortical tumor in a ferret. *N.S. Lipman, R.P. Marini. Code 9-3-O.* 157

Molecular cloning of a mink prion protein gene. *H.A. Kretzschmar, M. Neumann, G. Riethmüller, S.B. Prusiner. Code 9-4-3-M.* 157

Transmissible mink encephalopathy. *R.F. Marsh, W.J. Hadlow. Code 9-M.* 158

Experimental infection of mink with bovine spongiform encephalopathy. *M.M. Robinson, W.J. Hadlow, T.P. Huff, G.A.H. Wells, M. Dawson, R.F. Marsh, J.R. Gorham. Code 9-M.* 158

Physicochemical and biological characterizations of distinct strains of the transmissible mink encephalopathy agent. *R.F. Marsh, R.A. Bessen. Code 9-M.* 158

Titles of other publications - not abstracted

Fatty liver in mink. *R.J. Aulerich, A.C. Napolitano, E.J. Lehning, R.K. Ringer. Mink and Poultry Research 1990. Research report from the Michigan State University Agricultural Experiment Station, East Lansing (USA), no. 509, pp. 38-45, January 1991. Code 9-6-M.*

Hematologic profiles of normal mink and mink with "wet belly". *R.J. Aulerich, J.M. Ploucha. Mink and Poultry Research 1990. Research report from the Michigan State University Agricultural Experiment Station, East Lansing (USA), no. 509, pp. 38-45, January 1991. Code 9-3-M.*

8. New books

Code of practice for the care and handling of farmed mink, fitch and fox in Europe. *Code 12-14-M-F-O.* 159

Breeding of fur animals. *Code 12-14-M-F-O.* 160

9. List of addresses 161

Notes
SCIENTIFUR
Vol. 19, No. 2, 1995

It is very promising for the editor that we receive an increasing number of original reports for publication in SCIENTIFUR. We regard this as a pat on our shoulder and an underlining that SCIENTIFUR is growing in importance as the leader of international information on fur animal science and production.

We would like to stress our gratitude to CEFBA for the 1995 support to SCIENTIFUR amounting to NOK 215,000 equal to approx. US$ 35,000. Without this support SCIENTIFUR could not even dream of having a glorious future as an important link for the international information and communication within fur animal research and production.

The IFASA board meeting planned to take place in Poland in week 22 of 1995 has been moved to week 38 instead, at which time the arrangement of the 6th International Scientific Congress in Poland in 1996 must be finally confirmed.

The postponement of the board meeting means that our members will have more time to send in suggestions and proposals regarding IFASA etc. to be discussed by the board.

Please send your proposals or questions to the president or to one of the board members.

Many of our IFASA members, subscribers, and contributors to SCIENTIFUR have received a request from the editor asking you to forward a copy of scientific reports published elsewhere. With this request we supplied information on IFASA and SCIENTIFUR. Thus we have contacted approx. 300 authors during the latest months, and we have already received a lot of information to be published in the future issues of SCIENTIFUR. It is of course our hope that some of the authors have gained such an interest in IFASA and SCIENTIFUR that we may in future count on them as members and subscribers!

We of course hope that as a result, colleagues all over the world will automatically send us reprints of reports published elsewhere so that we may bring an abstract in SCIENTIFUR as soon as possible after publication.

IMPORTANT SCIENTIFIC NEWS CANNOT BE TOO FRESH. Remember that and send us your reprint as soon as you have it in hand. Thank you in advance!

We are sorry that we have found it necessary to delay publication of some of the original reports received. These will be published in the next issue of SCIENTIFUR, as we feel there must be a certain balance between original reports and abstracts in each issue. Perhaps the original reports weigh a little heavily in this issue with no less than 8 original reports, but as they are all good and interesting reading we are sure that all the information will be welcome.

Again this year some of our subscribers will only receive a copy of our invoice at the time when we send out SCIENTIFUR No. 2. This is of course because they have not been as kind as you to pay the amount in due time before the 30 + an extra 30 days have gone by. We want to thank all of you who have this year paid promptly as this means less work for us.

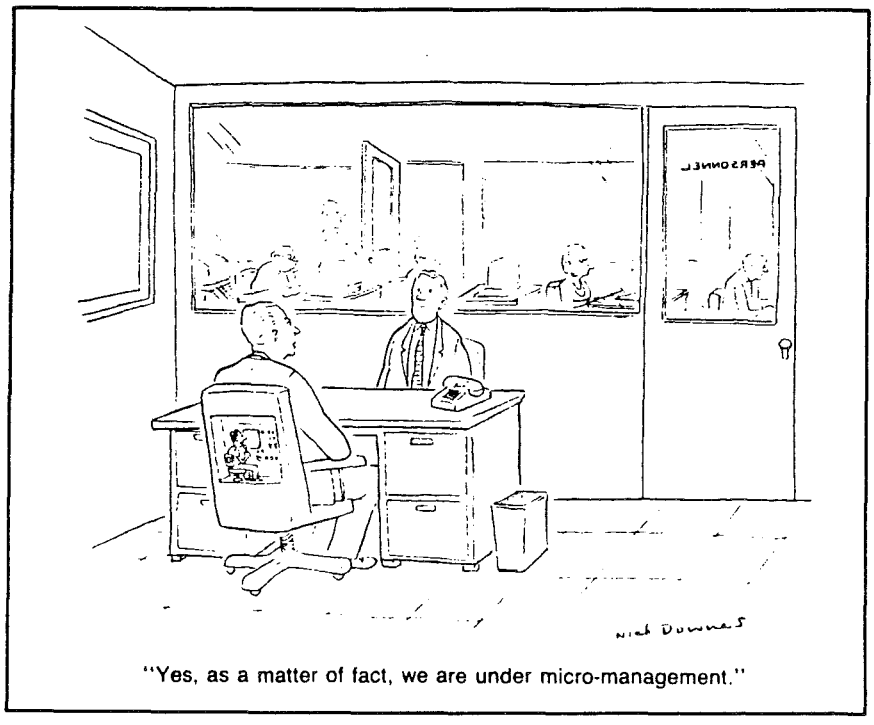
We hope that already in the autumn you received the first announcement of the 6th International Scientific Congress in Fur Animal Production in Poland in 1996. If not, you will find it in SCIENTIFUR No. 3 or No. 4 of this year.

It is our sincere hope that skin prices will be at such a level that the congress will be attended by a large number of scientists from the east as well as from the west, south and north.

Finally we wish all of you a good season - summer and growth in the northern hemisphere and winter, skin preparation, and breeding work in the southern hemisphere.

Your summer loving editor

Gunnar Jørgensen



"Yes, as a matter of fact, we are under micro-management."

JUST TODAY SCIENTIFURS ORDINARY PRINTER DID NOT WORK: THEREFORE THE LAY OUT IS NOT LIVING UP TO THE NORMAL STANDARD OF DORTHE.

Original Report

Changes in behavioural traits of the silver fox *(Vulpes vulpes)* under domestication and specific genotype-environment interactions

L.L. Vasilyeva

Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences, Novosibirsk

Summary

Significant differences were found between foxes with high and low values of domestication levels for traits such as contactability, critical distance and other traits, tested by the open field method, which included the number of crossed squares, defecations, rearings, vocalization and latency. Contact with humans during early development (handling) and/or subsequent taming produced an increase in the values of these traits characterizing domestic behaviour. Early exposure to handling had a stronger effect on the behaviour of females than males irrespective of their domestication level. In contrast, foxes with a higher domestication level were more responsive to handling than the less tame foxes. In general, the effects of human contacts during early and later development were unidirectional.

Introduction

Many researchers have attempted to determine the behavioural traits decisive in evolutionary transformation of animals, notably at the early steps of domestication (*King, 1967; Galef, 1970*).

Comparative analysis of the behaviour of contemporary domestic animals and their wild ancestors have revealed a wide range of behavioural changes (*Powell, 1971; Boice, 1972; Price, 1972; Hemmer, 1979*) and, also, the important role of environmental factors, such as maternal effect (*Galef, 1970; Price, Loomice, 1973*), postnatal taming (*Price, 1969, 1972; Powell, 1971; Smith, 1972; Hughes, 1975*) and handling (*Galef, 1970; Hughes, 1975*) in the domestication process. However, as Connor noted in 1975, animals that have undergone domestication can provide only insignificant information about the nature of genetic changes occurring in the course of the process.

In fact, almost all studies of genetic changes and behavioural traits of domestic animals have been based only on comparisons of differences between contemporary domestic animals and their wild counterparts or between laboratory and wild rodents, i.e., those that have diverged in evolution a long time ago. This makes the validity of such comparisons an open issue.

A search for behavioural traits which have undergone changes in the course of domestication, is of import-

ance not only for general theory and for broadening our concepts of selection as a factor of evolution. It is also of importance for practical work; successful introduction of wild animals in new conditions of captivity, such as reservations and zoos. The problem is timely, because today humans, interfering with natural ecological systems, disrupt niches of many species. A search for such traits has been performed in the course of the experimental domestication of silver foxes (*Vulpes vulpes*) (*Belyaev, 1962, 1970, 1980, 1985; Belyaev et al., 1985; Krushinski et al., 1975; Trut, 1978, 1987; Plyusnina et al., 1988*).

The domestication process was modeled through a systematic selection of foxes for tameness, i.e., for attenuated emotional-negative aggressive-fearful characteristics of wild animals and enhanced emotionally-positive responses to humans (*Trut, 1978*).

This paper presents not only a search for behavioural traits under selection in the course of domestication, but also an attempt to study changes in the behaviour of foxes at different levels of domestication depending on the time of exposure to humans during development.

Material and methods

This study was performed at the experimental fur farm of this institute. The groups of foxes consisted of adults and yearlings of a population undergoing domestication for 30 years. Each group was composed of two subgroups differing in DI, domestication indices (*Vasilyeva, Trut, 1990*): the high scores were for the first and the low were for the second subgroups (Fig. 1).

Group 1 (55 females, 42 males) were adults and parents of the next groups. Contact with humans was limited to management like in a commercial population. Group 2 (37 females, 36 males) were intact yearlings and were controls for the following three groups. Contact with humans was also limited to management. Group 3 (29 females, 36 males) were handled daily for 3 min. from the age of 3 days for 20 days. Group 4 (39 females, 41 males) were tamed yearlings. Starting from weaning and individual caging (from the age of 60 days), contact with humans was established (stroking of the body, play) daily for 3 min. for 2 months. Group 5 (31 females, 32 males) were handled and tamed like groups 3 and 4.

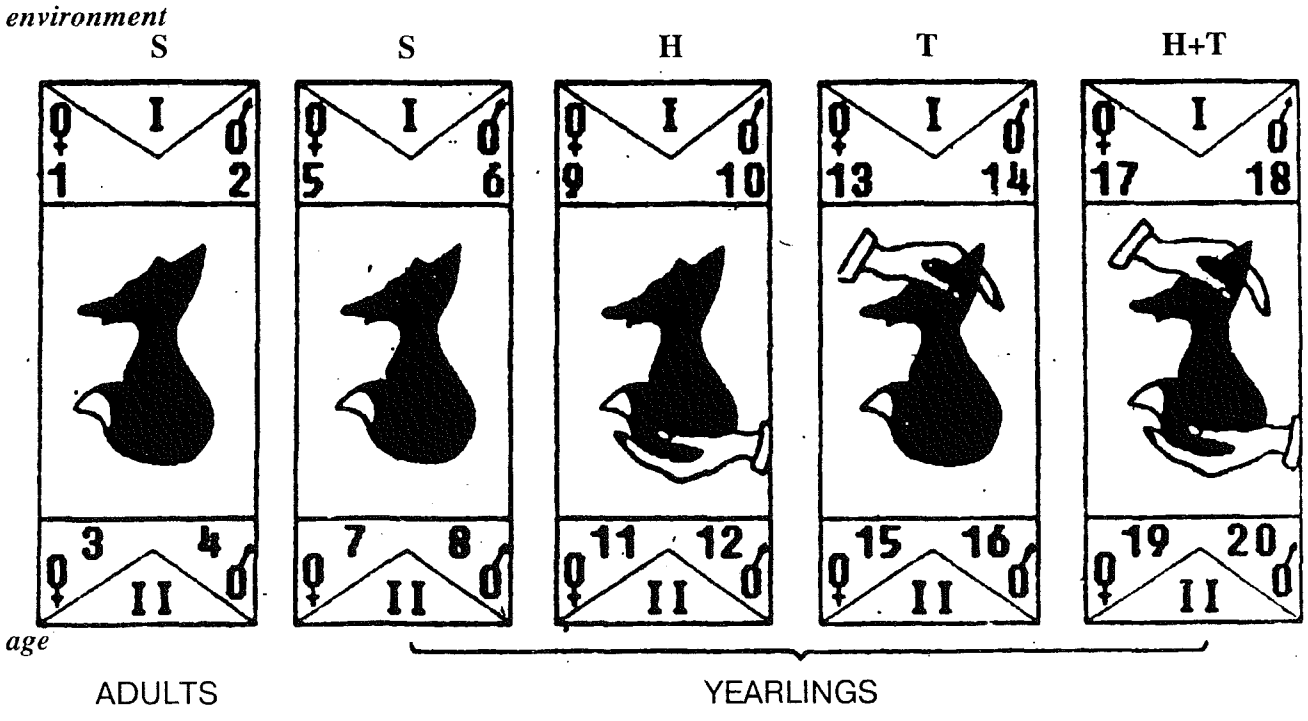


Fig. 1. The experimental groups. Designations: S - standard; H - handled; T - tamed. Subgroups: I - foxes with high DI value; II - foxes with low DI value. 1-20 - group numbers

Analyzed behavioural traits

1. Adults and yearlings, aged 4 months, were subjected to the open field test (*Hall, 1934*) in a 4 x 9 m enclosure for 10 min. (Fig. 2). The recorded behavioural traits were number of: a) crossed squares (0.8 m x 0.8 m); b) rearings; c) vocalizations; d) urinations; e) defecations and f) latent period, i.e., the time from placement of the fox into the enclosure to beginning of locomotion. The former two traits reflect orientation-exploratory activity and the latter four emotional responsiveness (*Denenberg, 1966*).

After testing foxes in the open field, the handler entered the enclosure and stepped on a special square in it. The state of contact was estimated during the first minute and the critical distance during the second minute.

2. Critical distance (CD). The notion of CD has been widely discussed in literature concerned with domestication as a possible index of domestication level (*Hediger, 1964; Hemmer, 1979; Price, 1984; Kaleta, Lewandowska, 1987*). The CD means the fixes distance from a domesticated animal to man not eliciting its avoidance response, with decrease in the distance eliciting the responce. Estimation of the CD was performed in an enclosure (4 m x 4 m) subdivided into 0.8 m squares (Fig. 2).

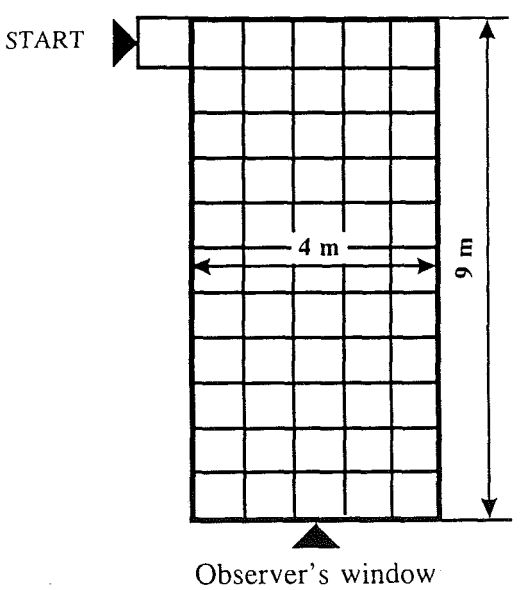


Fig. 2. "The open field"

The CD estimates were based on an 11-score scale. The CD estimates included distance not only in physical, but also in psychologial terms, as tolerance to touching of different parts of the body. Scores: 1, the fox allows approach at a distance of not less than 1.5 m without showing a passive-defensive response; 2, the same, at at distance of not less than 1 m; 3, the CD is 0.7 m; 4, it is 0.5 m; 5, it is 0.4 m m; 6, it is 0 m, the fox avoids tactile contact with humans; 7, the same, the fox allows brief contact; 8, the fox allows one to touch its head for a long time; 9, the same, allows stroking of the chest and back; 10, allows stroking of its abdominal area; 11 scores, the same, the fox actively exposes its anogenital areas. The smaller the CD, the higher the domestication level is and, accordingly, the higher is its score.

3. The contactability trait (C) has not, to our knowledge, been clearly defined in literature concerned with domestic behaviour. The C and the CD were often treated as the same notion (*Price, 1984*). In the present context, contactability means the level of motivation to establish social contact with humans. Contactability estimates were based on the minimal distance to which the fox approaches humnas. Contacability estimates were based on the minimal distance to which the fox approaches humans. Contactability estimates were based on the minimal distance to which the fox approaches the humans in the enclosure (4 m x 9 m enclosure, Fig. 2), its response to touching of its body parts. Teh scale score: 1, the fox does not approach humans, the distance between it and an is 10 field units. Each field unit was taken as 0.8 m; 2, 9 field units; 3, 8 field units; 4, 7 field units; 5, 6 field units; 6, 5 field units; 7, 4 field units; 8, 3 field units; 9, 2 field units, 10, 1 field unit, 11, 0 m, th fox avoids tactile contact with humans; 12, the fox allows humans to make brief tactile contact; 13, the fox allows one to touch its head for a long time but avoids touching of its other body parts; 14, the same, allows touching of its breast and back; 15, the same, allows touching of the abdominal area; 16, the same, actively exposes the anogenital area.

Results and discussion

Comparative analysis of the tested groups with high (1 index) and low values (11 indices) for domestication demonstrated (Table 1) that, regardles of previous ex-

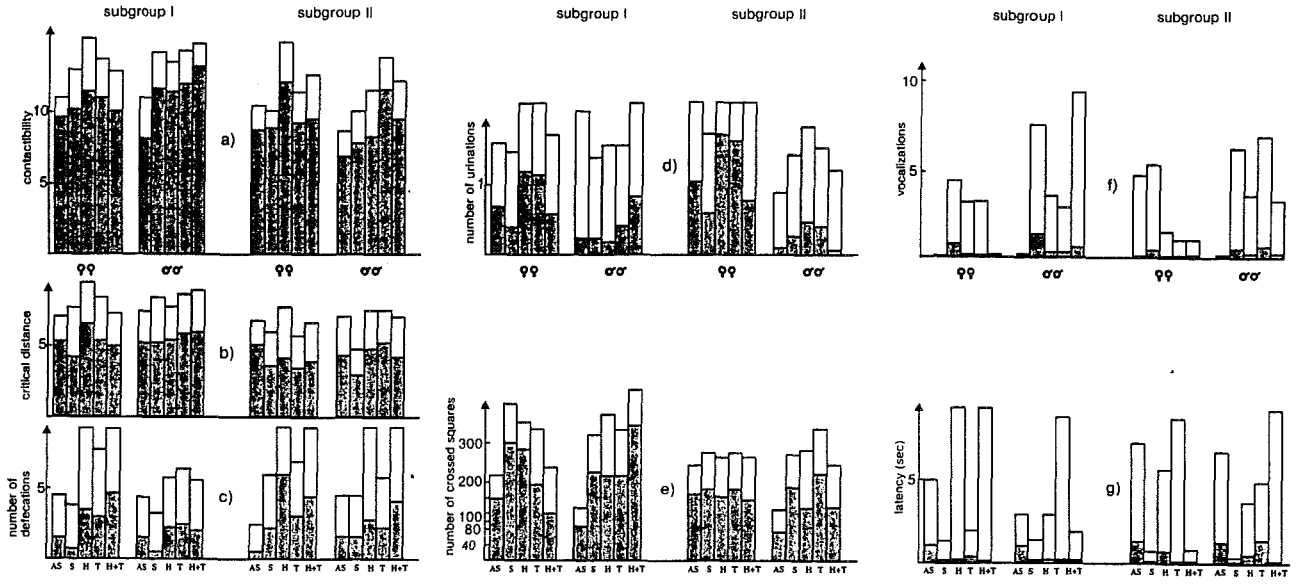


Fig. 4. Values of analyzed traits in relation to environment and domestication level (open parts of bars represent 95% confidence intervals). Designations: AS - adults, standard environment; yearling: S - standard environment (control); H - handled; H+T - handled and tamed; Subgroups: I - foxes with high DI values, II - foxes with low DI values.

Table 2. Values of domestication indices in relation to age, handling and/or taming effects

Groups of foxes	Domestication index, DI	
	males	females
Yearlings	0.40 ± 0.04 (42)	0.52 ± 0.03 (54)
Adults	0.49 ± 0.04 (34)	0.83 ± 0.04 (35)
Handling	0.85 ± 0.05 (33)	1.28 ± 0.05 (28)
Taming	1.02 ± 0.04 (32)	1.34 ± 0.04 (32)
Handling + Taming	1.38 ± 0.04 (37)	1.40 ± 0.04 (38)

Note: in parentheses are number of foxes

Adult males, regardless of their domestication indices, i.e., assignment to subgroup 1 or 11, showed smaller C values and domestication indices compared to counterpart groups of yearlings. Furthermore, defecation number in adults was somewhat larger than in similar groups of pups. This, possibly, reflects higher stress responsiveness to new stimuli of adults. The less advanced females, in terms of domestication, were exceptional (subgroup 11); defecation number significantly decerased with age, reflecting a decrease in their emotional or stress-responsiveness. It is noteworthy that locomotion in yearlings was significantly higher than in the comparable groups of adults. Recorded locomotion includes, in all probability a component of exploratory

activity. Exceptional are females of subgroup 11 not showing such obvious differences.

It should be noted that expression of traits, such as vocalization and latency, considerably depends neither on specific genotype-environment interactions (handling and/or taming), nor on sex.

References

Belyaev, D.K. 1962. Problems of correlated variability and their importance for evolutionary theory and animal selection. Izv. SO AN SSSR, No. 10, pp. 111-124 (in Russian).

Belyaev, D.K. 1970. Biological aspects of domestication of animals. Proc. the All-Union Conf. on Genetics & Breeding of Agricultural Animals. Alma-Ata, pp. 30-44 (in Russian).

Belyaev, D.K. 1980. Destabilizing selection as a factor of domestication, well-being of mankind and genetics. Proc. of the XIV Inter. Cong. of Genetics, vol. 1, pp. 64-80.

Belyaev, D.K. 1985. Destabilizing selection. Indian J. Genet, Vol. 45, No. 3, pp. 432-446.

Belyaev, D.K., Plyusnina, I.Z., Trut, L.N. 1985. Domestication in the silver fox (*Vulpes fulpes* Desm.). Changes in physiologial boundaries of the sensitive period of primary socialization. Appl. Anim. behav. Sci., Vol. 13, pp. 359-370.

Boice, R. 1972. Some behavioral tests of domestication in Norway rats. Behaviour, Vol. 42, pp. 198-231.

Connor, J. 1975. Genetic mechanisms controlling the domestication of a wild mouse population (*Mus musculus L.*). J. comp. Physiol. Psychol., Vol. 89, No. 2, pp. 118-130.

Denenberg, V.N. 1966. Open field behaviour in the rats. Symp. zool. Sco. London, No. 1, pp. 45-59.

Dobzhansky, Th. 1970. The genetics of the evolution ary process. N.Y., Columbia Univ. Press, p. 505.

Eysenck, H.J., Broadhurst, P.L. 1964. Experiments with animals. Introduction. Experiments in motivation. Ed.: H.J. Eysenchk. N.Y: Macmillan, pp. 285-291.

Falconer, D.S. 1981. Introduction to quantitative genetics. London: Longman, p. 365.

Galef, B.G. 1970. Aggression and timidity responses to novelty in feral Norway rats. J. Comp. Physiol. Psychol. Vol. 70, pp. 370-381.

Hall, C.S. 1934. Emotional behaviour in the rat. I. Defecation and urination as measure of individual differences in emotionality. J. Compeer. Psychol., Vol. 18, pp. 385-403.

Hediger, H. 1964. The physiology and behaviour of animals in Zoos and Circuses. N.Y.: Dover.

Hemmer, H. 1979. A simple and very promising way to new mammal domestication. Folia zool., vol. 28, No. 2, pp. 115-118.

Hughes, C.W. Jr. 1975. Early experience in domestica tion. J. Comp. Physiol. Physchol., Vol. 88, pp. 407-417.

Kaleta, T., Levandowska, A. 1987. The escape distance in farm silver foxes with regard to cronism problem. Scientifur, Vol. 11, No. 3, pp. 188-189.

King, J.A. 1967. Behavioural modification of the gene pool. Behavioral genetic analyses. Ed. J. Hirsch, pp. 22-43.

Krushinsky, L.V., Astaurova, N.B., Kusnetsova, L.M., Ochinskaya, E.I., Poletaeva, I.I., Romanova, L.G., Sotskaya, N.N. 1975. The role of genetic factors in determining the ability for extrapolation in animals. Current problems of behaviour genetics. Nauka, Leningrad, pp. 98-110 (in Russian).

Plyusnina, I.Z., Oskina, I.N., Onopchenko, L.G. and Lutsenko, N.D. 1988. Participation of fear reaction in the limitation of the period of primary socialization in silver foxes. Zhurnal vyshel nervnoy deyatelnosti imeni I.P. Pavlova, Vol. 38, No. 5, pp. 945-951 (in Russian).

Powell, R.W. 1971. Free-operant avoidance in field-raised and laboratory-raised rats. J. Comp. Physiol. Psychol., Vol. 75, pp. 216-225.

Price, E. 1969. The effect of early outdoor experience on the activity of wild and semi-domestic deermice. Develop. Psychobiol. No. 2, pp. 60-67.

Price, E.O. 1972. Domestication and early experience effects on escape conditioning in the Norway rats. J. Comp. Physiol. Psychol., Vol. 79, pp. 51-55.

Price, E.O. 1984. Behavioral aspects of animal dome stication. Quart. Rev. Biol., Vol. 59, No. 1, pp. 1-32.

Price, E.O., Loomis, S. 1973. Maternal influence on response of wild and domestic Norway rats to a novel environment. Develop. Psycholbiol., No. 6, pp. 203-208.

Schmalhausen, I.I. 1968. Factors of Evolution. Moscow-Leningrad, pp. 450 (in Russian).

Smith, R.H. 1972. Wildness and domestication in Mus musculus. A behavioural analysis. J. Comp. Physiol. Psychol., Vol. 79, pp. 22-29.

Trut, N. 1978. An essay on the genetics of behaviour. Nauka, Novosibirsk (in Russian).

Trut, L.N. 1987. The problems of new forms and the integrity of the organism in the context of destabilizing selection. Genetika, Vol. 23, No. 6, pp. 974-987 (in Russian).

Vasilyeva, L.L. 1991. Determination of fertility of silver fox males by certain environmental and genetic factors. The physiological basis of increasing productivity of fur animals: Inter. Symp. Physiol. bases for increasing the productivity of predatory fur animals. Petrozavodsk, pp. 80.

Vasilyeva, L.L., Trut, L.N. 1990. The use of the method of principal components for phenogenetic analysis of the integral domestication trait. Genetika, Vol. 26, No. 3, pp. 516-524 (in Russian).

Original Report

The effect of melatonin on advancing the priming of winter fur coat in blue foxes

S.J. Jarosz, O. Szeleszczuk

University of Agriculture in Krakow, Dept. of Fur Animal Breeding, 30-059 Krakow, Al. Michiewica 24/28, Poland

Summary

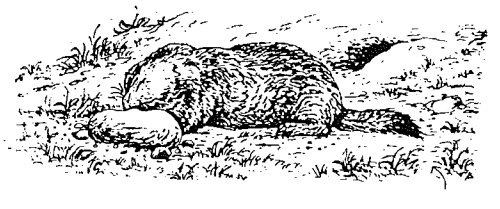
Based on the performed experiments it can be stated that a subcutaneously implanted and slowly released melatonin stimulated animals' appetite in their initial growth period which resulted in faster body weight gains. That period was followed by an inhibition of their growth in the autumn period making body weights of melatonin-receiving animals in the preslaughter autumn period similar to those of control (without melatonin) foxes.

Melatonin-implanted animals in mid-July (13 July) resulted in speeding up maturation of winter fur by 4-5 weeks, and that given in late July (27 July) by hardly 3 weeks compared to control animals.

In animals with melatonin implants a considerably faster growth and maturation of guard hairs was found which resulted in their advantage over underfur hairs. Thus it can be supposed that by inhibiting the growth of guard hairs in melatonin-treated blue foxes synchronization of their maturity with that of underfur hairs could be achieved providing low-protein diet to foxes in the initial period of their winter growth.

Introduction

In blue foxes a seasonal moult of fur coat occurs twice a year, in spring months when the winter fur is changed to the summer one, and in autumn months when the summer fur is changed to the winter one. Studies carried out on mink by Rust and Meyer (1969), Rose et al. (1984), Rougeot et al. (1984) and Fukunaga et al. (1992) as well as on foxes (*Smith et al., 1987*) have shown that the main factor influencing the process of renewal of fur coat in the mentioned species of fur animals is a neurohormone melatonin. Its level in the blood serum and its activity are strictly connected with photoperiodism. The hormone is mostly synthesized in the pineal gland under the influence of light stimuli absorbed by the eye retina and next transferred to the pineal gland through the nuclei in the anterior part of the hypothalamus over the optic chiasm, paraventricular nuclei and and superior cervical ganglia (*Valtonen, 1992*). Melatonin implants (slowly released) given subcutaneously to mink during a period of summer fur coat stabilization according to Allain and Rougeot (1980), Rose et al. (1984) accelerate growth and priming of the winter coat by about 4-6 weeks. Investigations concerning the effect of melatonin on advancing



the priming of fur coat in foxes are rather scare. This problem is of great economic significance since a reduced period of rearing because of earlier slaughter results in a considerable reduction of feeding and servicing costs on a fox farm.

In this study attempts were made to accelerate the growth and priming of the fur in blue foxes and to define the effects on the fur quality using melatonin implants given at two different periods and at various ages of the foxes.

Materials and methods

The experiment was conducted on a total of 90 young blue foxes of either sex, assigned to 3 genetically similar groups, including 2 experimental groups and 1 control (30 animals in each).

To the foxes of groups I and II, 12 mg of slowly releasing melatonin implants were given subcutaneously in the interscapular region of each animal (*Wildlife Pharmaceuticals lab., USA*) at two fixed dates: in group I - on 13 July 1993 (at 8-9 weeks of age) in group II - on 27 July 1993 (at 10-11 weeks of age), group III being control (without melatonin).

All animals were under the same management system (two-rowed sheds) and fed according to the norms recommended in a given breeding period. Since the start of melatonin administration its level in the blood serum was checked at monthly periods as well as body weight gains, growth and priming of winter fur.

In early October all animals were subjected to evaluation for size, colour type, clarity of colour, density, length, resilience, silkiness of hair and general appearance. After slaughter, from the skins of 6 animals of either sex in each group, sections were taken from 5 topographic sites (neck, back, rump, side, belly) for detailed evaluation of the length and thickness of guard and underfur hairs as well as their density per 1 cm^2 of the skin.

Results and discussion

Melatonin levels in the blood sera of experimental and control animals from July to November are presented in table 1. In animals of groups I and II which received melatonin implants on 13 and 27 July a considerable increase in melatonin level was found in the blood serum as early as one day after its administration (group I - to 258.83 pg/ml, group II - to 302.74 pg/ml) compared to control (87.82 pg/ml). In the next months (August - September) melatonin levels were found to decrease in the experimental animals to 144 pg/ml in group I and to 112 pg/ml in group II, being still much higher than in the control (84.43 pg/ml). In October and November melatonin levels in the experimental groups decreased (96.22 and 85.50 pg/ml) to the levels found in the control animals - 96.42 pg/ml. The rate of releasing implanted melatonin was faster in the initial period (by over 50%) than reported by the producer (*Wildlife Pharmaceuticals Lab., 1992*) according to whom 40% of the implanted melatonin should be released during 60 days and the rest during 200-300 days.

Table 1 Level of melatonin in blood serum of blue foxes (pg/ml)

Date of blood sampling	Group I (Melatonin)	Group II (Melatonin	Group III (Control)
14 July 1993	258.83	-	87.82
28 July 1993	-	302.74	-
27 Aug. 1993	146.17	161.10	86.17
4 Oct. 1993	144.27	112.30	84.43
21 Oct. 1993	96.22	-	-
3 Nov. 1993	-	85.50	-

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 11-12 weeks of age

Table 2 The dates of fur priming after implants of melatonin

Group	Date of melatonin implant and animal age	Date and animal age at of winter fur priming	Differences in winter fur priming compared to control
I (melatonin)	13 July 1993 8-9 weeks	21 Oct. 1993 22-23 weeks	2-5 weeks earlier
II (melatonin)	27 July 1993 10-11 weeks	3 Nov. 1993 24-25 weeks	3-4 weeks earlier
III (control)		22 nov. 1993 28-29 weeks	

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 10-11 weeks of age

Foxes with implanted melatonin displayed in the initial growth period a better appetite and faster weight gains and, during the autumn period, a much earlier priming of winter fur.

Foxes with implanted melatonin on 13 July attained a fully mature winter fur coat in October, which is about 4-5 weeks earlier than control animals, while those which received melatonin on 27 July - about 3-4 weeks earlier (at the beginning of November) than the control (table 2). These results concerning the effect of melatonin on acceleration of the winter fur priming in foxes were similar to those obtained by Smith et al. (1987) and in mink by Allain et al. (1980), Rose et al. (1984), Fukinaga et al. (1992) and Valtonen et al. (1992).

Evaluation of fox conformation (in early October) including length and body weight, colour type, clarity of colour, density of fur and jointly; length resilience and silkiness of hair as well as general appearance (based on a 30-point scale) did not show any significant differences between experimental and control animals (table 3). The lengths and body weights of experimental and control animals were similar (61.97 - 62.43 cm and 62.13 cm as well as 5.27 - 5.87 and 5.82 kg, respectively). It should be mentioned that the final body weight at skinning was slightly lower in the foxes with implanted melatonin (group I - 6.21 kg, group II - 6.41 kg) than in the control (7.10 kg). The difference may have resulted from a considerably later date of slaughter of the control animals and their faster growth of a subcutaneous layer of adipose tissue. The colour type, colour clarity, density of fur coat, length, resilience and silkiness of hair as well as the general apparance of the animal were in total slightly lower in group I (27.67 than in group II (28.37) and control group (28.00).

The results of a detailed laboratory analysis of the fur coat including length, thickness and density of guard and underfur hairs in 5 topographic sites of the skin (neck, back, rump, side, belly) are presented in table 4, 5 and 6.

The lengths of guard hairs calculated for all studied topographic sites of the skin were on average: group I - 48.56 mm, group II - 54.19 mm, control group - 47.60 mm. These lengths of guard hairs of melatonin-implanted animals displayed significant and highly significant differences compared to control foxes (table 4) which indicates an earlier and considerably faster growth of guard hairs than that of underfur. As a result the lengths of underfur hairs in the studied pelts of group I animals (28.65 mm) and group II (28.97 mm) were significantly lower than in the control group (29.48 mm) (table 4).

Asynchrony in the growth of guard and underfur hairs in the melatonin-treated animals is a negative phenomenon. Thus, it can be supposed that in the case of applying melatonin in blue foxes it might be possible in farm practice to inhibit the growth of guard hairs by feeding them a low-protein diet in that period as is recommended in silver fox feeding.

Table 3 Estimation of foxes conformation (based on a 30-point scale)

Traits	Group I (melatonin)	Group II (melatonin)	Group III (control)
Body length (cm)	61.97 + 2.14	62.43 + 2.10	62.13 + 1.87
Body weight (kg)	5.27 + 1.44	5.87 + 0.51	5.82 + 0.58
Colour type	3.0	3.0	3.0
Colour clarity	5.67 + 0.76	5.80 + 0.61	5.30 + 0.97
Fur density	5.63 + 0.62	5.83 + 0.49	5.70 + 0.47
Length, resilience, silkiness	5.17 + 0.70	5.10 + 0.71	5.30 + 0.56
General appearance	2.94 + 0.23	2.97 + 0.23	2.91 + 0.42
Total scores	27.67 + 1.77	28.37 + 1.07	28.00 + 1.13

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 10-11 weeks of age

Table 4 Length of guard hairs (mm) and underfur hairs

Collection site	Group I (melatonin)		Group II (melatonin)		Group III (control)	
	Guard hair	Underfur	Guard hair	Underfur	Guard hair	Underfur
Neck	50.43	20.48	56.72	30.02	50.72	29.95
Back	45.72	28.65	50.92	29.28	46.30	29.70
Rump	46.55	28.55	51.90	27.95	43.58	29.97
Side	53.37	31.98	62.17	31.35	51.35	32.08
Belly	46.80	25.60	49.25	26.28	46.03	25.72
Mean	48.56**	28.05**	54.19***	28.97**	47.60	29.48

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 10-11 weeks of age
Means with ** and *** were significantly and highly significantly different from values of the control group

Table 5 Thickness of guard hairs (μ) and of underfur hairs (μ)

Collection site	Group I (melatonin)		Group II (melatonin)		Group III (control)	
	Guard	Underfur	Guard	Underfur	Guard	Underfur
Neck	81.45	17.24	77.67	17.20	85.83	14.72
Back	75.33	17.68	74.83	17.20	86.00	15.72
Rump	75.70	17.44	72.33	17.84	90.33	15.96
Side	74.33	15.36	64.66	18.04	88.50	16.84
Belly	73.33	15.52	66.83	16.48	80.67	14.92
Mean	75.03**	16.65	71.26**	17.35	86.27	15.59

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 11-12 weeks of age
Means with ** were significantly and highly significantly different from values of the control group

The thickness of guard hairs in pelts of group I animals (75.03 microns) and group II (71.26 microns) was significantly lower than that in control animals (86.27 microns) (table 5). However, the thickness of underfur hairs was only slightly greater in group I (16.65 microns) and group II (17.35 microns) than in the control group (15.59 microns) (table 5), the difference not being statistically significant.

Density of guard hairs per 1 cm^2 as an average value for all topographic sites of the skin was in group I - 131, in group II - 141 and in the control group 140 hairs. Despite lower values in group I animals, no significant difference was found in relation to the control (table 6). Likewise, density of underfur hairs, on an average lower in skins of group I animals (15,316/cm^2) than in group II (17,085/cm^2) and control group (17,164/cm^2), did not display significant differences in relation to the control (table 6).

The average values for guard and underfur hair distribution in the skins of the experimental animals and particularly, in group I, are the results of a considerably lesser distribution of hairs in the back parts of animal skin.

Table 6 Guard hair and underfur hair distribution (per cm^2)

Collection site	Group I (melatonin)		Group II (melatonin)		Group III (control)	
	Guard	Underfur	Guard	Underfur	Guard	Underfur
Neck	203	22084	205	23970	187	24099
Back	126	17496	150	21915	137	21112
Rump	124	19702	130#	17111	162#	22147
Side	99	14498	113	9429	121	10789
Belly	105	5799	106	8000	96	7673
Mean	131	15316	106	16085	140	17164

Group I - melatonin implanted on 13 July 1993 at 8-9 weeks of age
Group II - melatonin implanted on 27 July 1993 at 11-12 weeks of age

Material

The first dataset was from a series of investigations on restricted feeding of mink in the growth period. These were performed at the Research Farm Nord in Denmark in 1991 and 1992. A full description of the trials and a listing of the data used here can be found in Hillemann (1992 and 1993). In a group of approximately 50 animals, average feed consumption was registered. Eight other groups were then restricted in relation to this control group. Restrictions amounted to 6% and 12% and were initiated at different dates. Each year the experiment was conducted on three colour types: standard, wild, and pastel, yielding a total of 54 groups.

The data used here is the data given in Hillemann (1992 and 1993), namely average feed consumption per animal (average of males and females), average weight gain of males and females (from July 11 to November 8) and average skin length for males.

The second dataset originated from Favrholm in 1984. The data is described in full detail in Berg & Lohi (1992). Average feed consumption was registered in paternal progeny groups with an average size of 8 (range 6 to 10). The animals originated from 16 different populations. The data used here is the average feed consumption (both males and females), average weight gain of males and females (from July 7 to pelting, early December), and average skin length of males and females. A total of 94 paternal progeny groups were included.

Methods

The regression of skin length and weight gain on feed consumption was estimated by the following model:

$$Y_{ijk} = \mu + C_i + T_j + b\,X_{ijk} + e_{ijk} \qquad [1]$$

where Y is feed consumption, C is colour type (i = standard, pastel, wild mink), T is year (j = 1991, 1992), b is the regression of X on feed consumption, X is average weight gain or skin length in group k (k = 1,..,54), and e is the residual, assumed to be identically and independently distributed with zero expectation and variance σ^2.

The residual correlations between feed consumption, weight gain, and skin length in the groups were estimated from:

$$Y_{ijk} = \mu + C_i + T_j + e_{ijk} \qquad [2]$$

where Y is a vector of traits in group k of colour type i and from year j. The residual vector e is assumed to be normally distributed N(0,R), where R is a symmetric (co)variance matrix of dimension 5 (weight gain in males and females, average weight gain, skin length and feed consumption).

In analysing the association between feed consumption and skin length and weight gain in paternal progeny groups, models [1] and [2] were modified as follows :

$$Y_{ij} = \mu + P_i + b\,X_{ij} + e_{ij} \qquad [3]$$

$$Y_{ij} = \mu + P_i + e_{ij} \qquad [4]$$

where P is the population of origin (i = 1,..,16) and Y is average feed consumption and X average weight gain or skin length of a paternal progeny group of size n_j (j = 1,..,94). The residuals e are assumed to be $N(0,\sigma^2/n_j)$.

Results

In Table 1 the average of the observed traits is presented. Feed effciency was calculated as the ratio of weight gain to feed consumption and length efficiency as the ratio of skin length to feed consumption.

A significant effect of colour type and year was found in model 1. As shown in Table 1, standard had the highest feed consumption and pastel the lowest, with wild mink intermediate. Pastel had the highest feed efficiency. Furthermore, the interactions between colour type and year and between these and the partial regression of weight gain or skin length on feed consumption were considered.

None of these interactions were found to be significant. Furthermore, a significant effect of population of origin was found in model 3, with a difference between populations of up to 70 g in average daily feed consumption (Berg & Lohi 1992).

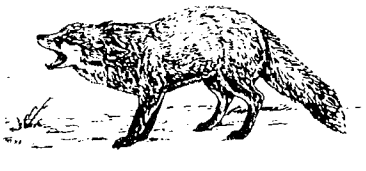
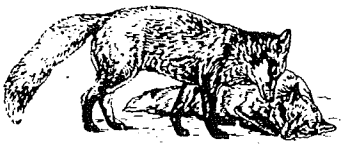


Table 1 Average and standard deviation of feed consumption, weight gain, skin length, feed efficiency (weight gain / feed consumption) and length efficiency (skin length / feed consumption) in Standard, Wild mink and Pastel at Nord (average of three years) and Standard from Favrholm.

Trait	Standard	Wild mink	Pastel	Favrholm
Weight gain (males), g	1078.2 ± 59.7	1025.4± 70.5	1085.2 ± 47.2	1128.8± 152.1
Weight gain (females), g	440.0 ± 27.0	405.6 ± 28.6	433.3 ± 22.9	476.2 ± 70.7
Weight gain (average), g	759.1 ± 39.6	715.5 ± 44.0	759.3 ± 32.5	801.1 ± 93.7
Skin length, cm	73.9 ± 0.99	73.8 ± 0.80	76.0 ± 0.79	67.3 ± 1.90
Feed consumption, kg	20.4 ± 0.5	19.5 ± 0.5	19.3 ± 0.5	25.1 ± 3.5
Feed efficiency g/kg	37.3 ± 1.22	36.7 ± 1.67	39.4 ± 1.01	32.0 ± 3.80
Length efficiency, cm/kg	3.63 ± 0.09	3.79 ± 0.08	3.95 ± 0.08	2.70 ± 0.20

Table 2 presents the partial regression of weight gain and skin length on feed consumption. These regressions represent the marginal efficiency, the increase in skin length by an increase in feed consumption, relative to Table 1 which presents the average efficiency, the skin length relative to the total feed consumption.

The cost in feed of producing one g of weight gain or one cm of skin length was higher on Nord. Furthermore, the cost of producing one gram of average weight gain was, surprisingly, higher than the cost of producing one g of male or female weight gain. However, feed consumption is the average of both sexes, so the regressions on one of the sexes are biased. Furthermore, the marginal efficiency on farm Nord, indicated by the Figures in Table 2, is slightly lower than the average efficiency shown in Table 1, whereas the marginal efficiency is considerably higher than the average efficiency on Favrholm. The association between feed consumption and weight gain and between feed consumption and skin length on farm Nord is shown in Figures 1 and 2. The measures have been corrected for the effect of colour type and year to the overall mean in the two years (see Table 1). Thus the regressions shown in Figures 1 and 2 are the partial regressions presented in Table 2.



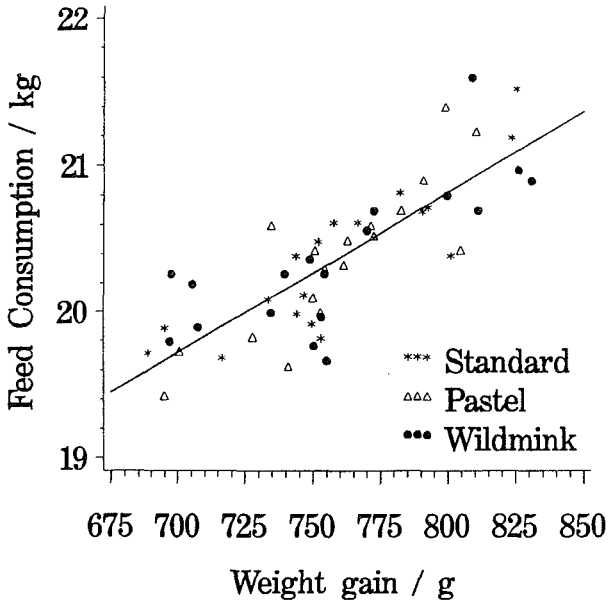


Figure 1. Feed consumption and weight gain at Nord. Observations have been corrected for the effect of colour type and year (Model 2) to the level of Standard (Table 1). The regression is the partial regression presented in Table 2.

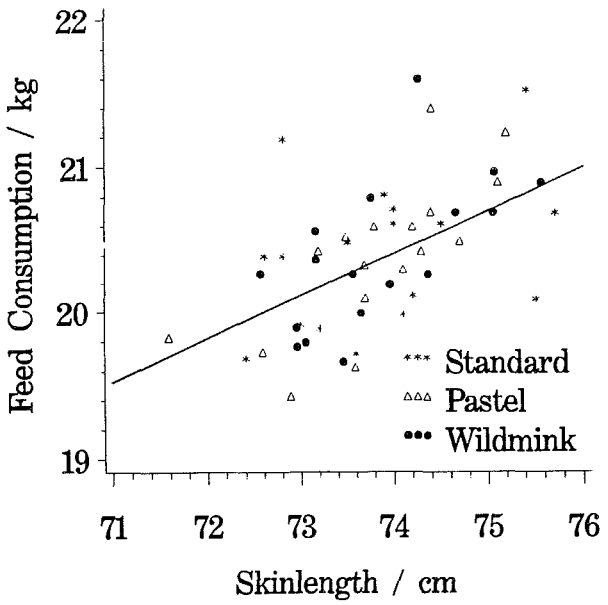


Figure 2. Feed consumption and skin length at Nord. Observations have been corrected for the effect of colour type and year (Model 2) to the level of Standard (Table 1). The regression is the partial regression presented in Table 2.

Table 2 Partial regression coefficients of weight gain and skin length on feed consumption. Estimates are the marginal changes in feed consumption (g) with one unit change in weight gain or skin length (g/g or g/cm).

Trait		Data from NORD	Data from Favrholm
Weight gain (males)	g	7.39 ± 0.68	2.18 ± 0.94
Weight gain (females)	g	9.89 ± 2.46	3.29 ± 2.05
Weight gain (average)	g	10.94 ± 1.12	4.51 ± 1.50
Skin length	cm	294.2 ± 68.6	218.0 ± 74.9

In Table 3 the residual correlations are presented from models 2 and 4.

The correlations are systematically higher at Nord. Especially the correlations between weight gain and feed consumption are higher at Nord.

At Nord the groups have been systematically differentiated under a restricted feeding regime.

At Favrholm approximate ad libitum feeding was practised. This is confirmed by the higher feed consumption and lower feed efficiency at Favrholm relative to Nord as shown in Table 1. The lower correlations at Favrholm are partly due to a few progeny groups with a low feed consumption.

With these 3 groups excluded, the correlations in the bottom row of Table 3 would be 0.44, 0.17, 0.57 and 0.53.

Table 3 Residual correlations between feed consumption, weight gain and skin length. Data from Nord is above the diagonal and data from Favrholm below the diagonal. Correlations larger than 0.21 are significantly different from 0.

Traits	Weight gain (males)	Weight gain (females)	Weight gain (average)	Skin length	Feed consumption
Weight gain (males)		0.57	0.96	0.59	0.84
Weight gain (females)	0.21		0.78	0.30	0.50
Weight gain (average)	0.91	0.55		0.55	0.81
Skin length	0.62	0.16	0.56		0.52
Feed consumption	0.26	0.18	0.32	0.31	

A relatively high correlation between skin length and weight gain is observed, with a higher correlation in males probably because males also contribute the largest variation in skin length.

Discussion

The average efficiency of longitudinal growth in Table 1 is probably overestimated, as feed consumption has only been measured in part of the production period.

The estimated efficiencies were higher in the data from Nord. With a more restricted feeding regime a higher association between marginal feed consumption and marginal skin length is expected due to diminishing returns.

The feed efficiency in these data shows that there is a potential for increasing the efficiency of producing mink, when compared to other domesticated species. The low feed efficiency is probably due to the long production period, resulting in a higher need for maintenance, and the high activity in mink. The variation between colour types, years, and populations shown in this report, indicates a potential for increasing efficiency in the production of mink.

The variation is larger in the data from Favrholm, due to the smaller group sizes. In most cases the variance is, as expected, 2.5 times larger (with group sizes of 8 and 50), but for feed consumption the variance is larger on Favrholm due to a few observations with a low feed consumption. Furthermore, the skin length is shorter in data from Favrholm, as it is the average of males and females. Feed consumption is larger at Favrholm, probably due to a less restricted feeding and to a longer period of measuring feed consumption. Feed consumption was not measured at Nord from November 8, a period with only small weight changes or even weight loss. The higher feed consumption at Favrholm also resulted in a higher weight gain. A very low efficiency is observed, compared to other farmed animal species.

The estimated increase in feed consumption was 218 and 294 g of feed with 1 cm increase in skin length. With a difference between size categories of 6 cm at the auction, there is a difference between 1.3 to 1.8 kg of feed for a change of one size category. This is equal to a difference in costs between size categories of approximately 3 DKK (with a price of approximately 2 DKK per kg feed). The price of a skin increases by approximately 10% for each size category (Børsting 1994).

With an average price of 150 DKK, a change of one size category is worth 15 DKK. The net gain would then be approximately 12 DKK, a reduction of 20% compared to the estimates solely based on the pricing of skins and not accounting for costs of producing skins.

The relationship between price and skin length seems to be non-linear (see Figures in Børsting (1994)) and especially with a small difference in price between the two largest categories.

As seen in Table 1 there is a marked difference between colour types in the cost of production. Standard has a higher feed consumption and a lower efficiency than Pastel. Furthermore, they have a longer production period as the skin is mature later than the other types, which has not been taken into account in Table 1.

Despite the cost of producing a larger skin, the marginal profit of skin size makes size a major factor in determining the profit from producing mink.

References

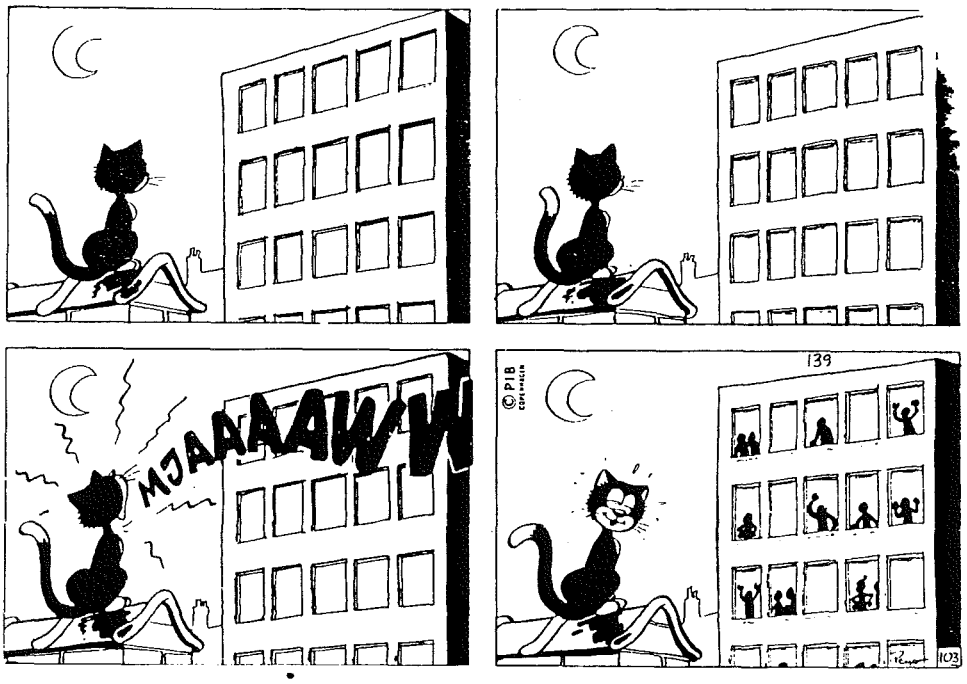
Berg, P. & Lohi, O. 1992. Feed consumption and efficiency in paternal progeny groups in mink. Acta Agric. Scand., Sect. A 42: 27-33.

Børsting, E. 1994. Skindegenskabernes økonomiske betydning. NJF-seminar nr. 253. 25 pp.

Hillemann, G. 1992. Restriktiv fodring af mink i vækstperioden. Faglig Årsberetning 1991, Dansk Pelsdyravlerforening. 121-147.

Hillemann, G. 1993. Restriktiv fodring af mink i vækstperioden. Faglig Årsberetning 1992, Dansk Pelsdyravlerforening. 63-76.

Lohi, L., Johannesen, K.-R., Børsting, E., Ei narsson, E.J., Joutsenlahti, U., Lagerkvist, G. & Jónsson, M. 1989. Analyses of pelt prices as an aid in breeding programmes. NJF utretninger/-rapporter no. 54.



Original Report

Concentration of some macroelements in fur of Greenland nutria during ontogenesis

E. Hanusova[1], D. Mertin[1], K. Süvegová[1], V. Stepanok[2]

[1]Research Institute of Animal Production, Hlohovská 2, 949 92 Nitra, Slovakia

[2]All-Russian Research Institute of Agricultural Using Meliory Soils, P.D. Emmaus, 171 33 Tver, Russia

Summary

The content of some macroelements (Ca, P, K, S, Cl) in the fur of Greenland nutria was studied during ontogenesis. Each group consisted of approximately 25 males and 25 females. The experiment was performed at the Experimental Farm of Fur Animals of the Research Institute of Animal Production in Nitra. The animals were clinically healthy, in good rearing condition, and fed the full value feed ration. Fur samples were cut from two topological parts of body (middle of back and middle of abdomen) at the age of 60, 135 and 240 days. Concentration of the individual elements was determined with the disperse-roentgen flourescent spectrometry (*Tumanov and Stepanok, 1986*).

The results were processed mathematically and statistically and the significance of differences in arithmetic means was tested with a t-test. There were statistically significant differences between males and females in the concentration of phosphorus at the age of 60 and 135 days, sulphur at the age of 135 days in both localities of the body, and chlorine at the age of 60 days in both studied localities of the body and in the locality of abdomen at the age of 135 and 240 days.

Introduction

The fur, as a non-vital derivative of the ingument, bears in its chemical composition information about environmental factors which influenced the organism during its growth. This property of fur can be used in fur animals to control the feed ration, optimize the mineral nutrition and study the relation between the concentration of elements and performance traits. A knowledge of the concentration of elements in the given somatomertic localities and during the ontogenetic stages of the organism at the defined feed rations is presumed (*Mertin et al., 1990*).

Some authors have dealt with the content of mineral elements in the fur of fur-bearing animals. They were interested mainly in the mineral composition of fur in carnivorous fur animals (*Ajvazjan, 1962; Samkov, 1972; Tjurnina, 1981; Berestov et al., 1984; Bialkowski and Saba, 1985; Mertin et al., 1990, 1991, 1992; Lohi and Jensen, 1991*). These authors mainly studied the content of mineral elements in the period of fur maturity. It is necessary to know the changes in its composition during the ontogenesis to use the analysis of mineral composition of fur for the evaluation of nutrition quality.

Some authors have dealt partially with this problem - Berestov et al. (1985) in polar foxes, Mertin et al. (1990, 1991, 1992) in silver foxes and cross foxes and Mertin et al. (1994 a,b,c) in standard nutria.

Buleca and Sviatko (1991) analysed the content of Ca, P, Mg, Na, and K in fur and blood serum of silver and Greenland nutria by the method of atomic absorption spectral photometry. They determined 58.26±13.44 mg/100 g dry matter Ca, 27.19±7.02 P, 45.62±8.43 Mg, 128.41±6.83 Na and 243.56±26.27 mg/100 g dry matter K in the fur of Greenland nutria.

Material and methods

The experiments were performed at the Experimental Farm of Fur Animals of the Research Institute of Animal Production in Nitra. The animals were kept in one-floor cages with pools in the hall. They were fed a pelleted feed mixture KK (producer AC Cataj) and were given alfalfa in the spring and summer period and fodder beet in the autumn and winter period as supplementary feed. They drank water from the pools. The animals used in the experiment were clinically healthy.

The experiment lasted eight months and approximately 25 males and 25 females of various ages were studied. Fur samples were cut from two topological parts of the body (middle of back and middle of abdomen). One sample contained approximately 2 g of fur. The samples were cut according to growth of the individual fur generations of fur at the age of 60 days (juvenile fur), 135 days (moulting) and 240 days (fur maturity).

Concentration of Ca, P, K, S, and Cl (% of dry matter) was determined by disperse-roentgen flourescent spectrometry (*Tumanov and Stepanok, 1986*). The concentration of these elements in the individual feeds was also studied (table 1). The results were processed mathematically and statistically (M±SD) and significance of differences of arithmetic means between sexes was tested with the t-test.

Results and discussion

The results of the analyses (table 2) showed that the content of macroelements in the fur of Greenland nutria varies depending on age and sex during the ontogenesis.

We observed significant differences between males and females in the concentration of phosphorus and chlorine in juvenile fur at the age of 60 days. There was a higher concentration of the given elements on the back as well as on the abdomen in males compared with females. We observed a tendency towards the increase of Ca, K and S concentrations in females on the back as well as on the abdomen compared with males. However, the results were not statistically significant.

We observed significantly higher concentrations of phosphorus and sulphur ($P \leq 0.01$) on both studied parts and of chlorine ($P \leq 0.01$) on the abdomen in males during the moulting period at the age of 135 days. Significant differences ($P \leq 0.05$) were observed in the content of chlorine in males on the abdomen in the period of fur maturity, at the age of eight months.

Table 1 Arithmetical means of studied mineral elements in feed components

Element	Alfalfa	KK	Fodder beet
Ca (%)	1.380	0.813	0.210
P (%)	0.630	0.403	0.471
K (%)	3.480	1.160	2.280
S (%)	0.170	0.023	0.078
Cl (%)	0.526	0.236	3.640

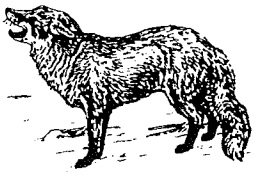


Table 2 Concentration of some macroelements (% from dry matter) in the fur of Greenland nutria during ontogenesis (M ± SD)

Age (days)	Ca		P		K		S		Cl	
Parts of body	male	female	male	female	male	female	male	female	male	female
60 B	n = 11 x 0.127 s 0.031	n = 19 0.144 0.045	n = 16 0.625^{++} 0.253	n = 19 0.365 0.141	n = 16 0.140 0.043	n = 19 0.152 0.067	n = 16 6.922 1.629	n = 19 7.298 1.658	n = 16 0.114^{++} 0.053	n = 19 0.051 0.015
60 A	n = 10 x 0.109 s 0.032	n = 19 0.137 0.041	n = 15 0.631^{++} 0.216	n = 19 0.361 0.166	n = 15 0.100 0.035	n = 19 0.103 0.037	n = 15 6.629 1.551	n = 19 7.089 1.045	n = 15 0.107^{++} 0.049	n = 19 0.045 0.027
135 B	n = 21 x 0.108 s 0.022	n = 15 0.095 0.016	n = 21 0.548^{++} 0.206	n = 15 0.327 0.091	n = 21 0.106 0.048	n = 15 0.112 0.031	n = 21 9.604^{++} 0.981	n = 15 5.098 1.066	n = 21 0.074 0.039	n = 15 0.054 0.023
135 A	n = 11 x 0.127 s 0.031	n = 19 0.144 0.045	n = 21 0.600^{++} 0.196	n = 15 0.258 0.051	n = 16 0.140 0.043	n = 19 0.152 0.067	n = 21 9.376^{++} 1.211	n = 15 4.807 0.280	n = 16 0.114^{++} 0.053	n = 19 0.051 0.015
240 B	n = 8 x 0.080 s 0.017	n = 23 0.082 0.018	n = 8 0.570 0.177	n = 19 0.491 0.146	n = 8 0.112 0.029	n = 19 0.093 0.26	n = 8 8.645 0.701	n = 19 9.018 0.711	n = 8 0.064 0.017	n = 19 0.050 0.25
240 A	n = 8 x 0.124 s 0.037	n = 25 0.105 0.023	n = 8 0.535 0.264	n = 20 0.525 0.155	n = 8 0.064 0.024	n = 20 0.060 0.029	n = 8 8.750 1.495	n = 20 9.341 0.660	n = 8 0.057^{+} 0.020	n = 20 0.038 0.016

B - back + $P \leq 0.05$
A - abdomen ++ $P \leq 0.01$

The concentration of the other studied macroelements was approximately the same in the males and females.

We can compare our results with the work of Mertin et al. (1994a). They studied the content of Ca, P, K, S and Cl (% of dry matter) in the fur of standard nutria during ontogenesis. It is possible to state on the basis of the mentioned results that the more marked differences in the concentration of the observed macroelements between the sexes were manifested in the Greenland nutria.

The authors found significant differences in the concentration of Ca on the back (male - 0.179, female - 0.150, $P \leq 0.05$), and Cl on the abdomen (male - 0.061, female - 0.041, $P \leq 0.05$), in the content of S on the back (male - 9.601, female - 8.828, $P \leq 0.01$) and on the abdomen (male - 9.744, female - 8.988, $P \leq 0.05$) in the fur of standard nutria at the age 240 days.

Mertin et al. (1994a) noticed a higher concentration of Ca on the studied localities during the ontogenesis in the standard nutria in general (standard - male: from 0.147 to 0.208, female: from 0.150 to 0.244, Greenland - male: from 0.048 to 0.127, female: from 0.095 to 0.144.

On the contrary we observed a higher concentration of chlorine in the Greenland males (0.074-0.114) compared with the standard ones (0.045-0.075), except at the age of 240 days. This concentration was higher in female standard nutria (0.041-0.058) compared with female Greenland nutria (0.038-0.054). Buleca and Sviatko determined 58.26 mg/100 g dry matter Ca, 27.16 P, 45.62 Mg, 128.41 Na and 243.56 mg/100 g dry matter K in the fur of Greenland nutria. The results of these authors can hardly be compared with our results because another method for the determination of their content was used.

References

Ajvazian, N.A. 1962. Med' v organizme nekotorych pusnych zverej Tr. Vsesojuz. sch. in Zaocn. Obrazovania 10, pp 110-114.

Berestov, V.A., Tjurnina, N.V., Tjutjunnik, K.N. 1984. Mineral'nij sostav volosianogo pokrova norok i pescov. Karelia, Petrozavodk, 158 pp.

Bialkowski, Z. and Saba, L. 1985. Investigations over relationship between occurrence of mineral elements in blood serum and hair of black-silver foxes. Scientifur Vol. 9, No. 1, pp. 21-23.

Buleca, J. and Sviatko, P. 1991. Minerálny profil makroelementov v krvi a srsti nutrií. Zborník súhrnov ref. ved. sympózia "Produkcia a xdravie v chove kozusinových zvierat" ZSVTS. Kosice, pp. 34-35.

Buleca, J. and Sviatko, P. 1991. Analýza mikroelementov v srsti nutrií. Zborník súhrnov re. ved. sympózia "Produkcia a zdravie v chove kozusinovych zvierat" ZSVTS, Kosice, pp. 93-94.

Hornshaw, T.C., Aulerich, R.J. and Ringer, R.K. 1985. Mineral Concentration in the Hair of Natural Dark and Pastel Mink (Mustela vison). Scientifur, Vol. 9, No. 3, pp. 216-220.

Lohi, O. and Jensen, L.V. 1991. Mineral Composition of Mink Feed and Hair. Report from National Institute of Animal Science 688, pp. 99-114.

Mertin, D., Rafay, J., Stepanok, V. 1990. Koncentrácia niektorých minerálnych prvkov v srsti strieborných lísok v obdobi kozusinovej zrelosti. Pol'nohosp. 36, 9, pp. 830-836.

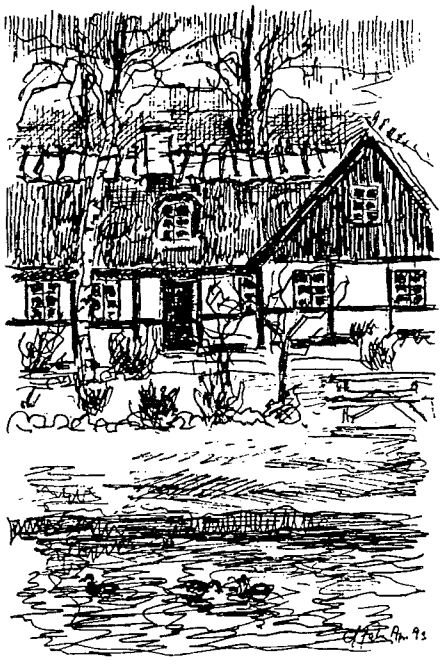
Mertin, D., Rafay, J. Berestov, V., Stepanok, V. 1991. Content of some mineral elements in hair of silver foxes during ontogenesis. Scientifur, Vol. 15, No. 3, pp. 183-189.

Saba, L., Bialkowski, Z., Wojcik, S., Janecki, T. 1982. Content of mineral elements in the hair of black-silver foxes. Scientifur, Vol. 6, pp. 8-11.

Samkov, Ju.A. 1972. Vlijanie vitaminov a mikroele mentov na kocestvo mecha lisic. Krolikov. i Zverov. 1, pp. 29-30.

Tjurnina, N.V. 1981. Sezonnyje izmenenija v soderzanii mineralnich vescestv v volosjannom pokrove vualevych pescov. In: Biologia i patologia pusnych zverej. Tez. dokl. 3-ej Vsesojuz. nauc. konf.1.vypusk, Petrozavodsk, pp. 101-102.

Tumanov, I., Stepanok, V. 1986. Metodiceskije ukazanija po ispol'zovaniu otescestvennoj apparatury pri provedenii energo - dispercionnogo - rentgeno - fljurescentnogo analiza pocvennych obrascov i biomaterialov (Metodiceskije ukazanija). Vserossijskij naucno-issled. inst. sel'. - choz. ispol'zovanija meliorirovanych zemel', Kalinin, 31 pp.



Original Report

Genetic and environmental determination of reproduction results in the polecat

G. Jezewska, J. Maciejowski, J. Tarkowski

Department of Biological Basis of Animal Production,

University of Agriculture in Lublin, Poland

Summary

Female reproduction and rearing results were studied on one farm for eight consecutive years. The mean results of litter size and number of weaned kits may be treated as very good. Variability between years was not very high, though the mean values appeared statistically significant. Significant were also differences between the mean numbers of kits in the consecutive litters of females; the highest values were found in the primiparas. Coefficients of heritability of the reproduction traits were low except for the kittening term.

Introduction

The reproduction results of any domestic animal species are particularly interesting for the breeder in consideration of production effects. Reproduction traits in the majority of studied species (sheep, pig, fox, mink) are characterized by a low heritability and, therefore, the responses of the traits to selection are very small.

The research findings on genetic and environmental control of the reproductive traits in the polecat are scarce (refs. 1, 5). The authors intend to utilize reproduction data from one of the polecat breeding farms in Poland.

Materials and methods

The studies were carried out for eight years on a fur animal farm in Wiartel (north-eastern Poland). The number of studied animals diminished from year to year because of economic reasons. In general 947 females were investigated.

Every year the reproduction data of females and rearing performances were registered. The results were used to estimate heritability of chosen traits and phenotypic correlations between them. The SAS (ref. 9) and Harvey (ref. 4) software packages were utilized in the calculations.

Results and discussion

The results of reproduction and rearing are presented in table 1. It contains main values and standard deviations for the following traits: litter size, number of weaned and kittening term defined as a successive day of the year. The means were calculated for a whole studied period and for consecutive litters of females. The lowest and highest values of the means and the years they appeared have been added to show fluctuations of the traits' values.

Table 1. Means and standard deviations of reproduction traits in polecat

Trait	Litter								Total	
	1		2		3		4			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Litter size	9.65	2.42	9.42	2.37	8.41	2.19	6.56	2.76	9.08	2.56
Min.-max. over the years	7.77 (1990) - 10.42 (1991)		8.13 (1990) - 10.59 (1990)		7.00 (1992) - 8.84 (1987)		6.50 (1992) - 7.90 (1989)		7.31 (1990) - 10.10 (1986)	
Number weaned	8.20	2.79	8.22	2.70	6.95	2.98	4.93	3.24	7.70	3.00
Min. - max. over the years	6.62 (1990) - 9.98 (1989)		7.30 (1990) - 10.00 (1985)		5.64 (1988) - 8.20 (1989)		3.07 (1992) - 7.60 (1989)		5.31 (1992) - 9.06 (1989)	
Kittening term*	142.7	8.85	142.1	7.37	143.8	6.30	143.7	5.46	142.8	7.77
Min. - max. over the years	138.1 (1992) - 149.0 (1984)		138.0 (1985) - 146.8 (1987)		139.0 (1992) - 149.0 (1986)		141.2 (1989) - 146.4 (1990)		139.1 (1992) - 149.0 (1984)	
Number of females	414		283		180		70		947	

* Kittening term is given as a successive day of year

Compared to the data in the literature (refs. 1, 2, 6, 7), the presented results of litter size and number of weaned kittens can be treated as very good. A two-way analysis of variance proved significant differences between litters and between years for both traits as well as significant interaction litter*year for the number of weaned. There were no significant differences of kittening term between litters nor years.

As has been shown in the numerous studies on several polyembryonic species (refs. 3, 8) heritability of reproduction traits appears to be relatively low. It could indicate that variability of these characteristics is determined mainly by environmental factors and to a smaller extent by genetic ones.

In table 2 the estimated heritabilities and phenotypic correlations between studied traits are presented. According to our expectations, also in the polecat, heritability of litter size and number of weaned kittens were not high and close to that found by the other authors. Positively higher heritability was characteristic for the term of kittening. As shown earlier by Maciejowski (ref. 3), the heritability of kittening term was also higher in polar foxes than the other traits of reproduction.

A relatively high positive correlation between born and weaned kitten numbers is clear. It is interesting, however, that the born kitten number was negatively correlated to the term of kittening. Since the term was given as a consecutive day of a year it means, that earlier kittenings were more advantageous than later ones. No relationship was found, however, between kittening term and number of weaned kits.

A common opinion exists among the breeders of carnivorous fur animals that there is a high correlation between a term of birth of a female and a term of its first kittening the following year. Estimated correlation between these traits in the polecat was very low (+0.07).

The studies show that the contribution of genetic factors to the total phenotypic variability of reproduction traits in the polecat is generally low, which does not presage a fast reaction to selection in this direction. An exception is kittening term whose heritability, similarly to that in foxes, appeared to be relatively high.

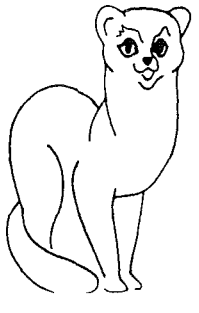


Table 2. Heritability coefficient of first kittening* (on diagonal) and phenotypic correlation (above diagonal) of chosen reproductive traits in the polecat

Trait	Born	Weaned	Kittening term
Born	0.11 + 0.14	0.61	-0.15
Weaned		0.12 + 0.14	-0.001
Kittening term			0.40 + 0.14

* Heritability was estimated from the maternal component of variation

References

1. Bednarz, M., Frindt, A. 1991. Hodowla tchorzy. PWRiL W-wa.
2. Bednarz, M., Szostak, M. 1983. Ocena poglowia tchorzofretek na podstawie wybranej fermy wielkostadnej. Zesz. Probl. PNR 302: 113-116.
3. Einarsson, E.J. 1987. Selection for litter size in mink. II. Direct response in litter size at birth. Norwegian Journal of Agricultural Sciences 1: 155-178.
4. Harvey, W.R. 1987. Mixed model Least-squares and maximum likelihood computer program. Ohio State University.
5. Jezewska, G., Maciejowski, J., Niezgoda, G. 1994. Dlugoscuzytkowania i wyniki rozrodu tchorzy hodowlanych. Zesz. Nauk. PNR 15: 177-184.
6. Lagerkvist, G. 1984. Reproduction and production qualities of the ferret. Scientifur 8, 3: 202-204.
7. Lagerkvist, G. 1982. Ferret mating. Scientifur 4: 37.
8. Maciejowski, J. 1973. Genetyczno-populacyjne ba danianad razrodem lisow polarnych. Cz.I. Powtarzalnose i odziedziczalnose terminow rui. Annalses UMCS, E, 27: 343-358.
9. Sas Institute, 1991 - Sas® User's Guide Version 6.04 Editor, SPS Institute Inc., Cary, NC.

Analysis of dansyl amino acids in feedstuffs and skin by micellar electrokinetic capillary chromatography

Søren Michaelsen, Peter Møller, Hilmer Sørensen

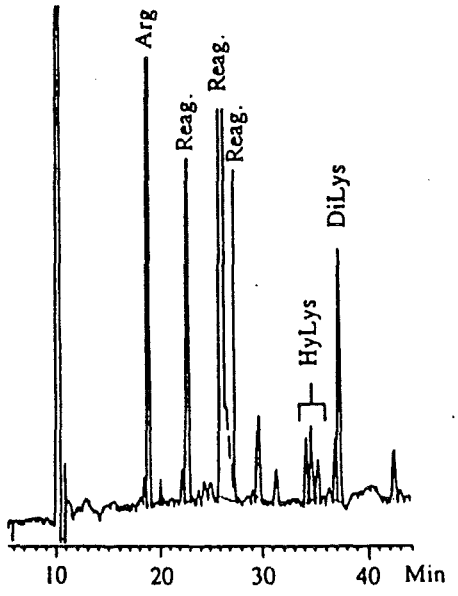


Fig. 9. Separation of derivatised basic amino acids in a hydrolysate of skin from mink

Micellar electrokinetic capillary chromatography (MECC) using sodium dodecyl sulphate (SDS) and sodium cholate have been used for analyses of 30 dansylated (Dns) amino acids. The influences of sample preparation, Dns/amino acid ratio, sample solvent composition, and separation conditions including voltage, temperature, pH and buffer composition were investigated. Complete separations of acidic and neutral amino acids were obtained within 45 min in the SDS system. The efficiency expressed as number of theoretical plates for the applied capillary 0.52 mm long were between 210,000 and 343,000, and the repeatability was very good with relative standard deviations on relative migration times between 0.09 and 0.70% and on relative normalised peak areas (RNPAs) between 0.85 and 3.41%. The linearity studies gave correlation coefficients between 0.9957 and 0.9993 for RNPAs against concentration. Detection limits were between 3 and 6 fmol or approximately 2 pg of each amino acid. Basic amino acids were separated in a MECC system using sodium cholate. Procedures and problems using Dns derivatisation for amino acids analysed by the MECC methods are described. Finally, examples of analyses of hydrolysates of real complex samples show, that this method can be applied to determine the amino acid composition of proteins in feedstuffs and skin.

Journal of Chromatography A, 680, pp. 299-310, 1994. 4 tables, 9 figs., 26 refs. Authors' abstract.

Age-related effects of Triphenyl Phosphite-Induced Delayed Neuropathy on Central Visual Pathways in the European Ferret (Mustela putorius furo)

Duke Tanaka, Jr., Steven J. Bursian, Richard J. Aulerich

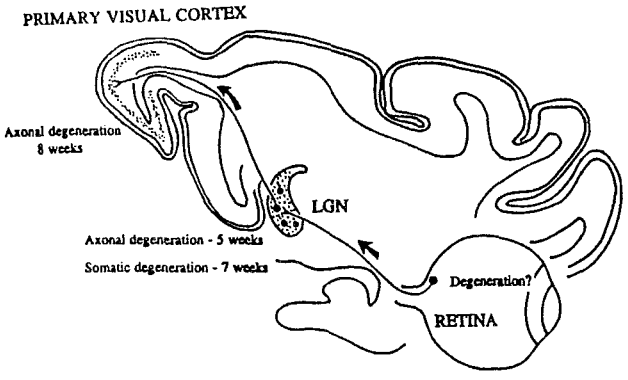


Fig. 11. Summary diagram illustrating the pathways, neurons, and time sequences involved in TPP-induced degeneration of visual pathways in the developing ferret. Stippling indicates areas showing axonal and terminal degeneration, arrows denote the direction of neural impulses, and the times indicate when axonal or somatic degeneration is first noted in each of the affected regions. Degeneration of retinal ganglion cells has not been directly demonstrated although the appearance and density of axonal and terminal degenerationin the LGN strongly suggests that these cells have undergone degenerative changes.

The objective of this study was to investigate the relationship between the maturation of visual system neurons and the onset of their susceptibility to triphenyl phosphite (TPP)-induced delayed neurotoxicity in the European ferret. We administered single subcutaneous

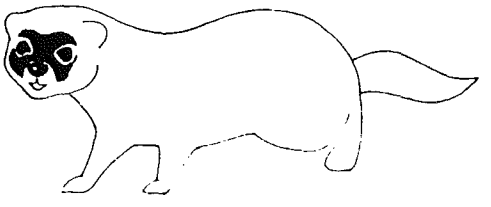
doses of TPP (1184 mg/kg body wt) to 1- to 10-week-old ferret kits to assess the effects on connections and neurons of the developing lateral geniculate thalamic nucleus (LGN) and primary visual cortex. Brains were processed with a modified Fink-Heimer silver-impregnation method. Axonal and terminal degeneration were first noted in the LGN of kits injected at 5 weeks of age. The severity of the degeneration increased in kits injected at later ages and reached adult densities and configurations in ferrets injected at 10 weeks of age. Degenerating neuronal cell bodies were also present in the LGN of kits injected at 7 weeks of age and older. In the visual cortex, axonal and terminal degeneration were consistenly present in kits injected at 8 weeks of age and attained adult-like densities in kits injected at 10 weeks of age. Previous studies have reported that the ferret visual system appears to reach anatomical maturity (as defined by mature LGN lamination patterns, the location and density of axon terminals originating from neurons in the retina and LGN, and the migration and synaptic connections of cortical neurons) by 4-5 weeks of age. A temporal comparison of these normal developmental data with the degeneration data obtained in the present study suggests that immature neurons in the visual system of the ferret are not susceptible to TPP-induced delayed neurotoxicity but only become so after they have achieved some degree of maturity. Whether the LGN neurons undergoing degeneration are directly affected by TPP or are showing a transneuronal response to loss of afferent input remains unresolved.

Fundamental and Applied Toxicology 22, pp. 577-587, 1994. 1 table, 11 figs., 39 refs. Authors' summary.

Contaminants in Fishes from Great Lakes-Influenced Sections and above Dams of Three Michigan Rivers. II: Implications for Health of Mink

J.P. Giesy, D.A. Verbrugge, R.A. Othout, W.W. Bowerman, M.A. Mora, P.D. Jones, J.L. Newsted, C. Vandervoort, S.N. Heaton, R.J. Aulerich, S.J. Bursian, J.P. Ludwig, G.A. Dawson, T.J. Kubiak, D.A. Best, D.E. Tillitt

Populations of mink (*Mustela vison*) have declined in many areas of the world. Such declines have been linked to exposures to synthetic, halogenated hydrocarbons. In the Great Lakes region, mink are fewer in areas along the shore of the Great Lakes and their tributaries where mink have access to fish from the Great Lakes. Recently, there has been discussion of the relative merits of passage for fishes around hydroelectric dams on rivers in Michigan. A hazard assessment was conducted to determine the potential for adverse effects on mink, which could consume such fishes from above or below dams on the rivers. Concentrations of organochlorine insecticides, poly-chlorinated biphenyls (PCBs), 2,3,7,8-tetrachlordibenzo-*p*-dioxin equivalents (TCDD-EQ), and total mercury were measured in composite samples of fishes from above or below hydroelectric dams on the Manistee and Muskegon Rivers, which flow into Lake Michigan, and the Au Sable River, which flows into Lake Huron. Concentrations of organochlorine insecticides, PCBs, and TCDD-EQ were all greater in fishes from below the dams than those from above. Concentrations of neither organochlorine insecticides nor mercury in fishes are currently a risk to mink above or below the dams. All of the species of fishes collected from downstream of the dams contained concentrations of PCBs and TCDD-EQ, which represent a hazard to mink. The hazard index for PCBs was less than one for the average of all species from the upstream reaches of the Manistee and Au Sable Rivers, but not the Muskegon. The hazard index (concentration in fish/NOAEC) was greater than 1 for all of the species collected from below the dams, in all three rivers. The greatest hazard index was observed for carp (*cyprinus carpio*) downstream on the Muskegon River. Because the concentrations of PCBs used in the hazard assessment were corrected for relative toxic potencies, the hazard rations based on PCBs should be similar to those based on TCDD-EQ. This was found to be true. Thus, either total PCBs or TCDD-EQ could be used as the critical toxicant in the hazard assessment. However, if uncorrected concentrations of PCBs, expressed as Aroclors®, were used in the hazard assessment, the toxicity of the weathered mixture would have been underestimated by approximately five-fold, and, in that instance, TCDD-EQ would be the critical contaminant for the hazard assessment. The average maximum allowable percentage of fish from above the dams, which would result in no observable adverse effects of TCDD-EQ, was 70%. Based on the average TCDD-EQ concentrations in the fishes, an average of 8.6% of the



diet could be made up of fishes from below dams on the rivers. The most restrictive daily allowable intakes were for carp on the Muskegon and steelhead trout (*Onchorhyncus mykiss*) on the Manistee Rivers. Only 2.7% of the diet could be made up of these two species from below dams without exceeding the no-effect concentration. This would represent approximately 15 days of food intake. Currently, consumption of all species of fish from below the dams would pose some risk to mink. The concentrations of PCBs and TCDD-EQ in fishes from below the dams were 10-20 times more hazardous, on average, than those from above the dams.

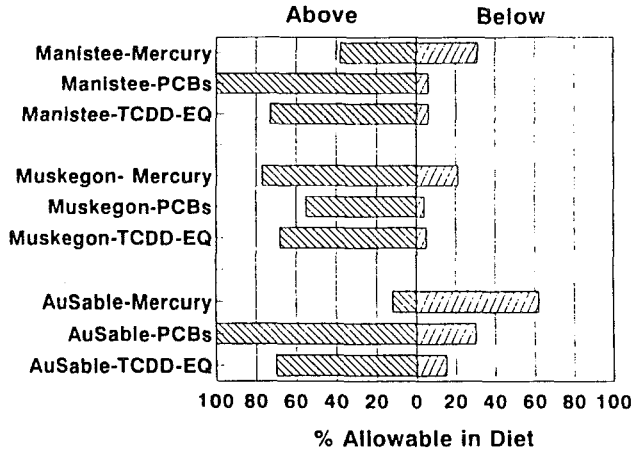


Fig. 1. Percent of fish, based on the average concentrations of mercury, PCBs and TCDD-EQ in all species combined collected at each location, which would be allowed in the mink diet so as to not exceed a hazard index of 1

Arch. Environ. Contam. Toxicol. 27, pp. 213-223, 1994. 7 tables, 1 fig., 76 refs. Authors' abstract.

Use of clinical analysis for the improvement of production in mink

Birthe M. Damgaard

An account is given of the use of blood tests to monitor the nutritional status, health, temperament, metabolism and infertility in mink.

Dansk Pelsdyravl, 56, 10, pp. 414-415, 1993. 1 photo. In DANH. CAB-abstract.

Fur biting in mink

G. Lagerkvist

The incidence of fur biting in mink selected for litter size, body weight, fur density or litter size + body weight in 1986-89 was investigated on the live animals in November and after pelting. The incidence of fur biting ranged from 0 to 6%. There were no significant differences between lines or between the progeny of fur biting and non-fur biting sires, but females had a greater incidence of fur biting than males.

Vara Pälsdjur, 64, 6, pp. 143-145, 1993. 3 tables. In SWED. CAB-abstract.

Morphological investigations of hair and pelts from fur bearers

Palle V. Rasmussen

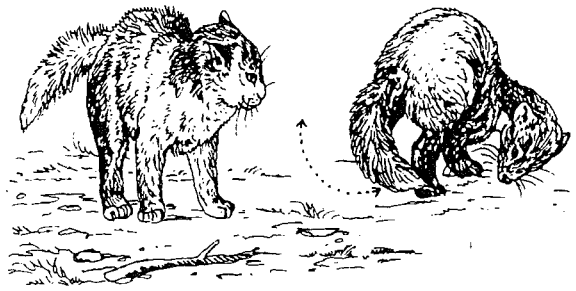
An account is given of recent work in Denmark on the morphology of the hair and skins of mink and blue foxes.

Dansk Pelsdyravl, 57, 1, pp. 12-14, 1994. 4 figs. In DANH. CAB-abstract.

Sprinkling of mink may prove interesting at high temperatures

Steen Møller, Steffen W. Hansen

The body weights of 96 Pastel mink females and their kits in cages fitted with a sprinkling system and of 100 females and control kits in standard cages were assessed at 2-week intervals from 9 May to weaning of the



kits at 7 wk of age. Air temperature ranged from 3° to 28°C, but had no significant effect on the frequency of sprinkling. Sprinkling had no significant effect on the body weight of dams, but kits in cages with sprinklers tended to have a slightly higher gain from 2 to 6 weeks of age than controls.

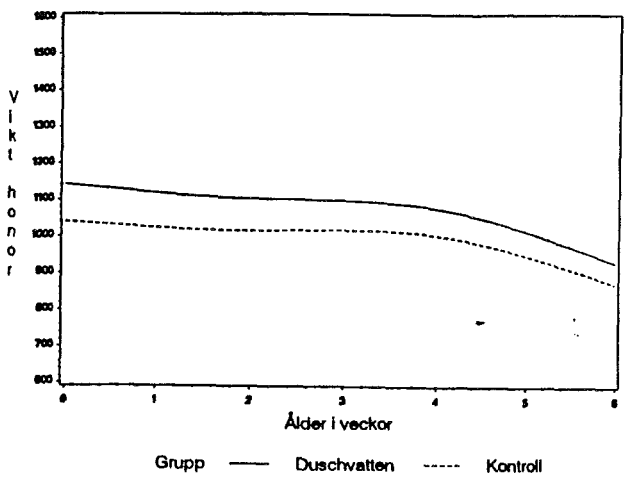


Fig. 1. Weight development for lactating females with and without water sprinklers

Vara Pälsdjur, 64, 4, pp. 92-94, 1993. 2 figs. In SWED. CAB-abstract.

The influence of temperature on energy and behaviour pattern of mink in the winter period

H. Korhonen, P. Niemelä

Feeding behaviour of mink during the winter was studied. Most feeding activity was observed through the night, but the largest intakes were in the morning and in the evening.

Finsk Pälstidskrift, 27, 1/2, pp. 16-21, 1993. 6 tables, 1 fig., 6 photos, 4 refs. In SWED. CAB-abstract.

Growth and reproduction in farmed martens

H. Korhonen, P. Pyyvaara, P. Niemelä

In 1993, there were 10 male and 13 female adult martens and 11 young animals (4 of which were born in captivity) at Kannus Research Station in Finland. An account is given of trials carried out in 1990-93 on the growth pattterns, behaviour, morphology and reproduction of captive martens, and details are given of nutrition and housing. Adult body weight averaged 1480-1510 g for males and 1130-1150 g for females, and there were seasonal differences in body weight in both sexes. Some of the females exhibited oestrus in July-Aug. every year, but only 1 female gave birth (to a litter of 4 martens) in the 3-year period (in 1993). It was concluded that, in view of the fact that martens do not attain sexual maturity until 2-3 years of age, farming would only be financially justified if pelt prices were high. The bibliography is not printed in the journal, but may be obtained from the author.

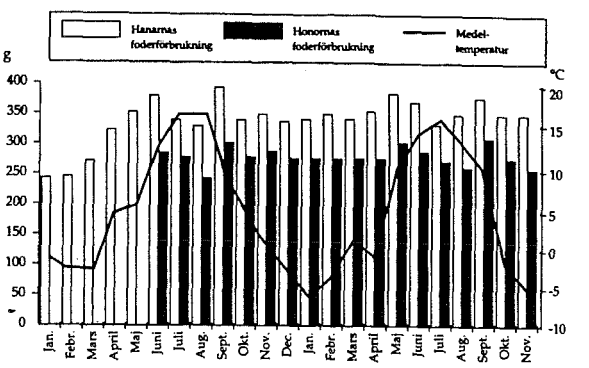


Fig. 1. Male and female marten feed consumption (g/animal/day) and monthly mean temperature 1991-1992. Males N= 9-10, females N=13.

Finsk Pälstidskrift, 27, 12, pp. 300-306, 1993. 1 table, 8 figs., 43 refs. In SWED. CAB-abstract.

Assessment of the welfare of farmed foxes on the basis of behavioural and physiological parameters

Vivi Pedersen

An account is given of some methods of assessing the effects of stress on the reproductive performance and physiology of farmed foxes, and details are given of some recent work on the effects of housing and exposure to humans on the incidence of stress.

Norsk Pelsdyrblad, 67, 12, pp. 20-22, 1993. 2 photos, 20 refs. In NORG. CAB-abstract.

Shelf trials with blue foxes during the winter and the breeding season in January-July 1993

H. Korhonen, P. Niemelä

The frequency of use of shelves in the cages of blue foxes in winter, spring and early summer and the effects of the provision of shelves on body condition at mating, oestrus, behaviour and litter size were investigated, using 120 females and 40 males. Only 8.1% of foxes used the shelves in winter vs. 18.1% of males and 13.2% of females in Apr. and 20 and 25%, respectively, in July. Of 60 females provided with shelves, 56 mated vs. 50 og 59 controls not provided with shelves, 12 failed to give birth to a litter vs. 7, the number of cubs born per mated and whelping female averaged 8.1 and 10.8, respectively, vs. 8.4 and 10.3, and the number of kits retained for breeding per female averaged 8.1 vs. 8.4. In Jan., the body weight of foxes with shelves averaged 8.4 kg vs. 9.2 for controls (P 0.05), but there were no significant differences between groups in body weight from mid-Mar. It was concluded that the provision of shelves has only a minor effect on the reproductive performance of blue fox females.

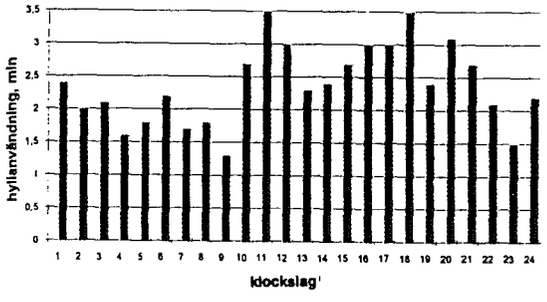


Fig. 2. Distribution of the foxes' (10 males, 10 females) use of shelves per day (min). Videorecording in Jan.-Mar. (20 days/month). Becuase of only small differences between sexes, males and females are combined

Finsk Pälstidskrift, 27, 10, pp. 210-218, 1993. 9 tables, 4 figs., 7 photos, 18 refs. In SWED. CAB-abstract.

Importance of the growth curve in Standard mink

A. Baumgarten

For about 250 standard mink breeding females on 10 farms in Sweden, body weight on 1 jan., Feb., Mar., Apr., May, June, July, Aug., Sep., Oct., Nov. and Dec. averaged 1030, 1050, 960, 1110, 1150, 1080, 950, 1040, 1210, 1220, 1180 and 1070 g, respectively. There were no significant differences between young and adult females in body weight. The effects of nutrition on milk Ig concentration from parturition to day 42 of lactation are considered, and the consequences for the disease resistance of kits are discussed.

Vara Pälsdjur, 64, 5, pp. 110-113, 1993. 5 figs. In SWED. CAB-abstract.

Danish breeders should aim for larger mink

Iwan Santin

In 1992-93, 10,594,378 mink pelts were offered for sale in Denmark, representing an increase of 6.7% over the previous year. Of the pelts, 31% were Scanbrown, 34% Scanglow, 22% Scanblack and 5.3% Pastel. The number of fox and polecat pelts offered was 62,085 and 3,547 respectively, representing a decrease of 11.3 and 10%, and 231 raccoon dog pelts were offered vs. 216 the previous year. Data are tabulated on the distribution of pelt size and quality, and details are given of prices paid.

Dansk Pelsdyravl, 56, 9, pp. 312-314, 1993. 7 tables. In DANH. CAB-abstract.

Whelping results in the Sampo scheme in 1993

K. Smeds

In 1993, in Finland, 15,037 and 24,069 fox breeding females, representing around 5 and 10%, respectively, of the total farm populations of the 2 species, participated in the Sampo litter recording scheme. The number of kits born per mated female averaged 3.95, 4.87 and 3.88, respectively, for black, brown and other mink females, 6.19 and 5.37, respectively, for blue and

silver fox females mated with blue fox males, and 2.75 for silver fox females mated with silver fox males.

Finsk Pälstidskrfit, 27, 10, pp. 203, 1993. 1 table. In SWED. CAB-abstract.

Results of the pelt quality recording scheme for fur bearers

Anonymous

The pelt quality, size and colour of 11,195 mink, 23,393 silver foxes and 50,772 arctic foxes in Norway were recorded in 1993. Data are presented by district and colour type, and are compared with those for 1992.

Norsk Pelsdyrblad, 68, 2, pp. 40-41, 1994. 4 tables. In NORG. CAB-abstract.

Scanning electron microscopic study on collagen fibrils in the mink dermis during the hair cycle and growth

Jae In Pak, Fumio Nakamura, Kazuaki Takenouchi, Keiji Kondo

Changes of the collagen fibrillar networks in mink dermis during the hair cycle and growths were studied by the use of the cell-maceration/scanning electron microscope method. In telogen, flat and felt-like structures of a collagen fibrillar network with small gentle undulations covered the dermal surface. In contrast, during anagen, the rough undulations constituted by collagen fibrillar bundles caused a discernible three dimensional effect on the dermal surface. In mink, dermal cross-section during telogen, the collagen fibrillar bundles were bundled tightly together, the inter-bundle space was minimal and the dermis was thin. However, in anagen, the collagen fibrillar bundles were in a looser arrangement so there was more inter-bundle space and a thicker dermis. The size of the pore of the hair (PH) increased during mink growth and was also larger in anagen than in telogen. The number of the individual collagen fibrils increased, and the density of collagen fibrillar bundles also increased during mink growth. Most collagen fibrils are arranged vertical to the body axis in mink dermis. The interstitial collagen fibrils of panniculus adiposus composed a felt-like structure. On the other hand, the collagen fibrils inside the connective tissue sheath of hair follicles were bundles running longitudinally parallel to the hair axis, and the collagen fibrils of the outer layer enclosed the inner layer and ran transversely against the hair axis.

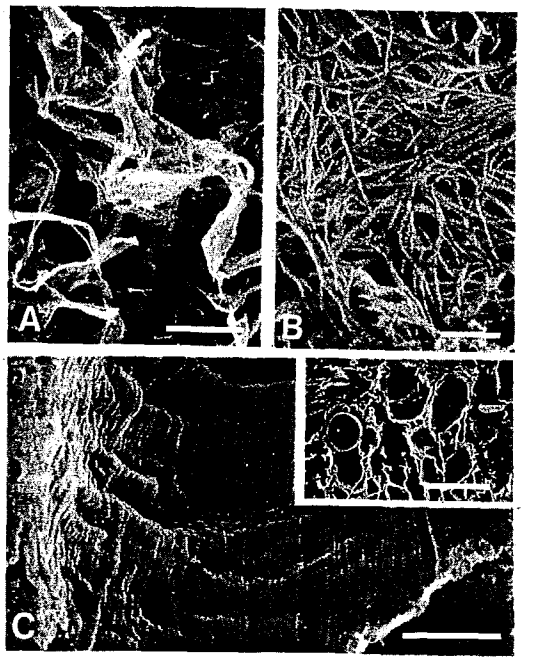


Fig. 7. SEM views of the collagen fibrils of the panniculus adiposus, and hair follicle. The panniculus adiposus collagen sheath (A) shows a felt-like structure at a closer view (B). The connective tissue sheath of the hair follicle (*inset*) is composed of an inner longitudinal layer and an outer circular layer (C). Bar in A is 40 μm, B is 1 μm, C is 5 μm and *inset* is 50 μm.

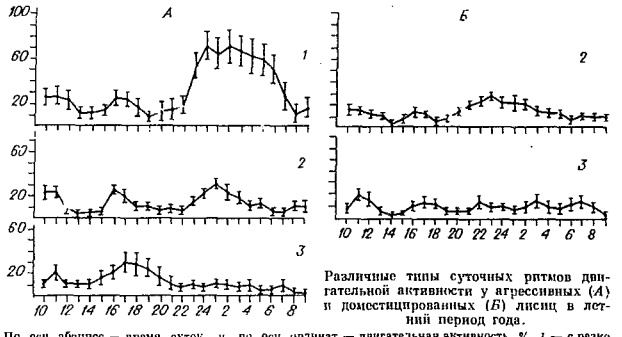
Anim. Sci. Technol. (Jpn) 65 (12): 1111-1118, 1994. 7 figs., 20 refs. Authors' abstract.

The daily rhythm of locomotor activity in silver foxes (*Vulpes Fulvus* Desm.) and its changes during domestication

I.Z. Plyusnina, L.N. Trut, N.M. Selina

The selection of foxes for domesticated behaviour induced a reorganization of the strictly stabilized reproductive function and some changes of the role of the main ecological factor, light, in the control of the reproductive function. Domestication seems to modify the circadian rhythm of photosensibility which is supposed to be the basis of photoperiodical measure of time in foxes. The daily changes of photoreactivity are known to be closely correlated with the daily changes of locomotion in some species. The problem was set to find out whether the changes of daily rhythm of motor activity occur in the process of domestication in foxes and whether these changes are associated with some blurring of the seasonal rhythm of reproductive activity. The aim of this study was to compare the daily rhythms of motor activity in foxes selected for domesticated behaviour, those selected for aggressive behaviour, and those unselected from the population bred for commercial purposes.

The motor activity was recorded by a fully automatic method with use of a microcomputer in the summer and was determined in 10-minute intervals for 24 hours, and estimated the percentage of time the animal was moving.



Различные типы суточных ритмов двигательной активности у агрессивных (*А*) и доместицированных (*Б*) лисиц в летний период года.

По оси абсцисс — время суток, ч, по оси ординат — двигательная активность, %. *1* — с резко выраженной ночной фазой активности; *2* — с умеренно выраженной ночной фазой активности; *3* — аритмичный.

Fig. 1. Different types of daily rhythm of locomotion in aggressive (A) and domesticated (B) foxes in summer

Three groups of animals were found: foxes having a sharply expressed phase of motor activity (at the level of 80-100%), moderately expressed (up to 50%) and arhythmical ones (those without any periodicity in locomotion), among aggressive and unselected foxes. No animals with a sharply expressed nocturnal phase of locomotion were discovered and a clear tendency was found for an increase of arhythmical animals among the domesticated foxes.

The time of beginning of locomotion, its duration and the average amplitude are the essential characteristics of the active nocturnal phase. The aggressive and unselected foxes did not differ in all the characteristics of the nocturnal phase but they had differences in the first two characteristics from domesticated foxes. In the latter the phase began earlier and was prolonged.

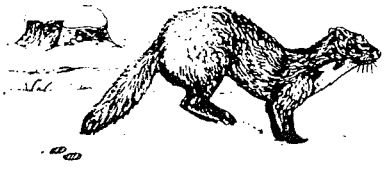
It is supposed that the peculiarities of the daily rhythm of locomotion in domesticated foxes reflect the alteration of the circadian rhythm of photosensitivity arisen during domestication. An alternative hypothesis may be that both rhythms have changed simultaneously during the selection for behaviour.

Izvestiya Sibirskogo Otdeleniya Akademii nauk SSSR Seriya Biologischskikh nauk, No. 4, pp. 11-15, 1991. In RUSS. 2 tables, 1 fig., 15 refs. Authors' summary.

Would raccoon dogs benefit from hibernation?

S. Pasanen, J. Asikainen, H. Korhonen

From 26 Nov. to 12 Feb., raccoon dogs (19 females and 8 males per group) were given 250 g feed daily, containing 375 kcal energy (controls), or were not fed. For animals in the 2 groups, weight loss during the trial averaged 2.8 and 1.4 respectively, the differences between the sexes being non-significant. There were no significant differences between the groups in blood creatine kinase or gamma-glutamyl transferase activity, or in urine composition, but the average CR and litter size of fasted females were 80% and 4.0 respectively vs. 68% and 1.8 for controls.



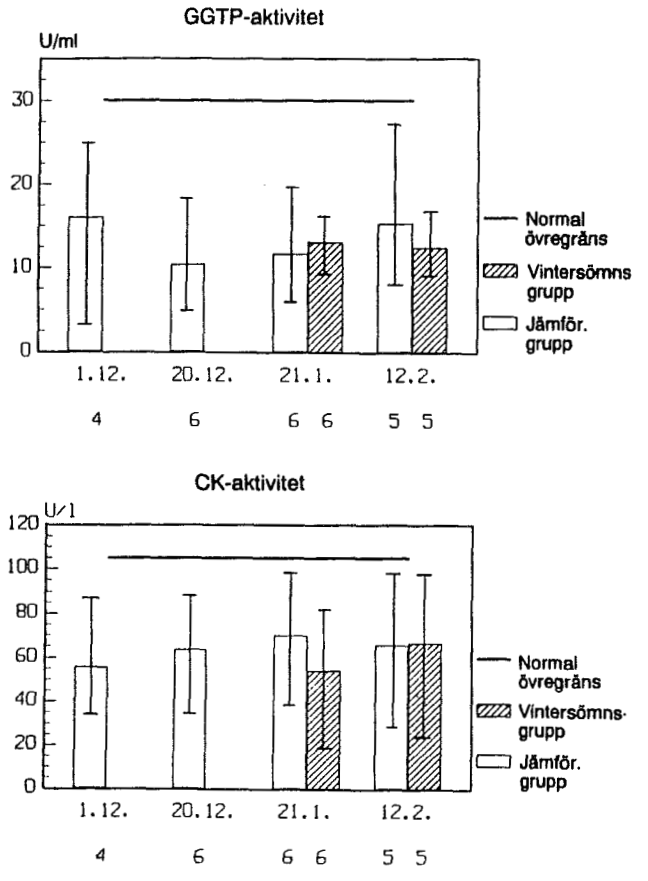


Fig. 1. GGTP- and CK-activity in blood serum of raccoon dogs in control and hibernation groups. Bar height = mean value; border values are the samples' minimum and maximum values.

Finsk Pälstidskrift, 27, 12, pp. 298-299, 309, 1993. In SWED. 1 fig., 7 refs. CAB-abstract.

Breeding raccoon dogs in a combination of a cage and enclosure

H. Korhonen, S. Alasuutari

The behaviour of a breeding pair of raccoon dogs, housed in a roofed cage (supplied with a nest box) and with access to an open enclosure measuring 2 x 4 m (also with a nest box), was observed twice daily in spring and summer. The animals were found to spend 54% of their time in the cage, 23% in the cage nest box, 8% in the enclosure and 15% in the enclosure nest box, and did not normally visit the enclosure until the evening. The female gave birth to a litter in May and reared her young in the cage, but observations by a video camera revealed that both adults and kits spent 60% of their time in the enclosure from June.

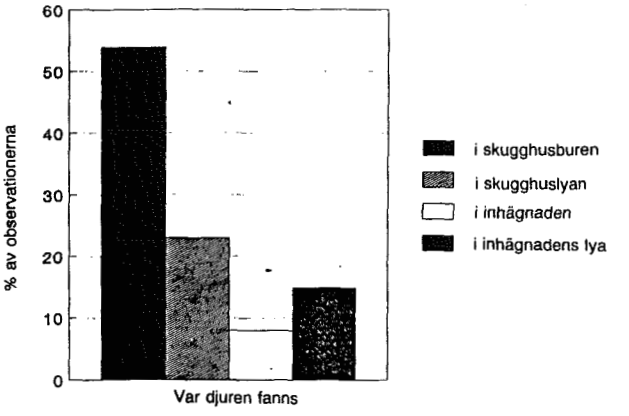
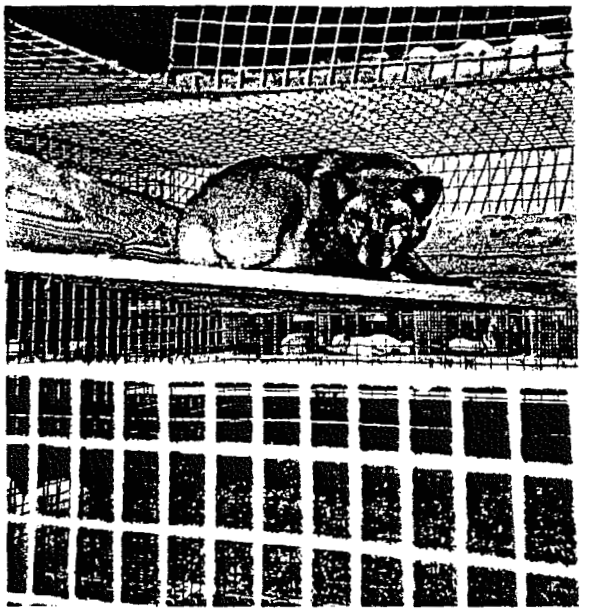


Fig. 1. Area where the raccoon dog pair were in the cage/enclosure combination during the day. Observations were carried out twice daily from 8-9 a.m. and 16-17 p.m. from March 15 - May 5 (whelping).

Finsk Pälstidskrift 27, 11, pp. 274-276, 1993. In SWED. 1 fig., 2 photos, 7 refs. CAB-abstract.

A summary of the shelf trials at the experimental farms in 1992

H. Korhonen, P. Niemelä, J. Mäkelä, J. Asikainen, S. Alasuutari



Examination of 432 blue fox pelts from 3 experimental farms in Finland revealed that 39.9% of pelts from foxes in cages provided with shelves showed wear on the belly vs. 25.8% of those from controls in cages with no shelves (P 0.01), and that pelts from the former were shorter than those from the latter (104.6 cm vs. 106.0, P 0.05). There were no significant differences between the housing groups in pelt quality or fur density score, but there were significant differences between farms.

Finsk Pälstidskrift, 27, 4, pp. 86-87, 1993. In SWED. 2 photos, 3 refs. CAB-abstract.

Trials on the provision of shelves for blue foxes during the rearing period

H. Korhonen, P. Niemelä

From weaning to pelting, 240 blue foxes at Kannus were housed in cages with no shelves (group 1, controls), with a shelf measuring 107 x 26 cm, without or with a division in the middle (groups 2 and 3) or with a V-shaped shelf measuring 107 x 25 cm (group 4). Video monitoring of the foxes revealed that 43.9% rarely used the shelves, 35.4% made occasional use of the shelves, 14.6% used the shelves fairly frequently and 6.1% more frequently by females than by males. Use of the shelf had no adverse effect on growth or pelt length, but compared with controls fur density and quality scores were somewhat lower for foxes in group 2, and the incidence of pelts with a worn belly was higher in groups 2-4 (P 0.05).

Finsk Pälstidskrift, 27, 4, pp. 80-85, 1993. In SWED. 6 tables, 2 figs., 5 photos, 9 refs. CAB-abstract.

Blue fox shelf trials in winter

S. Alasuutari

Of blue fox females (14-21/group), housed in (1) a standard cage, (2) a reversed standard cage without a roof, (3) a box-shaped cage, or (4) a V-shaped cage during the winter months, 73.3, 76.2, 75.0, and 78.6% respectively mated and 33.3, 42.9, 31.3, and 21.4% failed to produce a litter. In the 4 groups, the number of cubs born per mated female averaged 10.5, 80, 10.1, and 13.2, the number of weaned 6.2, 4.9, 6.3, and 9.0, and the average date of mating was 28 Mar., 4 Apr., 29. Mar, and 5 Apr. Details are given of behaviour.

Finsk Pälstidskrift, 28, 3, pp. 57-59, 62.64, 1994. In SWED. 2 tables. CAB-abstract.

Age and context affect the stereotypies of caged mink

Georgia J. Mason

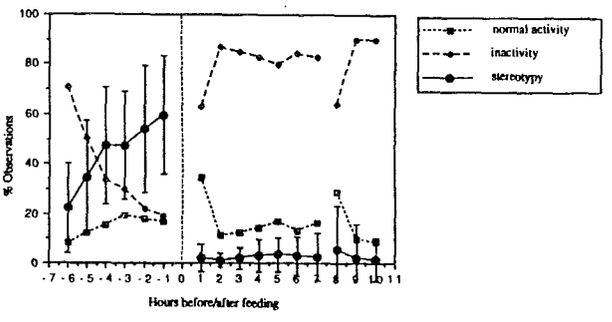


Fig. 3. The diurnal activity of caged adult female mink. (Data are means of 105 animals' average activity levels over 14 days in late March/early April 1988)

The effects of age and context on the stereotypies of caged mink were examined in order to assess the developmental changes undergone by the behaviour, and to find context-specificity that might suggest its motivational bases. Caged mink perform stereotypies consisting of a variety of movements, most commonly pacing and rearing, running in and out of the nest box, and stationary head-twirling or nodding.

Stereotypies are largely performed as feeding-time approaches, and many mink do not show them at all once fed. Stereotypies become more frequent and less variable with age; and in adults, individuals with the highest levels of stereotypy show the least variable forms of the behaviour and are most likely to perform it in more than one contest, i.e. not solely in the pre-feeding period. These data suggest that mink stereotypies become 'established' with age, in the manner described

for stereotypies in other species. However, the behaviour of kits does not follow the pattern seen in adults; kits performing stereotypies in more than one context do not have particularly high levels of the behaviour, nor are their stereotypies particularly unvarying. In addition, post-feeding stereotypies are commonly shown even by very young animals. Thus it cannot be the case that mink stereotypies are performed first in the pre-feeding situation and only later in other contexts via a process of emanicipation. This conclusion is further supported by the finding that the forms of the behaviour often differ pre- and post-feeding. The specific forms and contexts of mink stereotypies suggest certain motivational bases for the behaviour. The rise in stereotypies as feeding time approaches and the sustained levels seen when the animals are not fed indicate hunger as an important factor, and in one dataset, the individuals whose stereotypies were solely pre-feeding used the most longitudinal movements (i.e. pacing and its variants). This suggests that stereotypies, and pacing movements in particular, may stem from appetitive, food-searching behaviour. In contrast, stationary movements such as head-twirling are performed more in the hours after feeding, and in one group of mink their levels declined over the pre-feeding period as feeding time approached. The physical appearance of such movements suggests they might be derived from attemps to escape the cage. Thus mink stereotypies are probably seen in a range of contexts because they develop from several different behaviour patterns, with different motivational bases. The link, in adults, between performance in this range of contexts and the degree of establishment of the behaviour may be explained in one of two ways. In one adult group the data suggest that animals with stereotypy in more than one context incorporate the typically post-feeding stationary movements into their pre-feeding behaviour as if emancipation of this movement had occurred. However, data from the other adult group do not support this hypothesis, and the degree of establishment and the number of contexts in which stereotypies are performed may not be causally linked at all, but instead the independent products of individual propensities to develop stereotypic behaviour. Sex and site differences have yet to be fully explained. Females show consistently higher levels of stereotypy than males, as if perhaps they find the environment more frustrating. There are also enormous differences in the frequency and incidence of the behaviour on the two different sites studied.

Behaviour 127 (3-4), pp. 191-229, 1993. 10 tables, 9 figs., 76 refs. Author's abstract.

The influence of weight, sex, birthdate and maternal age on the growth of weanling mink

Georgia J. Mason

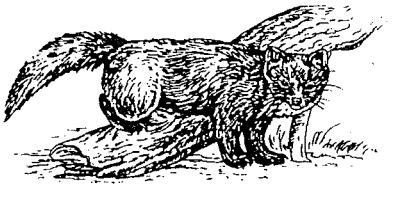
To summarize the most interesting findings, in the mink some litters experience a pause in growth before the transition to reliance on solid food. The evidence suggests that some mothers may deny milk to their young once they reach a certain stage of development, and that it is older mothers that are most likely to do this. The age differences in mothering-style found in mink are difficult to explain in terms of parent-offspring conflict theory. The accelerated development of the litters born latest in the season sug-gests that mink are breeding in a narrow optimum time window, but it is not clear what factors constrain their reproduction thus. The occurrence of the growth pause raises the difficulty of defining weaning in an empirically useful way, as in these litters the time at which the rate of parental investment falls most rapidly would seem to occur a few days before the kits' transition to a reliance on solid food.

J. Zool., Lond. 233, pp. 203-214, 1994. 4 figs., 59 refs. Author's summary.

Effects of different post-weaning handling procedures on the later behaviour of silver foxes

Vivi Pedersen

Male and female cubs from 52 litters of primiparous silver-fox vixens were in pairs randomly assigned to three groups at the age of 8 weeks. Seventeen pairs were exposed to forced handling and 18 pairs were exposed to gentle and unforced handling twice daily for



3 continous weeks post-weaning. Seventeen pairs of fox cubs served as control animals and were not handled.

Behavioural tests performed at the cubs' age of 18, 24, 30, and 32 weeks showed that handling of foxes either forcibly or gently affected the foxes' fear responses towards humans compared with no handling. Handled animals showed less fear responses and more exploration compared with control animals at most ages of testing ($0.05 < P < 0.001$, χ^2). The gently handled group showed a marked reduction of fear responses towards people both known and unknown to them and a less evident reduction of fear responses when exposed to novel stimuli. Foxes forcibly handled showed some reduction of fear responses towards people known and unknown to them and they showed more exploration when exposed to novel stimuli compared with both gently handled animals and control animals at most ages of testing.

It was concluded that gentle handling of fox cubs was a means to reduce later fear responses towards humans and that forced handling was a means to reduce the general fearfulness of the foxes. Positive human-fox relationships may be achieved by gentle, unforced handling and forced handling may produce less emotional foxes, but further research is needed to conclude if one of the handling procedures is more efficient than the other in making the foxes better adapted to the frequent exposures to humans and the different management routines in the farm environment.

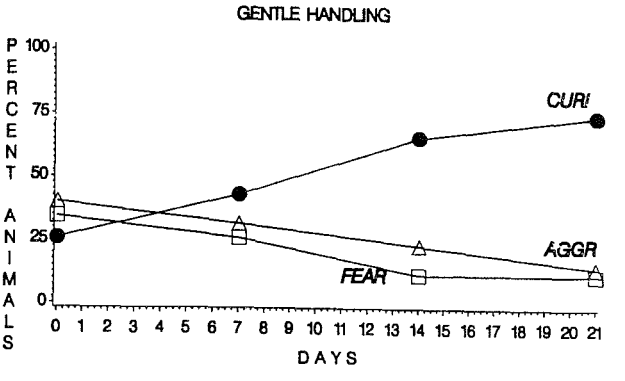


Fig. 2. Behaviour on Days 1, 7, 14 and 21 during gentle handling. Percentage of animals responding either fearfully (FEAR), with defensive aggression (AGGR) or calm or explorative (CURI).

Applied Animal Behaviour Science, 37, pp. 239-250, 1993. 1 table, 5 figs., 18 refs. Author's abstract.

Original Report

Genetic and phenotypic parameters for fur characteristics in Chinchilla lanigera (*Chinchilla laniger*)

C.A. Cappelletti, F.M.B. Rozen

Faculty of Veterinarian Sciences, University of Buenos Aires

Av. Chorroarin 280, CP 1427, Buenos Aires, Argentina

Abstract

Heritabilities, and genetic and phenotypic correlations were estimated for various traits of fur in Chinchilla.

The traits were graded subjectively at the age of 9 months. The analysis was performed by Least Square on paternal half sibs. The $h^2 \pm SD$ were: colour $.66 \pm .09$, general appearance $.48 \pm .09$, head conformation $.43 \pm .08$, shoulder conformation $.58 \pm .09$, body conformation $.19 \pm .06$, veil purity $.80 \pm .10$, underfur purity $.88 \pm .10$, body density $.48 \pm .08$, shoulder veil cover $.65 \pm .09$, side veil cover $.22 \pm .06$ and body veil cover $.62 \pm .09$.

Differences for sex were not significant and for sires significant in all traits except for body conformation and side veil cover ($p < .01$). Genetic correlations ranged from -.10 to 1.00.

Introduction

Production of chinchilla fur of high quality is the economical purpose of any chinchilla enterprise. In Argentina there is not enough information on selection plans directed to that goal, except some isolated efforts.

The present study is a preliminary intent to estimate genetic parameters with data provided by a familiar farm.

The results of heritabilities and genetic correlations of fur traits, graded in subjective scales, are compared with results obtained in other fur-bearing animals such as mink and nutria because of the difficulty in finding specific references in a comparable habitat.

The population of chinchilla in Argentina came from a narrow genetic base made up of local specimens and some imported from USA and Europe.

Material and methods

Traits of 283 chinchillas born of 23 sires were subjectively judged on a private farm during the period 1989-92. The breeding system used consisted of families of five female per male, with natural services in pens under indoor conditions.

At the age of 9 months the kits were graded for fur traits. The traits examined and the scores used for grading were: colour, general appearance, head conformation, shoulder conformation, body conformation, veil purity, underfur purity, body density, shoulder veil cover, side veil cover, and body veil cover, where in colour 1=standard, 2=standard medium-dark and 3=standard dark, and for the other traits 1=scarce (regular), 2=good, 3=very good and 4=excellent.

The data were analyzed by the two-way mixed model:

$$Y_{ijk} = \mu + \alpha_i + s_j + e_{ijk}$$

where Y_{ijk} is the trait's response, α_i the fixed effect due to sex i, s_j a random effect due to sire j and e_{ijk} the random error, for i 0 1, ..., 2, j = 1,..., 23 and k = 1,..., n_{ij},(*Searle, 1971*).

Heritabilities were estimated through the sires variance components considering paternal half-sibs and the genetic correlations by covariance analysis. The standard deviations of h^2 were calculated by the usual formula for the intraclass class correlation coefficient (*Pirchner, 1969*).

Before the computations the original data were edited to include only sires with at least four sons. The mean number of progeny per sire was 12.3.

Results and discussion

Table 1 show the mean and C.V. for the scores of each trait by sex and for males+females. The results are given for all animals without discriminating by sex because the differences were not significant in any traits ($p > .05$). The sires contribution was significant ($p < .01$) for all traits except for body conformation and side veil cover.

Heritabilities

Estimates for h^2, $SD(h^2)$, S^2s, S^2w and r_I for all traits are shown in table 2.

Except for side veil cover (0.22) and body conformation (0.19) with relatively small values, the rest are from medium to high (0.43 to 088).

Table 1 Mean and CV for scores per traits

Traits	Mean		CV		Mean	CV
	M	F	M	F	M+F	M+F
1. Colour	1.8	1.9	.04	.04	1.9	.44
2. General appearance	2.9	2.9	.03	.03	2.9	.29
3. Head conformation	1.5	1.5	.03	.03	2.3	.31
4. Shoulder conformation	1.9	1.9	.04	.04	2.9	.25
5. Body conformation	1.5	1.6	.03	.03	2.5	.25
6. Veil purity	2.4	2.4	.03	.03	2.5	.36
7. Underfur purity	2.5	2.4	.03	.03	2.7	.34
8. Body density	2.7	2.6	.02	.03	2.8	.30
9. Shoulder veil cover	1.6	1.6	.03	.03	2.7	.24
10. Side veil cover	1.3	1.4	.04	.03	2.2	.33
11. Body veil cover	1.5	1.5	.03	.03	2.4	.27

Table 2 Heritability, SD, variance components and intraclass correlation for traits

Trait	h^2	SD	S^2s	S^2W	r_I
1. Colour	.66	.09	.104	.522	.16
2. General appearance	.48	.09	.058	.446	.12
3. Head's conformation	.43	.08	.027	.225	.11
4. Shoulder's conformation	.58	.08	.075	.444	.15
5. Body's conformation	.19	.06	.012	.232	.05
6. Veil's purity	.80	.10	.111	.441	.20
7. Underfur purity	.88	.10	.114	.405	.22
8. Body's density	.48	.08	.052	.380	.12
9. Shoulder's veil cover	.65	.09	.038	.196	.16
10. Side's veil cover	.22	.06	.012	.216	.05
11. Body's veil cove	.62	.09	.039	.213	.15

It is difficult to compare these values with those obtained in other species, but we did not find specific references, at least in Argentina, to chinchilla.

Kenttamies and Vilva (1988), working with black mink and pastel, in two periods of the year, found for general appearence 0.43 and 0.20 in August and November for black and 0.07 and 0.05 for pastel mink. These differences may be explained because it is a compound character and its evaluation is difficult. Mezzadra et al. (1992), found in silver nutria in Argentina $h^2=0.73$ for the same character.

The h^2 for colour is high, 0.68. Lagerkvist and Lundeheim (1990) found for mink 0.42 to 0.93 for standard colour in August and November. Kenttamies and Vilva (1988) estimated in black male mink 0.12 to 0.18 compared with 0.45 to 0.54 for pastel. The authors consider that discrepancies in colour are due to the grading criterium.

For body density h^2 is high, 0.88. Mezzadra et al. (1992) found in nutrias 0.46 and Berg (1993) small values from 0.20 to 0.30. In mink of standard colour Lagerkvist et al. (1990) found h^2 ranging from 0.10 to 0.20.

Correlations

Table 3 shows the estimations of genetic (r_g) and phenotypic (r_f) correlations, with the exception of colour and general appearence because the values were outside the normal range.

All the correlations, r_g and r_f, are positive and relatively high, except $r_g = 0.10$ for shoulder conformation and side veil cover. With these values it can be expected that it is possible to select simultaneously for more than character, but do not forget that r_g and r_f are calculated with subjective grading and it is not simple to isolate the traits without being influenced by others.

Table 3 Estimated genetic (above diagonal) and phenotypic (below diagnonal) correlations

Traits	a	b	c	d	e	f	g	h	i
a. Head conf.	*	.70	.48	.96	1.00	1.00	1.00	.89	.96
b. Shoul. conf.	.50	*	.75	.59	.80	.71	.62	-.10	.61
c. Body conf.	.37	.49	*	.65	.57	.66	.62	.90	1.00
d. Veil purity	.41	.39	.29	*	.87	1.00	.99	.66	.85
e. Underf. purity	.34	.37	.33	.53	*	.99	.79	.72	.62
f. Body density	.36	.33	.34	.49	.57	*	1.00	.76	1.00
g. Shoul. veil cov.	.27	.24	.20	.40	.33	.29	*	.84	.88
h. Side veil cov.	.29	.35	.39	.31	.26	.22	.39	*	.87
i. Body veil cov.	.28	.33	.26	.43	.38	.35	.48	.44	*

Conclusions

In Argentina there are some chinchilla breeding farms but, in general, they do not follow a scientifically designed plan. We know that it is not easy to evaluate external characteristics in live animals in order to improve the fur quality, besides the small size of the sample for estimation, as in our case. However, our results allow us to see that the genetic variability is important and that it is possible to obtain good rates of progress.

Finally, if these results are confirmed in other works, it will be possible to design selection programs for selecting animals with aggregate genotypic values.

Acknowledgement

The authors wish to thank Med. Vet. and Mrs. José M. Caride who kindly provided the information from their farm.

References

Berg, P. 1993. Variation between and within populations of mink.II. Skin and fur characteristics. Acta Agric. Scand., Sect. A. Animal Sci. 43:158-164.

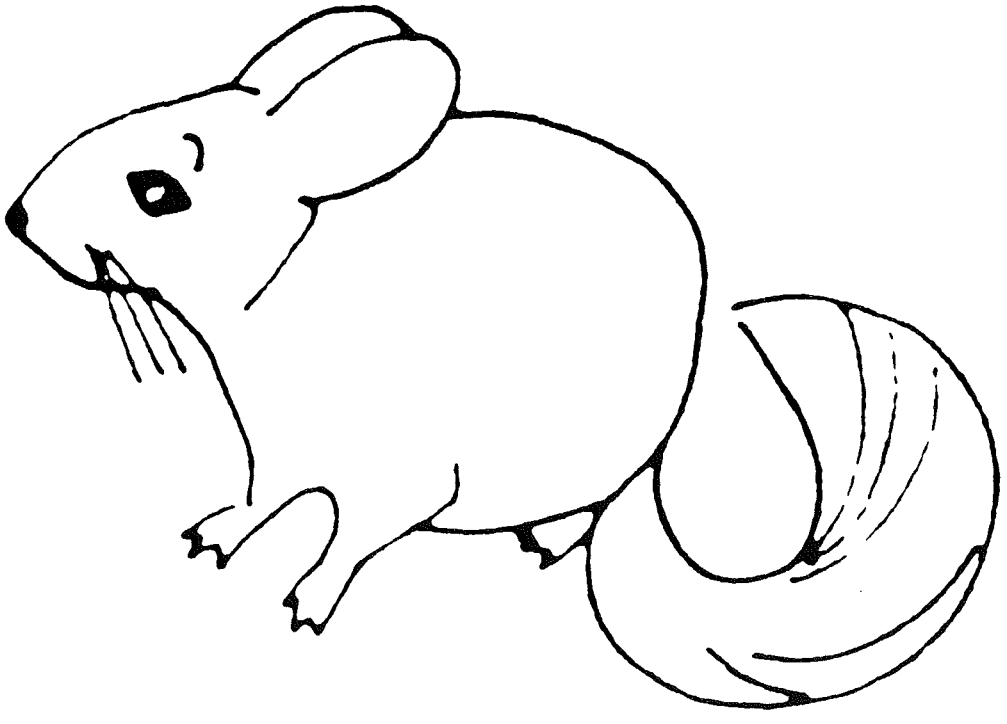
Kenttamies, H. & Vilva, V. 1988. Phenotypic and genetic parameters for body size and fur characteristics in mink. Acta Agric. Scand., 38:243-252.

Lagerkvist, G. & Lundeheim, N. 1990. Fur quality in standard mink-price relationships, heritabilities and genetic and phenotypic correlations. Acta Agric. Scand. 40:367-376.

Mezzadra, C., Milano, C., Nicolini, J. & Faverin, C. 1992. Genetic and phenotypic parameter for fur and growth traits in nutria. Scientifur, Vol. 16, No. 1.

Pirchner, F. 1969. Population Genetics in Animal Breeding. Ed. W.H. Freeman and Co. San Francisco, 273 pp.

Searle, S.R. 1971. Linear Models. Ed. J. Wiley & Sons, N.Y., 532 pp.



Genetic models for the inheritance of the silver colour mutation of foxes

Flemming Skjøth, Outi Lohi, Alun Thomas

We have considered genetic models for the inheritance of the particular colour patterns of silver foxes. The models are evaluated by computation of statistical likelihoods based on observations of related foxes in extended pedigrees. Problems caused by incomplete paternity information are addressed by inferences based on phenotypic observations. The unreliability of subjective evaluations of fur colour also provides difficulty, in particular as *crossfoxes* emerge as being difficult to differentiate. No evidence of linkage between Agouti locus and Extension locus is found in this dataset.

Genet. Res. Camb, 64, pp. 11-18, 1994. 7 tables, 3 figs., 10 refs. Authors' summary.

Effect of selection on digestibility and carcass composition in mink

Gabrielle Lagerkvist, Anne-Helene Tauson

In a 5-generation selection experiment, separate lines of mink (*Mustela vison*) were selected for litter size at 3 weeks (F-line) and body weight in September (BS-line). One unselected line served as a control (C). Nutrient digestibility was studied in a balance experiment with four male kits from each line in the last generation. Carcass composition was determined for four 4th-generation F- and BS-males each that had been killed on September 21. The feed consumption rate was higher in the BS-line animals in the balance experiment than in the F- and C-animals (1687 versus 1532 and 1504 kJ/animal and day). These differences reflected the higher average live weights measured on August 25, of the BS-males (1831 g versus 1728 and 1619). CP and CHO digestibility were similar in all lines, whereas a a numerically small but significant difference in apparent fat digestibility was found between the F- and BS-lines (95%) and the C-line (93%). Average body weights of animals in the carcass composition evaluation were 2607 g (BS-line) and 2023 g (F-line). Retained protein, fat, and energy were significantly affected by line. The amount of protein retained per kg metabolic weight ($kg^{0.75}$) was nearly equal in the two lines, indicating that the animals' genetic capacity for protein retention was similar and probably utilized to its full extent. Retained fat and energy per $kg^{0.75}$ were higher in the BS-line, indicating that the animals had been selected for fat deposition rather than for body size. Hence, selection for body size in mink should be performed by using a selection criterion with which the negative effects of increased fat deposition on reproductive performance can be avoided.

Arch. Anim. Nutr., Vol. 45, pp. 155-160, 1993. 3 tables, 15 refs. Authors' summary.

Embryonic development of the endocrine system in the silver fox after long-term selection for domestic behaviour

L.V. Osadchuk, T.A. Schurkalova

Selection of silver foxes for lack of aggression towards man leads to some destabilization in maturation of separate units of pituitary-testicular and pituitary-adrenal systems during embryogenesis. It was shown that testicular production of testosterone stimulated by chorionic gonadotrophin in vitro was increased more in the earlier period of embryogenesis in a selected group than in an unselected control. The adrenal content and serum level of cortisol were significantly lower in domesticated embryos than in undomesticated ones at the end of embryonic life. Adrenocorticotrophin increased in vitro cortisol production by fetal adrenals in both groups but to the smaller values in domesticated animals.

Proceedings of the 5th World Congress on Genetics Applied to Livestock production, August 7-12, 1994. University of Guelph, Guelph, Ontario, Canada, pp.. 485-488. 5 tables, 3 refs. Authors' summary.

DanMink - the new way of mink breeding

J. Claussen

This paper describes the design and structure of a personal computer program, called DanMink, which has been developed to store performance data on mink and to calculate breeding values. Usage of DanMink in

Denmark has increased from 40 farms (with approx. 65,000 female mink) in 1987 to 400 farms (350,000 mink) in 1989.

Proceedings of the 3rd International Congress for Computer Technology Integrated decision support systems in agriculture successful practical applications, Frankfurt am-Bad soden, May 27-30, 1990 (edited by Kuhlman, F) pp 235-247. 7 refs. In GERM. CAB-abstract.

Colour genetics in foxes

E.M. Koldaeva

This short note is a further contribution to the discussion of colour inheritance in foxes that followed publication of a paper by T.M. Chekalovoi (*Krolikovodstvo i Zverovodstvo (1991) No. 4, 13)*. In particular, it draws attention to the paucity of data on colour inheritance in crosses, and to the genetic heterogeneity of silver foxes.

Krolikovodstvo i Zverovodstvo, No. 4, 11, 1992. In RUSS. CAB-abstract.

A new breeding plan. 1. Background and previous experiences

K.R. Johannessen

Details are given of the reproductive performance, AI and pelt size and quality of mink and foxes in Norway. Long- and short-term possibilities of improving pelt size and quality, litter size, temperament, feed conversion and disease resistencce are considered. Data are presented in 8 tables.

Norsk Pelsdyrblad, 68, 1, pp. 6-9, 1994. 7 tables, 2 figs. In NORW. CAB-abstract.

A new breeding plan. 2. Breeding aims and initiatives

K.R. Johannessen

The feasibility of the genetic improvement of reproduction, pelt size and quality and mothering ability of mink, foxes and arctic foxes in Norway is discussed.

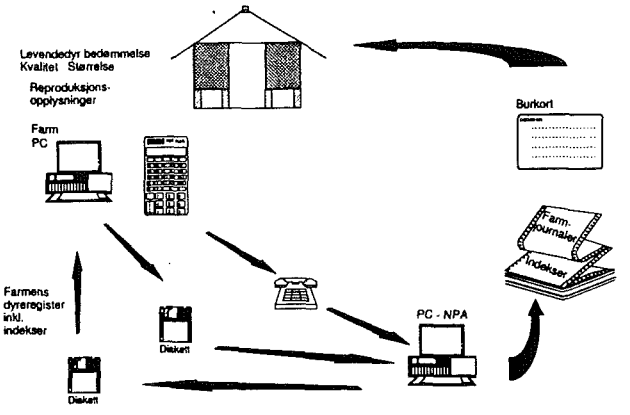


Fig. 1. Informasjonstrømmen i Pelsdyrkontrollen ser vi med utgangspunkt i farmen der dataene oppstår. Herfra kan de innrapporteres på tre måter, skriflig, med håndterminal eller med disketter fra en PC som farmen disponerer. Dataene vil så bli behandlet på en PC hos NPA, og der beregnes så dyrenes avlsverdier (indekser). Disse vil så kunne sendes til farmen skriftlig, sammen med burkort og andre statistiske oversikter. Det vil i tillegg utvikles mulighet for å sende dataene i retur som disketter, som så kan brukes i farmens egen PC, hvorfra de samme rapporter osv. printes ut ved behov.

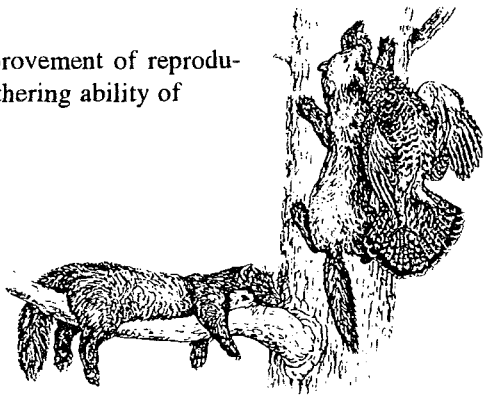
Norsk Pelsdyrblad, 68, 2, pp. 8-10, 1994. 2 figs., 2 photos. In NORW. CAB-abstract.

A gene bank for furbearing animals of different colour types

H. Kenttämies

Possibilities of maintaining unusual mink and fox mutations by the preservation of live animals and the freezing of semen and embryos are discussed, and a proposal is made for the establishment of a Nordic gene bank for fur bearers.

Finsk Pälstidskrift, 27, 11, pp. 270-271, 1993. 2 photos. In SWED. CAB-abstract.



A further chapter in the Mahogany saga

Janne Hansen

1046 pelts from Standard x Wild, Pastel, Pearl, Violet, Silverblue, Demi Buff or Mahogany mink, from Mahogany x Demi Buff and Wild mink and from Red Glow x Wild mink were evaluated. Overall, approximately 50% of the pelts were classified as Mahogany. The best results were obtained from Standard x Mahogany and Mahogany x Demi Buff crossings (83 and 100% Mahogany pelts respectively). In view of the considerable variation in colour purity in pelts from crossbreds, it is suggested that purebreeding will be required for top-quality pelts.

Dansk Pelsdyravl, 57, 2, pp. 42-43, 1994. 1 table. In DANH. CAB-abstract.

cDNA clones encoding mink immunoglobulin λ chains

A.M. Najakshin, J.S. Belousov, B.Yu. Alabyev, S.S. Bogachev, A.V. Taranin

Screening of a mink cDNA library with an antibody probe resulted in the isolation of clone pIGL-2 containing an Ig λ chain coding sequence. The sequence comprised almost the entire V segment as well as J, C, and 3′-untranslated sequences. A second clone, pIGL-10, was isolated by rescreening the cDNA library with the use of pIGL-2 as a probe. pIGL-10 was found to contain a frameshift deletion of a single nucleotide in the C region. pIGL-2 and pIGL-10 were 81% homologous to each other in the FR3 of the V segment, and 95% of the homology was found in their C regions. The J segments of the two clones differed in only one nucleotide position. Comparison of cloned λ chain sequences with those of other mammals revealed that mink V_λ and C_λ genes have the highest homology with their human counterparts. The V_λ sequence of clone pIGL-2 appears to be a homologue of human subgroup III V_λ genes. Southern blot hybridization of mink DNA with the C_λ and V_λ probes derived from pIGL-2 revealed five or six hybridizing C_λ fragments and at least 11 hybridizing V_λ fragments. This suggested that the λ genes in carnivores, like those in primates, have duplicated extensively during evolution.

Molecular Immunology, Vol. 30, No. 13, pp.. 1205-1212, 1993. 1 table, 4 figs., 49 refs. Authors' abstract.

Effect of the "star" gene on the rate of migration of melanoblasts in silver fox (*Vulpes vulpes*) embryos

L.A. Prasolova, L.N. Trut

Star (S) is a semidominant mutation that causes depigmentation of certain parts of the coat in standard silver foxes; the "star" is a depigmented area on the head of heterozygotes (Ss). Skin preparations from newborn SS, Ss and (unaffected) ss animals were studied histologically. The results indicated that the S gene delays the migration of melanoblasts into the regions that will be depigmented. This delay appeared to disrupt interactions between the melanoblasts and the cells of the hair follicles, so that the melanoblasts failed to proliferate, and died.

Genetika, Moskva, Vol. 329, No. 6, pp. 787-789, 1993. In RUSS. 2 figs., 12 refs. Only Russian copy recieved. CAB-abstract.

Inheritance models of North American red fox coat color

Donald R. Johnson, Pall Hersteinsson

The monohybrid and two dihybrid models of red fox (*Vulpes vulpes*) coat-colour inheritance were evaluated using phenotypic frequency data available in the fur trade literature. The monohybrid model fit 62% (N=21) of the samples from the North-west Territories and the insular and coastal parts of Alaska. The Warwick-Hanson (allelic interaction) and modified Iljina (dominance modifier) models fit 97% (N=133) of the samples from other regions. We favor the Warwick-Hanson model over the modified Iljina (Haldane) model with its restrictive assumption that the *B* locus is fixed

for a single allele. The results of some of Iljina's experiments suggest that a part of her silver-phase breeding stock was misidentified as to phenotype. If that was the case, a modifier locus is boviated and the Iljina model is identical with that of Warwick and Hanson.

Can. J. Zool. 71, pp. 1364-1366, 1993. 2 tables, 18 refs. Authors' abstract.

The effect of the S gene on fertility and embryo mortality in foxes

A.I. Zhelezova

In domesticated silver fox females with genotypes ss and Ss at the locus controlling the "starlet" coat colour trait, the number of corpora lutea averaged 7.85 and 7.08 resp. (P 0.05). The number in domesticated and non-domesticated SS females averaged 7.2 and 7.28 resp. The number of corpora lutea was higher in 1- to 2-yr-old Ss and ss females than in females of these genotypes more than or equal to 3 yr, except in possible genotypes at the locus indicated that females homozygous or heterozygous for the S allele had a high level of postimplantation embryo mortality.

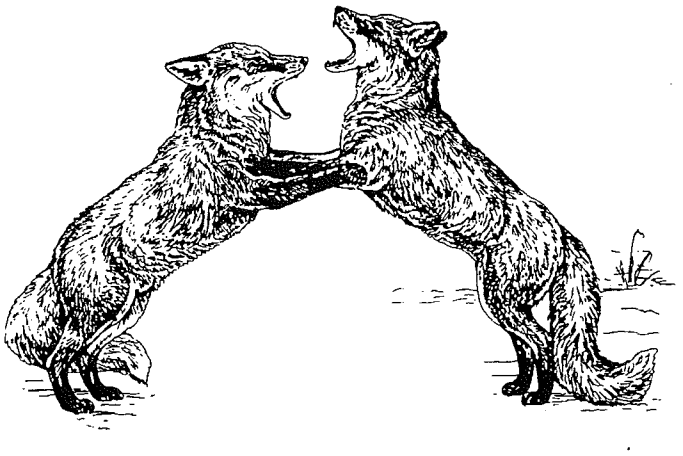
Krolikovodstvo i Zverovodstvo, No. 3, pp. 5-6, 1993. In RUSS. 4 tables. CAB-abstract.

Comparative analysis of the level of heterzygosity for glucose phosphate isomerase (GPI) locus in silver foxes (*Vulpes vulpes*) of domesticated and control populations

L.N. Trut, T.B. Nesterova, S.M. Zakian

This communication is the first step in the studies on the correlation between protein polymorphism and the level of phenotypic diversity. The level of heterozygosity for glucose phosphate isomerase (GPI) locus was analysed in two populations of silver foxes. One of them has been selected for domestic behaviour for many years. This selection vector gave rise to many phenotypic novelties; 46% of the foxes analyzed had aberrant phenotypes. Another population was control bred under the same conditions at the experimental farm of Siberian Dept. Russian Sci. with a commercial purpose. All the foxes analyzed from this population, except one, had a standard phenotype. Among 96 domestic foxes under analysis, only one heterozygote for the GPI locus was detected. Among 112 control foxes, six were heterozygotes. In other words the data obtained indicate no correlation between the level of morphological diversity and the state of heterozygosity of the GPI locus.

Genetika, Moskva, 29, 4, pp. 694-698, 1993. 1 table, 1 fig., 20 refs. Authors' summary.



Periovulatory endocrinology, oocyte maturation, fertilization and fertility in the female blue fox (*Alopex lagopus*)

Wenche Farstad
Department of Forensic Medicine
Norwegian College of Veterinary
Medicine, P.O. Box 8146
N-0033 Oslo, Norway

New doctor in the family. We congratulate Dr. W. Farstad with the new title and the fine thesis.

This volume contains 8 papers (published or in press) with the author as sole author or coauthor. These are followed by 13 pages of discussion and general conclusions. References are listed separately for each paper. All papers are abstracted in SCIENTIFUR according to the list of papers. The thesis was based on the following papers.

1. *Farstad, W.* (1992). Reproduction in the blue fox (*Alopex lagopus*). In: Tauson, A.H. and M. Valtonen (Eds.). Reproduction in Carnivorous Fur Bearing Animals. Nordiska Jordbruksforskares Forening, Utredningsrapport 75, Jordbrugsforlaget, Copenhagen, pp. 119-133. **Scientifur, Vol. 19, No. 2, 1995.**

2. *Farstad, W., Mondain-Monval, M., Hyttel, P., Smith, A.J. and D. Markeng* (1989). Periovulatory endocrinology and oocyte maturation in unmated mature blue fox vixens (*Alopex lagopus*). Acta Vet. scand. 30: 313-319. **Scientifur, Vol. 15, No. 4, pp. 285, 1991.**

3. *Mondain-Monval, M., Farstad, W., Smith, A.J., Roger, M. and N. Lahlou* (1993). Relationship between gonadotrophin, inhibin and sex steroid secretion during the periovulatory period and the luteal phase in the blue fox (*Alopex lagopus*). J. Reprod. Fertil. Suppl. 47. In press. **Scientifur, Vol. 19, No. 2, 1995.**

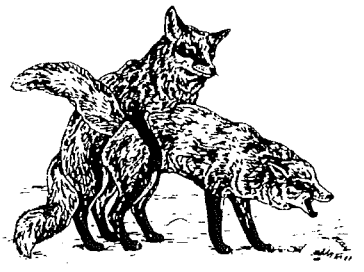
4. *Hyttel, P., Farstad, W., Monain-Monval, M., Bakke-Lajord, K. and A.J. Smith* (1990). Structural aspects of oocyte maturation in the blue fox (*Alopex lagopus*). Anat. Embryol. 181: 325-331. **Scientifur, Vol. 19, No. 2, 1995.**

5. *Farstad, W., Hyttel, P., Grøndahl, C., Mondain-Monval, M. and A.J. Smith.* Fertilization and early embryonic development in the blue fox (*Alopex lagopus*). Mol. Reprod. Dev. In press. **Scientifur, Vol. 19, No. 2, 1995.**

6. *Farstad, W., Hyttel, P., Grøndahl, C., Krogenæs, A., Mondain-Monval, M. and A.L. Hafne* (1993). *In vitro* fertilization of *in vivo* matured oocytes in the blue fox (*Alopex lagopus*). J. Reprod. Fertil. Suppl. 47. In press. **Scientifur, Vol. 19, No. 2, 1995.**

7. *Farstad, W., Fougner, J.A. and C.G. Torres* (1992). The effect of sperm number on fertility in blue fox vixens (*Alopex lagopus*) artificially inseminated with frozen silver fox (*Vulpes vulpes*) semen. Theriogenology 37: 699-711. **Scientifur, Vol. 17, No. 3, pp. 219, 1993.**

8. *Farstad, W., Fougner, J.A. and C.G. Torres* (1992). The optimum time for single artificial insemination of blue fox vixens (*Alopex lagopus*) with frozen-thawed semen from silver foxes (*Vulpes vulpes*). Theriogenology, 38: 853-865. **Scientifur, Vol. 18, No. 2, pp. 113, 1994.**



older males mated with more females than did young males (P 0.01). Social status of females was significantly correlated with cub mortality (decreasing with increasing social rank), and litter size was significantly affected by body weight at mating (decreasing with increasing body weight, P 0.05), but body weight at whelping had no significant effect on litter size or cub mortality. Females housed next to females with litters of at least 7 cubs tended to have a poor whelping performance.

Finsk Pälstidskrift, 27, 4, pp. 90-93, 1993. 3 tables, 5 photos, 5 refs. In SWED. CAB-abstract.

Species differences in fertility after artificial insemination with frozen semen in fox pure breeding

W.K. Farstad, J.A. Fougner, K.A. Berg

Field trials with frozen silver fox semen using a programmable freezer and a new automatic freezing programme were initiated in 1988. Conception rates of 80% and mean litter size of 8 cubs resulted when frozen silver fox semen was used to inseminate blue fox vixens. Vixens were inseminated twice (24-h interval) and 100-150 million spermatozoa were deposited intrauterinely at each insemination. Also, silver fox females have been artificially inseminated intrauterinely with frozen silver fox semen (double insemination, 100 million spermatozoa per insemination) yielding an 81% conception rate and 3.6 cubs per litter at whelping (n=21, 1991). These results are comparable with those obtained for artificial insemination with fresh semen. A gene bank has been established by freezing silver fox semen obtained from superior males, i.e., rare or otherwise valuable mutants. It was assumed that cryopreservation of blue fox semen would benefit from the improvement in post-thaw semen quality obtained by the new freezing technique developed for silver fox semen. However, artificial intrautrine insemination of 70 (1990) and 52 (1991) blue fox vixens with frozen blue fox semen (2 x 100 million spermatozoa) resulted in low (33%, 1990 and 48%, 1991) conception rates and mean litter sizes of only 2.3 and 5.8 cubs born per litter, respectively. Electron microscopical studies of post-thaw acrosome integrity of spermatozoa from blue and silver foxes did not reveal any differences between the two species in the severity of prevalence of acrosomal damage. Conclusively, differences are observed between the two fox species in fertility of semen frozen by the same freezing method, but studies of post-thaw acrosome integrity of the spermatozoa or other semen parameters studied by means of light- or electon microscopy could not explain the differences in fertility results.

Norwegian Journal of Agricultural Sciences, Suppl. no. 9, pp. 115-121, 1992. 1 table, 10 refs. Authors' summary.

Plasma progesterone during the luteal phase and pregnancy in parturient and barren blue fox vixens

N.M. Valberg, W. Farstad

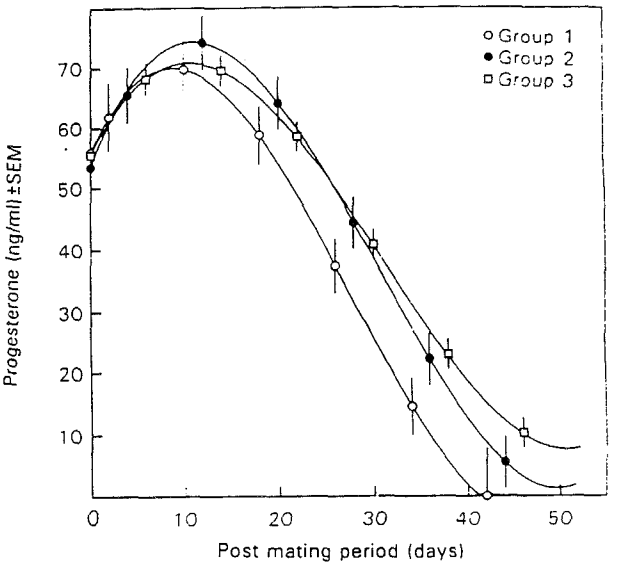
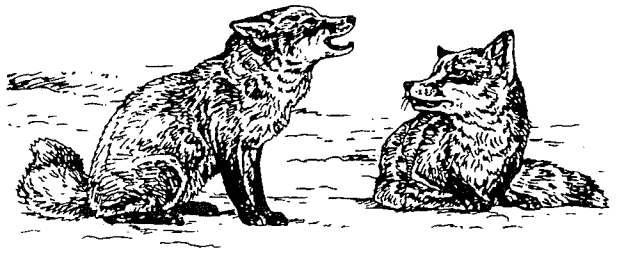


Fig 1. Plasma progesterone concentrations ± SEM during the luteal phase/pregnancy in the three groups of blue fox vixens. Group 1: mated vixens with no signs of implantation in uterus. Group 2: mated vixens with implantation zones in uterus, but no cubs at parturition. Group 3: parturient vixens.

The variation in progesterone secretion during the luteal phase and pregnancy in blue fox vixens was analyzed. Progesterone was measured in blood plasma once or twice a week using radioimmunoassay. The material was allocated into three groups; five mated, but barren,



blue fox vixens, six mated vixens with implantation zones in the uterus, but no cubs at parturition, and 26 normally parturient vixens. The progesterone profiles for the three different groups of females showed a steady increase in progesterone immediately after mating. Maximum values were observed on days 8-12 of pregnancy. Then the progesterone levels decreased gradually until delivery around day 52. The levels of progesterone were found to be significantly different ($P<0.05$) between non-pregnant and pregnant females from day 22 after mating. The plasma progesterone level seems to be affected by the presence of conceptuses.

Acta Agric. Scand., Sect. A, Animal Sci. 42: 232-239, 1992. 3 tables, 2 figs. Authors' summary.

In vitro techniques in fox reproduction

W. Farstad, A. Krogenæs, E. Nagyová, A.L. Hafne, P. Hyttel

The domestic blue fox (*Alopex lagopus*) is extensively farmed in Scandinavia, and represents a genetic reserve, as well as a model for basic reproductive studies for the wild arctic fox, which is a canid species threatened by extinction. The development of in vitro techniques may be a way to preserve genetic material from the wild fox population. The scope of this paper was to review the authors' first experiments with maturation and fertilization in vitro (IVM, IVF) of fox oocytes. IVF was attempted after collection of in vivo matured oocytes 2 days after maximum vaginal electrical resistance, from 6 farmed blue fox females in natural oestrus. IVM was carried out in oocytes collected from ovaries of 29 vixens in pro-oestrus, i.e. prior to the preovulatory LH peak. The oocytes for IVM were cultured in bovine IVM media (M199, 10% FCS, w/wo FSH), but without LH. In the IVF experiment, 2 of 36 inseminated ova developed beyond the 4-cell stage. One embryo developed to a morula 144 h after insemination. In the IVM experiment 325 oocytes were evaluated, 91% (w/FSH) vs 78% showed germinal vesicle breakdown. GVBD was observed after 24 h in culture (19% w/FSH vs 27%), MI was reached at 48 h (70% vs 40%), MII at 48-72 h (48% vs 22%), but the majority of MII were seen at 96 h after insemination (73% vs 66%). Duration of IVM (96 h) was somewhat longer than observed in vivo (72 h). Although dissociation of cumulus cells was observed, corona radiata cells were highly connected with the oocytes, suggesting incomplete cytoplasmatic maturation.

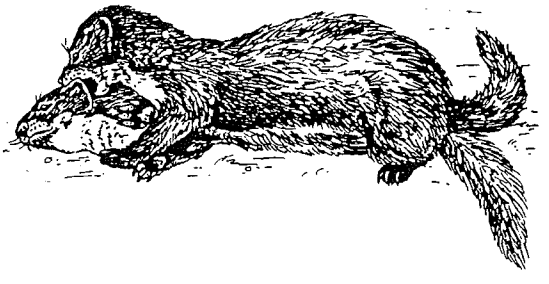
Livestock Production Science, 36, pp. 23-27, 1993. 15 refs. Authors' summary.

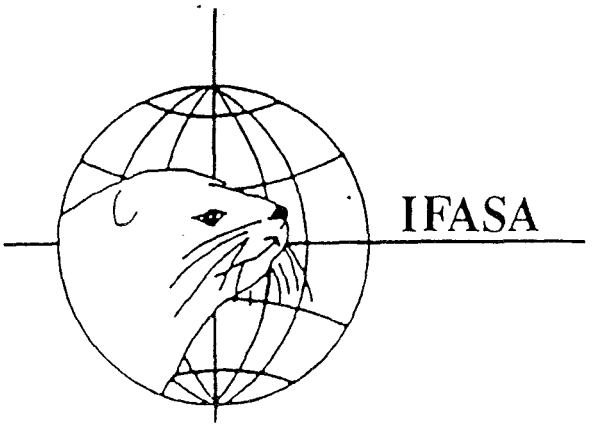
The effect of changes in the light regime on endocrine function of the gonads in silver foxes

L.V. Osadchuk

Beginning in Sep., anoestrous female silver foxes were given artificial light of constant duration and 2 h additional light from midnight to 02.30 h. This regime significantly shortened the duration of anoestrus, and stimulated secretion of ovarian hormones. However, ovulation did not occur, and progesterone secretion from the corpora lutea gradually decreased.

4 Vses konf 'Endokrin sistema organizma i vred faktory okruzh srede', 15-19 sent 1991 Tez dokl 177, 1991. In RUSS. Only CAB-abstract received. CAB-abstract.





INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

Be member of IFASA and subscriber to SCIENTIFUR and hereby put yourself in front of

INTERNATIONAL SCIENCE - INFORMATION AND COOPERATION IN FUR ANIMAL PRODUCTION

MEMBERSHIP FEE (NOK = Norwegian kroners)

PERSONAL MEMBERSHIP	NOK 170,-
INSTITUTIONAL MEMBERSHIP which include 1 personal + 1 subscription	NOK 1700,-

SCIENTIFUR SUBSCRIPTION

IFASA Members	NOK 500,- / vol.
Ordinary subscribers	NOK 600,- / vol.

SCIENTIFUR INDEX: See special announcement.

Write for further information and sample copy of SCIENTIFUR

IFASA/SCIENTIFUR
P.O. Box 145, Økern
N-0509 Oslo, Norway
Fax.: +47 32 87 53 30

Original Report

Responses of growing mink to supplemental dietary copper and biotin

C.R. Bush, J.C. Restum, S.J. Bursian, R.J. Aulerich

Department of Animal Science, Michigan State University, East Lansing, MI; USA 48824-1225

Abstract

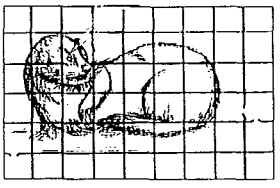
Mink (*Mustela vison*) were fed a diet that contained 0, 100, or 200 ppm supplemental Cu, as $CuSO_4 \cdot 5H_2O$ and 0 or 0.3 ppm supplemental d-biotin for 132 days to determine the effects on growth and fur colour. There were no significant ($P < 0.05$) effects on the mink body weight gains, hematological parameters, or brain, liver, kidney, heart, or adrenal gland weights. Spleen weights of the males fed 200 ppm Cu without added biotin were significantly ($P < 0.05$) greater than those of the control males. The mink liver and kidney Cu, Zn, and Fe concentrations were highly variable but showed trends toward higher hepatic Cu and lower hepatic Fe concentrations with increasing dietary Cu concentrations. There was also a trend toward darker fur in the male mink fed the Cu-supplemented diets.

Introduction

The addition of Cu to the diet in excess of the requirement has yielded beneficial effects on growth rate in swine (*Hawbaker et al., 1961; Braude, 1965; Castell and Bowland, 1968; Drouliscos et al., 1970; Radecki et al., 1992; Dove, 1993*), poultry (*Smith, 1969; Jenkins et al., 1970; King, 1972*), and rabbits (*King, 1975*).

According to Castell and Bowland (1968), Drouliscos et al. (1970), and Jenkins et al. (1970), there is a greater growth response to supplemental Cu in animals fed high fish meal diets, as oppposed to soybean meal diets, because the minerals in fish meals tend to bind Cu. Because typical mink diets usually contain considerable amounts of fish and/or fish meals, studies were conducted to determine if supplemental dietary Cu has beneficial effects on growth rate in mink (*Aulerich and Ringer, 1976; Aulerich et al., 1982*). The earlier feeding trial (*Aulerich and Ringer, 1976*) showed a statistically significant ($P < 0.05$) growth response in male mink fed 50 ppm supplemental Cu (from $CuSO_4 \cdot 5H_2O$), and a greater (although not statistically significant) increase in the body weight gains of the males fed 25 ppm supplemental Cu. Both 25 and 50 ppm supplemental Cu cuased a numerical increase in body weight gains of the female mink on the trial. The later feeding trial showed no significant increase in body weight gains during the postweaning growth period in mink fed up to 200 ppm supplemental Cu.

Brooks et al. (1984) have shown that the effect of Cu as a growth promotant in swine was enhanced when both Cu and biotin were added to the diet. It was suggested that the antimicrobial action of high concentra-



tions of Cu may interfere with adequate microbial biosynthesis of biotin in the gut resulting in suboptimal biotin concentrations. Adding both Cu and biotin to the diet provided adequate concentrations of biotin for the animals, resulting in greater growth promotion than that obtained with supplemental Cu alone.

In the present study, the influence of supplemental dietary Cu and/or biotin on postweaning growth rate, hematological parameters, organ weights, liver and kidney Cu, Zn, and Fe concentrations, and fur colour of mink was investigated.

Materials and methods

On July 29, 1993, 96 natural dark, weaned mink kits were assigned by body weight to 6 groups, each containing 8 males and 8 females, and placed on the dietary treatments shown in table 1. Littermates were not assigned to the same dietary group in an attempt to minimize genetic influence on response to the treatments. A sample of diet 1 (control) was collected for nutrient analysis. Diets 1, 2 and 3 were analyzed for Cu concentrations and diets 1 and 4 were analyzed for biotin concentrations.

Table 1. Composition of experimental diets.

	Diet[1]					
Ingredients	1	2	3	4	5	6
Cereal, %	22	22	22	22	22	22
Fish trimmings, %	17	17	17	17	17	17
Poultry by-products, %	22	22	22	22	22	22
Beef liver, %	8	8	8	8	8	8
Pork, %	5	5	5	5	5	5
Water, %	26	26	26	26	26	26
Copper[2], ppm	0	100	200	0	100	200
d-biotin[3], ppm	0	0	0	0.3	0.3	0.3

[1] Proximate analysis of diet 1 (as fed basis) yielded 63.16% moisture, 14.05% crude protein, 7.61% fat, 1.29% crude fiber, and 4.53% ash (Litchfield Analytical Services, Litchfield, MI).

[2] Supplied as $CuSO_4 \cdot 5H_2O$; J.T. Baker, Inc., Philipsburg, NJ; copper analysis of diets 1, 2, and 3 (dry weight basis) yielded copper concentrations of 35.8, 308, and 568 ppm, respectively (MSU Animal Health Diagnostic Laboratory, East Lansing, MI).

[3] Sigma Chemical Co., St. Louis, MO; biotin analysis of diets 1 and 4 yielded biotin concentrations of 0.196 and 0.431 ppm (wet weight basis), respectively (National Environmental Testing, Inc., Chicago, IL).

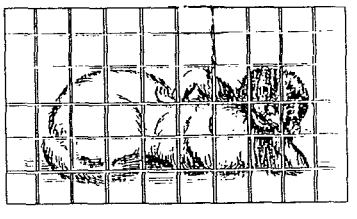
During the study, the animals were housed individually in open-sided sheds in mink grower cages (61 cm L x 30.5 cm W x 38 cm H) with attached wooden nest boxes (20 cm L x 16.5 cm W x 29 cm H). They were cared for according to standard operating procedures of the Michigan State University Experimental Fur Farm which are similar to those employed on commercial mink farms. Feed and drinking water were provided *ad libitum*. The mink were fed the experimental diets for 132 days, from approximately 10 weeks of age through pelting on December 7, 1993. Mink body weights and average individual daily feed consumption (based on 2 consecutive days' consumption) were measured every 2 weeks. At the termination of the study, 4 male and 4 female mink from each dietary group were anesthetized (0.3 ml ketamine HCl[1]) and blood samples taken via the jugular vein for hematologic measurements. All the mink were then euthanized (CO_2) and pelted. Necropsies were performed on the carcasses and organ weights (brain, liver, heart, kidneys, spleen, and adrenal glands) recorded.

Samples of liver and kidney from 4 male and 4 female mink per group were analyzed for Cu, Zn, and Fe concentrations. In order to evaluate the effects of Cu and biotin supplementation on fur colour, the pelts from the mink were arranged by sex according to IA colour (darkest to lightest) and assigned numerical scores of 1 to 5 as follows: darkest 20% = 5; the next darkest 20% = 4, etc. The colour scores were then averaged for the males and females in each group to assess the effects of the treatments on fur colour. Where appropriate, the data were analyzed by the General Linear Methods procedure of SAS (*SAS Institute Inc., 1992*). Means of the following treatment parameters were compared using the Student's t-test at $P>0.05$; control (0 ppm Cu, 0 ppm biotin) vs. 100 ppm cu, 0 ppm biotin, control vs. 200 ppm Cu, 0 ppm biotin; control vs. 0 ppm Cu, 0.3 ppm biotin; control vs. 100 ppm cu, 0.3 ppm biotin; control vs. 200 ppm Cu, 0.3 ppm biotin; 100 ppm Cu, 0 ppm biotin vs. 100 ppm Cu, 0.3 biotin; and 200 ppm Cu, 0 ppm biotin vs. 200 ppm Cu, 0.3 ppm biotin.

Table 2. Mean initial and final body weights, body weight changes, fur color scores of mink fed diets containing various concentrations of supplemental copper and d-biotin (mean ± S.E.).

		Body weight (g)					
		Initial		Final		Change	
Group	Treatment	No.	7-27-93	No.	12-7-93		Fur color score[1]
Males							
1	0 ppm Cu; 0 ppm biotin; control	8	1211 ± 51.6	8	2310 ± 82.9	1099	2.63 ± 0.35
2	100 ppm Cu; 0 ppm biotin	8	1213 ± 50.6	8	2422 ± 74.6	1209	3.50 ± 0.61
3	200 ppm Cu; 0 ppm biotin	8	1225 ± 43.8	8	2403 ± 90.2	1178	3.13 ± 0.54
4	0 ppm Cu; 0.3 ppm biotin	8	1222 ± 44.1	8	2285 ± 92.5	1063	2.88 ± 0.45
5	100 ppm Cu; 0.3 ppm biotin	8	1222 ± 42.9	8	2306 ± 106.0	1084	3.13 ± 0.45
6	200 ppm Cu; 0.3 ppm biotin	8	1222 ± 41.4	8	2326 ± 76.2	1104	3.25 ± 0.42
Females							
1	0 ppm Cu; 0 ppm biotin; control	8	813 ± 33.5	8	1233 ± 76.0	420	3.25 ± 0.42
2	100 ppm Cu; 0 ppm biotin	8	821 ± 35.5	8	1288 ± 73.5	467	2.63 ± 0.43
3	200 ppm Cu; 0 ppm biotin	8	818 ± 36.7	7	1257 ± 59.9	439	3.86 ± 0.51
4	0 ppm Cu; 0.3 ppm biotin	8	819 ± 29.0	8	1197 ± 36.6	378	3.25 ± 0.55
5	100 ppm Cu; 0.3 ppm biotin	8	827 ± 27.0	8	1296 ± 75.6	469	2.50 ± 0.35
6	200 ppm Cu; 0.3 ppm biotin	8	829 ± 23.0	5	1160 ± 58.4	331	2.80 ± 0.72

[1] Mink pelts were ranked from darkest (blackest) to lightest. The darkest 20% were assigned a score of 5; the next darkest 20% were assigned a score of 4, etc. The lightest 20% of the pelts received a score of l.



[1]Ketaset, 100 mg ketamine HCl/ml; Fort Dodge Laboratories, Inc., Fort Dodge

Results and discussion

Four mink died (1 female in Group 3 and 3 females in Group 6) during the study. Since these mink were all fed 200 ppm supplemental Cu, it may be that this high concentration of Cu had an adverse effect on the health of the females in these groups. Necropsy of the females that died, however, revealed no lesions or alterations pathognomonic of Cu toxicosis, such as anorexia, melena, weakness, pallor, icterus, gastric ulcers, and hepatic and renal necrosis (*Osweiler et al., 1985*). In a previous study conducted in our laboratory (*Aulerich et al., 1982*), no toxic effects were observed in natural dark mink fed up to 200 ppm supplemental Cu (as $CuSO_4 \cdot 5H_2O$) for 357 days, although Brandt (1983) reported 50% mortality in male pastel mink fed 320 ppm cu (300 ppm supplemental Cu, as $CuSO_4$) from 90 days post-partum to pelting. To our knowledge, the concentration of dietary Cu that is toxic to natural dark mink has not been determined.

In this feeding trial, there were no statistical differences in body weight gains of the male or female mink fed the various concentrations and combinations of Cu and biotin, although the greatest body weight gains generally occurred in the mink fed supplemental Cu (table 2). These results are similar to those obtained in our earlier trial (*Aulerich et al., 1982*) where Cu supplementation up to 200 ppm failed to produce a statistically significant increase in body weight gains during the growing period, as had been observed previously with natural dark male mink fed 50 ppm supplemental Cu (*Aulerich and Ringer, 1976*).

Although Brooks et al. (1984) showed that the addition of both Cu and biotin to the diet of growing pigs increased the growth rate by 14.4%, whereas the addition of Cu alone increased it by only 2.3%, the addition of d-biotin to the mik diets containing supplemental Cu did not produce a beneficial effect on either male or female mink body weight gains. Brooks et al. (1984) suggested that the antimicrobial action of Cu decreased the biosynthesis of biotin, resulting in a marginal deficiency of that vitamin.

The results from this study suggest that long-term feeding of a typical mink diet containing 0.196 ppm biotin (wet weight) supplemented with up to 200 ppm supplemental Cu to dark mink does not produce suboptimal biotin concentrations. It may be that mink do not have an active transport system for the absorption of biotin from the gut as found in other species (*Wehr et al., 1980*) and/or that because of their short digestive tract and rapid rate of food passage (*Bleavins and Aulerich, 1981*), which would tend to limit intestinal microfloral synthesis of biotin, they may not be as dependent on microbial synthesis of biotin as other species. Also, no clinical signs of biotin deficiency (achromotrichia of the underfur, loss of guard hairs, and crusty exudate around the eyes and nose, *Aulerich et al., 1981*) were observed in any of the mink fed the Cu-supplemented diets. We have previously shown that the addition of up to 0.33 ppm d-biotin to a conventional mink diet prior to and during the reproductive period did not result in any obvious beneficial or detrimental effects on preweaning kit growth or survival (*Aulerich et al., 1989*).

Except for the male mink in Group 3 (200 ppm cu, 0 ppm biotin) that consumed significantly more feed than the control (Group 1) males during the 4th and 5th weeks of the trial, feed consumption by the males and females in the groups compared was not statistically different. Dove (1993) suggested that an increase in average daily feed intake in swine due to the addition of Cu may indicate that Cu plays a role in increasing the appetite of weaning pigs during the first 14 days post-weaning. Feed consumption of the mink fed supplemental Cu in this trial, however, was not significantly greater than in the controls during the first few weeks following Cu supplementation.

Analysis of the mink blood samples for red and white blood cell counts, hemoglobin concentrations, and hematocrit values[2] showed no statistically significant differences in these hematologic parameters, by sex, between the dietary groups compared. Aulerich et al. (1982) also found no statistical differences in hematocrit or hemoglobin values of natural dark mink fed

[2]Analysis by Michigan State University Clinical Pathology Laboratory

from 0 to 200 ppm supplemental Cu for 357 days. Brandt (1983), however, reported a statistically significant decrease in hemoglobin concentration of male, pastel mink fed 300 ppm supplemental Cu from 3 months post-partum to pelting but noted no differences in hematocrit values in these mink or in the hemoglobin concentrations and hematocrit values of males fed 150 ppm supplemental Cu.

In this study, brain, liver, kidney, heart, and adrenal gland weights (expressed as absolute weight and as a percentage of body weight) were not affected by the supplemental Cu and/or biotin. Spleen weights (expressed as absolute and relative weights) of the males in Group 3 (200 ppm Cu, 0 ppm biotin) were, however statistically greater than those of the control males in Group 1 (5.60 ± 0.55 vs. 3.85 ± 0.24 g, respectively; mean $\pm$ standard error, absolute wet weight). Unfortunately, the spleens were not examined histologically and the reason for the splenomegaly was not determined.

The mink liver and kidney Cu, Zn, and Fe concentrations are shown in Table 3. The statistical differences noted in some of the organ mineral concentrations are difficult to interpret and may be due, in part, to the small sample size. There was a general increase (except in Groups 1 and 2) in hepatic Cu concentrations in both males and females with increasing dietary Cu concentrations, which is consistent with reports in the literature for mink (*Aulerich et al., 1982*) and some other animals fed "high" concentrations of Cu (*Owen, 1965; Suttle and Mills, 1966; Anon., 1991*). Except for the liver Cu concentrations of the male in Group 1 (control) and 3 (200 ppm Cu, 0 ppm biotin) and females in Groups 3 (200 ppm Cu, 0 ppm biotin) and 6 (200 ppm Cu, 0.3 ppm biotin), the liver and kidney Cu concentrations of the mink were within the ranges reported by Stejskal et al. (1989) for "normal" 7-month-old, natural dark, male and female mink fed a typical conventional mink diet that contained 6.5 ppm Cu, 41 ppm Zn, and 91 ppm Fe (wet weight).

Table 3. Copper, zinc, and iron concentrations in livers and kidneys of mink fed diets containing various concentrations of supplemental copper and d-biotin (mean $\pm$ S.E.).

			Liver element concentration (ppm wet weight)[1]			Kidney element concentration (ppm wet weight)[1]		
Group	Treatment	No.	Copper	Zinc	Iron	Copper	Zinc	Iron
Males								
1	0 ppm Cu, 0 ppm biotin (control)	4	46.6 ± 14.31	28.3 ± 2.25	321 ± 13.9	4.32 ± 0.36	19.3 ± 0.98	100 ± 23.8
2	100 ppm Cu, 0 ppm biotin	4	17.1 ± 2.96	25.3 ± 0.74	369 ± 42.5	3.58 ± 0.11	17.4 ± 0.89	79 ± 17.5
3	200 ppm Cu, 0 ppm biotin	4	45.1 ± 8.65	35.1 ± 2.56	249 ± 33.3	3.90 ± 0.06	19.3 ± 1.16	63 ± 6.6
4	0 ppm Cu, 0.3 ppm biotin	4	12.9 ± 3.24[2]	23.9 ± 1.22	431 ± 43.4	4.21 ± 0.18	18.6 ± 0.62	86 ± 15.5
5	100 ppm Cu, 0.3 ppm biotin	4	21.3 ± 4.64	30.2 ± 2.40	356 ± 77.9	4.25 ± 0.14[3]	21.7 ± 1.36	107 ± 14.0
6	200 ppm Cu, 0.3 ppm biotin	4	42.1 ± 5.39	29.7 ± 2.44	186 ± 56.3	4.33 ± 0.39	19.1 ± 0.86	70 ± 16.0
Females								
1	0 ppm Cu, 0 ppm biotin (control)	4	20.6 ± 2.32	31.6 ± 2.27	408 ± 79.8	5.25 ± 0.67	20.5 ± 1.52	94 ± 8.7
2	100 ppm Cu, 0 ppm biotin	4	10.2 ± 1.93	21.6 ± 1.12[2]	328 ± 14.6	4.29 ± 0.29	18.6 ± 0.37	110 ± 14.0
3	200 ppm Cu, 0 ppm biotin	4	44.0 ± 8.08	29.1 ± 2.40	275 ± 24.9	4.96 ± 0.26	18.9 ± 0.85	83 ± 11.7
4	0 ppm Cu, 0.3 ppm biotin	4	29.6 ± 8.33	28.7 ± 1.49	361 ± 33.3	4.69 ± 0.34	20.4 ± 1.08	132 ± 8.8
5	100 ppm Cu, 0.3 ppm biotin	4	37.8 ± 9.62	32.4 ± 2.26[3]	527 ± 79.6	4.97 ± 0.29	19.2 ± 0.23	95 ± 13.0
6	200 ppm Cu, 0.3 ppm biotin	4	57.9 ± 12.70[2]	33.8 ± 2.23	267 ± 102.1	6.38 ± 0.69	22.6 ± 1.40	121 ± 34.6

[1] Mean ± S.E.

[2] Significantly different from control ($P < 0.05$).

[3] Significantly different from Group 2 ($P < 0.05$).

The mink liver and kidney Zn concentrations, except for the males in Group 3 (200 ppm Cu, 0 ppm biotin), were also within the ranges reported by Stejskal et al. (1989) for "normal" mink of this age, sex, and colour phase. Although the differences were not statistically significant, the trend toward lower mean liver Fe concentrations in the mink fed 200 ppm supplemental Cu, with or without added biotin, are notable and may be associated with the antagonistic interaction between Cu and Fe (*Anon., 1987*). Stejskal et al. (1989) reported ranges of 186 to 727 and 328 to 882 ppm Fe in the livers and 88 to 330 and 134 to 279 ppm in the kidneys of "normal" seven-month-old, natural dark, male and female mink, respectively.

Hair colour of the mink fed the various concentrations of Cu and biotin was evaluated (but not statistically analyzed) because fur colour is an important characteristic in dark mink, Cu is an essential mineral in melanin (the primary pigment in the hair of dark mink) formation (*Aulerich et al., 1981; Anon., 1991*), and the results of a previous study conducted in our laboratory (*Aulerich et al., 1982*) showed darker hair in male mink (females were not evaluated) fed 100 or 200 ppm Cu compared to those fed 0, 25, or 50 ppm Cu. As shown in Table 2, the male mink fed the Cu-supplemented diets in this trial also had darker fur (higher pelt scores) than the males that were fed no supplementary dietary Cu. This trend, however, was not observed in the females, which we cannot explain. Although one of the clinical signs of Cu deficiency in mink is hypochromotrichia (*Bleavins et al., 1983*) and some mink farmers have reported feeding supplemental dietary Cu to intensify fur colour in dark mink, further studies are needed to clarify the role of Cu in the pigmentation of mink hair.

Acknowledgements

This study was conducted with support from the Mink Farmers Research Foundation, Corvallis, and the Agricultural Experiment Station, Michigan State University, East Lansing, MI. The authors thank Dr. W.E. Braselton, Jr., Michigan State University Animal Health Diagnostic Laboratory, for copper, iron, and zinc analyses. We also thank L. Lewis, A. Napolitano, D. Powell, and P. Summer for their technical assistance and C. Daniel for typing the manuscript.

References

Anon., 1987. Interaction of iron, copper, and zinc. Nutr. Rev. 45 (6): 167-169.

Anon., 1991. Cellular uptake of copper by hepatocytes. Nutr. Rev. 49 (4): 123-125.

Aulerich, R.J. and Ringer, R.K., 1976. Feeding copper sulfate: could it have benefits in nutrition of mink? U.S. Fur Rancher 56 (12): 4, 6, 9.

Aulerich, R.J., Bleavins, M.R., Napolitano, A.C., Ringer, R.K. and Hughson, D.D., 1981. Feeding spray-dried eggs to mink and its effects on reproduction and fur quality. Feedstufs 53 (27): 24, 26-28.

Aulerich, R.J., Ringer, R.K., Bleavins, M.R. and Napolitano, A., 1982. Effects of supplemental dietary copper on growth, reproduction performance, and kit survival of standard dark mink and the acute toxicity of copper to mink. J. Anim. Sci. 55: 337-343.

Aulerich, R.J., Heil, C.R. and Napolitano, A.C. 1989. The role of biotin in mink reproduction. In: Smith, B. (Editor), 1990 Blue Book of Fur Farming. Comm. Marketing, Inc., Eden Prairie, MN, pp. 54, 56-60.

Bleavins, M.R. and Aulerich, R.J. 1981. Feed consumption and food passage time in mink (*Mustela vison*) and European ferrets (*Mustela putorius furo*). Lab. Anim. Sci. 31: 268-269.

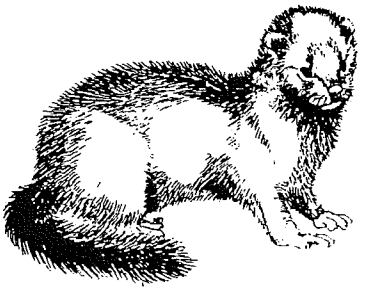
Bleavins, M.R., Aulerich, R.J., Hochstein, J.R., Horn shaw, T.C. and Napolitano, A.C. 1983. Effects of excessive dietary zinc on the intrauterine and postnatal development of mink. J. Nutr. 113: 2360-2367.

Brandt, A. 1983. Effect of dietary copper and zinc on the haematology of male pastel mink kits. A pilot investigation. Scientifur, Vol. 7, No. 2, pp. 61-65.

Braude, R. 1965. Copper as a growth stimulant in pigs. In: Cuprum Pro. Vita (Transactions of a symposium). Copper Development Association, London, pp 55.

Brooks, P.H., Morgan, D.T. and Hastings, K.E. 1984. The effect of dietary biotin on the response of growing pigs to copper sulphate used as a growth promoter. 8th IPVS Congress, Ghent, England, August 27-31, 1984. pp. 316 (abstr.),

Castell, A.G. and Bowland, J.P. 1968. Supplemental copper for swine: Growth, digestibility, and carcass measurements. Canad. J. Anim. Sci. 48: 403-413.



Dove, C.R. 1993. The effect of adding copper and various fat sources to the diets of weanling swine on growth performance and serum fatty acid profiles. J. Anim. Sci. 71: 2187-2192.

Drouliscos, N.J., Bowland, J.P. and Elliot, J.I. 1970. Influence of supplemental dietary copper on copper concentration of pig blood, selected tissues, and digestive tract contents. Canad. J. Anim. Sci. 50: 113-120.

Hawbaker, J.A., Speer, V.C., Hays, V.W. and Cat ron, D.V. 1961. Effect of copper sulfate and other chemotherapeutics in growing swine rations. J. Anim. Sci. 20: 163-167.

Jenkins, N.T., Morris, T.R. and Valamotis, D. 1970. The effect of diet and copper supplementation on chick growth. Brit. Poultry Sci. 11: 241-248.

King, J.O.L. 1972. The feeding of copper sul-phate to growing fowls. Brit. poultry Sci. 13: 61-65.

King, J.O.L. 1975. The feeding of copper sul-phate to growing rabbits. Brit. Vet. J. 131: 70-75.

Osweiler, G.D., Carson, T.L., Buck, W.B. and van Gelder, G.A. 1985. Clinical and Diagnostic Veterinary Toxicology, 3rd Edition. Kendall/Hunt Publ. Co., Dubuque, IA. 494 pp.

Owen, C.A., Jr. 1965. Metabolism of radiocop-per (^{64}Cu) in the rat. Amer. J. Physiol. 209: 900-904.

Radecki, S.V., Ku, P.K., Bennink, M.R., Yokoyama, M.T. and Miller, E.R. 1992. Effect of dietary copper on intestinal mucosa enzyme activity, morphology, and turnover rates in weanling pigs. J. Anim. Sci. 70: 1424-1431.

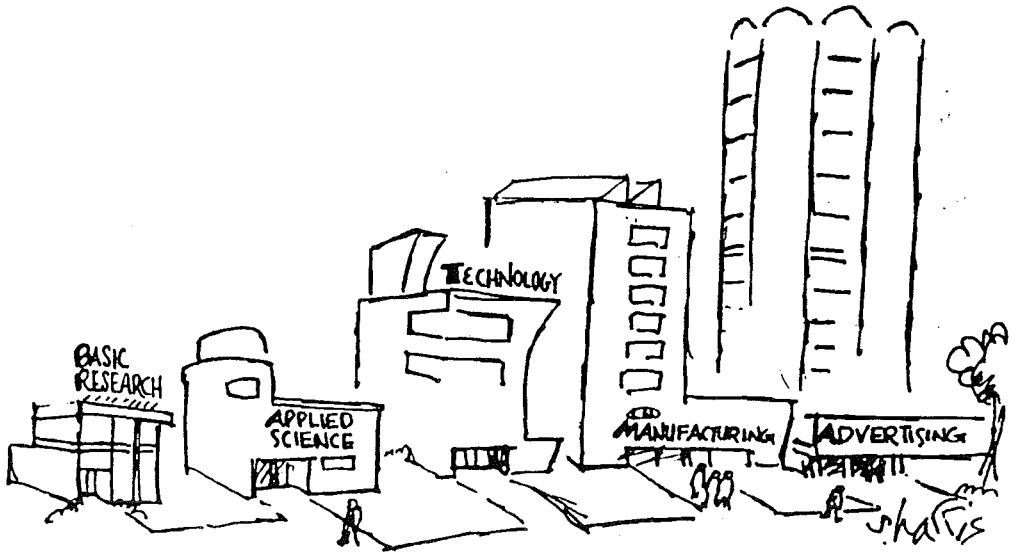
SAS Institute, Inc. 1992. SAS System for Windows 3.10, Release 6.08. SAS Institute Inc., Cary, NC.

Smith, M.S. 1969. Responses of chicks to dietary supplements of copper sulphate. Brit. Poultry Sci. 10: 97-108.

Stejskal, S.M., Aulerich, R.J., Slanker, M.R., Brasel ton, W.E., Lehning, E.J. and Napolitano, A.C. 1989. Element concentrations in livers and kidneys of ranch mink. J. Vet. Diagn. Invest. 1: 343-348.

Suttle, N.F. and Mills, C.F. 1966. Studies of the toxicity of copper to pigs. I. Effects of oral supplements of zinc and iron salts on the development of copper toxicosis. Brit. J. Nutr. 20: 135-161.

Wehr, N.B., Adair, J. and Oldfield, J.E. 1980. Biotin deficiency in mink fed spray-dried eggs. J. Anim. Sci. 50: 877-885.



WHY NOT SPEND SOME OF YOUR ADVERTISING MONEY IN SCIENTIFUR?

High dietary level of polyunsaturated fatty acids and varied vitamin E supplementation in the reproduction period of mink

Anne-Helene Tauson

Interaction effects between high level of PUTA and level of vitamin E supplementation were evaluated within four groups of mink females, each consisting of 10 animals. Group 1 was fed a conventional diet and groups 2-4 a diet where more than 95% of the fat was derived from fish products and fish oil with a peroxide value below 10 mgq./kg fat. Vitamin E in the form of dl-α-tocopherylacetate was added at levels of 108 (groups 1 and 3), 27 (group 2), and 324 (group 4) mg/kg DM. The experiment included the gestation and lactation periods, totalling 13 weeks. Reproductive results and kit survival rate were not significantly affected by treatment, but a tendency towards inferior performance in group 4 (fish oil; high vitamin E) stresses the need for further evaluation of the role of vitamin E in mink reproduction. The supplementation level in group 2 (fish oil; low vitamin E) was below the requirement, as indicated by poor condition and losses of females. ME intake was reduced in the fish-oil groups, resulting in inferior kit growth performance which was, however, not conclusively affected by vitamin E supplementation level. Plasma vitamin E i females decreased in all groups to fulfill the requirements of the kits, whose concentrations were higher. Vitamin E status was best in the control group. The fish-oil diet induced a significantly increased GSH-Px activity in whole blood, which, together with higher TBARS and the lack of response in plasma vitamin E to increased dietary supply, indicates that the fish-oil diet provoked an oxidative stress that was not fully counteracted by the vitamin E supplementation levels used here. Futhermore, the fish-oil diet resulted in lower plasma cholesterol in females and kits, and lower haemoglobin and haematocrit in kits.

J. Anim. Physiol. a. Anim. Nutr. 72, 1-13, 1993. 4 tables, 1 fig., 39 refs. Author's summary.

Plasma thyroxine concentration in non-pregnant and lactating mink, and effect of dietary rapeseed oil in the reproduction period

Anne-Helene Tauson, Maria Neil

Effect of dietary rapeseed oil from 00-varieties of rapeseed (0, 1.5% or 3% respectively in the wet compounded diets) on plasma thyroxine (T_4), reproductive performance and kit weight gain during lactation was investigated with 3 groups of each 20 mink females. Plasma T_4, which has not previouly been reported for female mink, was significantly lower in lactating than in non-pregnant females. Unlike in an earlier experiment with growing male mink, it was not affected by dietary rapeseed oil. Reproductive performance, female weight development, feed consumption, and kit weight gain were normal in all treatment groups and there were no significant effects of the experimental treatment.

Arch. Anim. Nutr., Vol. 46, pp. 103-109, 1994. 4 table, 18 refs. Authors' summary.

Litter size of the raccoon dog in relation to nutrition during the winter

J. Asikainen, H. Korhonen, S. Pasanen

Analysis of data from 45 raccoon dog farms in Finland revealed that the daily consumption of feed in Nov.-Feb. averaged 262 g at farms with an average litter size of 4.0 vs. 189 g at farms with a litter size averaging 6.0. Litter size was significantly greater at farms with an average of 280 breeding females than at farms averaging 74 females. At an experimental farm, raccoon dogs (19 females and 8 males per group) were starved from 26 Nov. to 12 Feb. or received 250 g feed daily, after which animals in both groups were fed 250 g daily until early pregnancy. Litter size per mated female averaged 4.0 for restricted females vs. 1.8 for full-fed controls, and body weight on 12 Feb. averaged 7.0 kg vs. 8.4.

Finsk Pälstidskrift, 17, 10, pp. 220-221, 1993. 1 photo, 3 refs. In SWED. CAB-abstract.

Particle size analysis of ground mink feeds

A. Alden

Particle size of ground samples of feeds for mink were estimated. 11 cereal mixtures, 1 sample of dried potato, 2 samples of maize gluten flour and 1 sample of a commercial feed were studied. Only 4 cereal samples fulfilled the requirement of 95% of particles less than 1 mm.

Vara Pälsdjur, 64, 2, pp. 30-32, 1993. 2 tables, 3 figs., 3 refs. In SWED. CAB-abstract.

Inclusion of oxidized fish oil in mink diets. 1. The influence on nutrient digestibility and fatty-acid accumulation in tissues

C.F. Børsting, R.M. Engberg, K. Jakobsen, S.K. Jensen, J.O. Andersen

In a feeding experiment with 18 male, adult, pastel mink over a period of 15 weeks, the influence of high amounts (55% of metabolizable energy) of fresh and oxidized fish oil (200 and 400 meq. O_2/kg oil) on performance and fatty-acid accumulation in liver and inguinal fat was examined. The apparent digestibility of macronutrients, fatty acids and α-tocopherol was determined during the eighth week of the experiment. The quality of the experimental oils was followed during oxidation and storage (13 weeks, -80°C, exclusion of light and oxygen).

During storage, the peroxide values of the respective oils were kept relatively stable but a considerable loss of n-3 fatty acids was recorded especially in the heavily oxidized oil (400 mgq. O_2/kg oil). The apparent digestibility of crude fat decreased from 95% (fresh oil) to 91% (200 meq. O_2/kg oil) and 74% (400 meq. O_2/kg oil). The apparent digestibility of total fatty acids decreased in parallel. The apparent digestibility of α-tocopherol was in the range of 60% and was not influenced by the dietary fat quality.

Feed intake, growth and performance in the mink were negatively affected, in particular by the heavily rancid fish oil. The fatty-acid composition of the liver and inguinal fat clearly reflected the marine origin of the dietary fat source. The accumulation of long-chain fatty acids (C20, C22) was extremely high in both liver (28-31% of total fatty acids) and inguinal fat (38-42%).

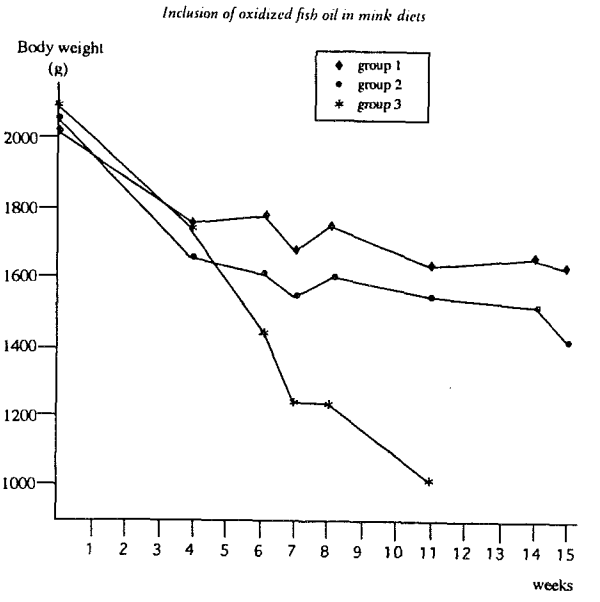


Fig. 3. Body weights (g) of the mink during the experimental period

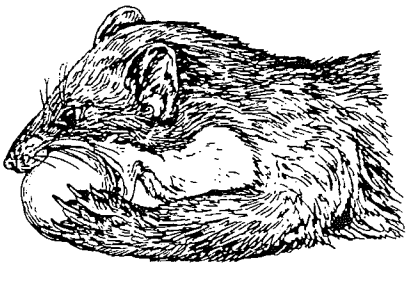
J. Anim. Physiol. a. Anim. Nutr. 72, pp. 132-145, 1994. 6 tables, 3 figs., 39 refs. Authors' summary.

Inclusion of oxidized fish oil in mink diets. 2. The influence on performance and health considering histopathological, clinical, chemical, and haematological indices

R.M. Engberg, C.F. Børsting

In an experiment with 18 adult, male, pastel mink, the influence of long-term feeding (15 weeks) with high amounts (approximately 55% of ME) of fresh and oxidized fish oil (200 and 400 meq. O_2/kg oil, respectively) on performance and health was evaluated. The concentrations of vitamin E in the diets were: 74 mg/kg (group 1, fresh oil); 68 mg/kg (group 2, 200 meq. O_2/kg oil); and 64 mg/kg (group 3, 400 mgq. O_2/kg oil). The corresponding concentrations of selenium were: 0.37 mg, 0.35 mg and 0.42 mg/kg DM in groups 1, 2 and 3, respectively.

Generally, the severity of the pathological findings was closely related to the quality of the oxidized fish oil and



to the duration of the dietary treatment. The feeding of the most oxidized oil resulted in severe weight losses leading to the death of two animals after 9 weeks. Elevated plasma enzyme activities of CK, ASAT and ALAT indicated degenerative processes in liver and skeletal muscle tissue in the mink fed the oxidized oil.

Following the intake of oxidized fish oil, a decrease in plasma α-tocopherol concentrations and an increase in plasma GSH-Px-activity was observed. Irrespective of the dietary fish-oil quality, all animals showed low haemoglobin concentrations (5.5-7.9 mmol/l) as well as a low liver iron content (>300 μg/g dry matter) at the end of the experiment, which indicates the development of iron deficiency anaemia.

The results of the histopathological examinations of the intestinal epithelium and liver suggest, furthermore, that rancid oil possesses both local and systemic toxic properties.

J. Anim. Physiol. a. Anim. Nutr. 72, pp. 146-157, 1994. 4 tables, 33 refs. Authors' summary.

Retinoic acid regulates retinol metabolism via feedback inhibition of retinol oxidation and stimulation of retinol esterification in ferret liver

Xiang-Dong Wang, Norman I. Krinsky, Robert M. Russell

When the plasma concentration of retinoic acid is increased, there is an accompanying reduction of circulating levels of retinol, suggesting that retinoic acid may have a regulatory effect on retinol metabolism in vivo. To determine which specific step(s) of retinol metabolism might be regulated by retinoic acid, retinol was incubated with ferret liver microsomes or cytosol with retinoic acid in vitro. Incubating the microsomal fraction with retinoic acid resulted in a dose-dependent (8p to 0.5 μmol/L) decrease in the formation of retinal. On the contrary, no retinoic acid inhibitory effect was observed on retinal synthesis in the cytosol incubation, or in the cytosol plus microsome incubation. However, when retinoic acid was added to the cytosolic incubation mixture in the presence of the retinal oxidative inhibitor, citral, a dose-dependent inhibition of retinal synthesis was observed. Furthermore, the effect of retinoic acid on retinyl ester metabolism in ferret liver was studied by using endogenous retinyl esters of ferret liver as the substrat. When retinoic acid was added to the incubation mixture of microsomes plus cytosol, small, non-significant increased in retinol and retinyl esters were observed. When retinoic acid was added in the presence of citral, both the inhibition of retinol oxidation and the stimulation of retinol esterification were dose dependent up to ~0.3 μmol/L and then remained the same up to 1.0 μmol/L. These data strongly suggest that retinoic acid has a regulatory effect on retinol metabolism in ferret liver, which may occur via feedback inhibition of retinol oxidation and stimulation of retinol esterification.

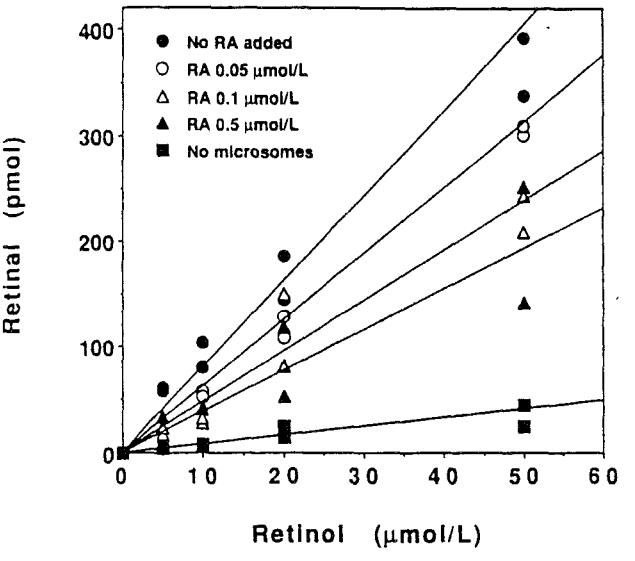


Fig. 1. Inhibitory effect of retinoic acid (RA) on retinal synthesis from retinol in ferret liver microsomes. Microsomes were incubated at 37°C for 15 min with 80 μg of protein and with different concentrations of retinol, in the absence or presence of RA at 0.05, 0.1 and 0.5 μmol/L. Controls represent incubations without microsomes. Retinal formation was measured by HPLC as described in Materials and Methods. Each point represents a single experiment.

The Journal of Nutrition, Vol. 123 (7), pp. 1277-1285, 1993. 3 tables, 5 figs., 35 refs. Authors' abstract.

The effects of nitrate, nitrite, and n-nitroso compounds on animal health

Colleen S. Bruning-Fann, Johan B. Kaneene

The clinical signs of acute nitrate toxicity vary according to species. In general, ruminant animals develop methemoglobinemia while monogastric animals exhibit severe gastritis. Nitrate ingestion has also been linked

to impairment of thyroid function, decreased feed consumption, and interference with vitamin A and E metabolism. Hematological changes seen with chronic high nitrate exposure include both compensatory increases in red blood cells and anemia, along with increased neutrophils and eosinophils. Unlike nitrate, nitrite is capable of inducing methemoglobinemia in a wide range of species, i.e. cattle, sheep, swine, dogs, guinea pigs, rats, chickens and turkeys In rats, chronic nitrite exposure causes pathological changes in a variety of tissues, alterations in motor activity and brain electrical activity, and alters gastric mucosal absorption. Nitrite affects the metabolism of sulfonamide drugs in animals such as the pig, guinea pig, and rat. The N-nitroso compound dimethylnitrosamine causes toxic hepatosis in cattle, sheep, mink, and fox. Nitrosamines have been reported in cow milk and have been found to pass into the milk of goats under experimental conditions.

Vet Hum Toxicol 35 (3), pp. 237-253, 1993. 1 table, 264 refs. Authors' abstract.

Distribution of ß-carotene and vitamin A in lipoprotein fractions of ferret serum. Effect of ß-carotene supplementation

J.D. Ribaya-Mercado, J. Lopez-Miranda, J.M. Ordovas, M. C. Blanco, J.G. Fox, R.M. Russell

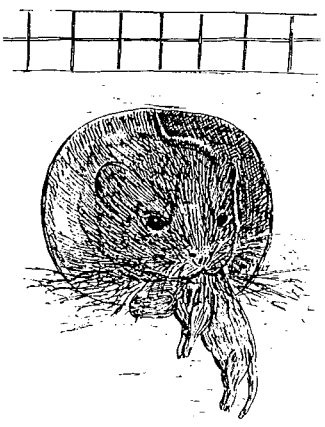
Like humans, ferrets (*Mustela putorius furo*) absorb significant amounts of intact ß-carotene and store this compound in their tissues. Unlike humans, however, high concentrations of vitamin A esters (primarily retinyl stearate and, also, retinyl palmitate) circulate in ferret blood. In fasting humans, little or no retinyl esters are found in blood; vitamin A circulates in human blood primarily as retinol bound to retinol-binding protein. In this study, we investigated the distribution of ß-carotene, vitamin A and cholesterol in lipoprotein- and nonlipoprotein fractions of ferret versus human serum. We also studied whether supplementation of ferret diets with ß-carotene induces changes in the distribution of ß-carotene and vitamin A in these serum fractions.

Reprinted from Carotenoids in Human Health, volume 691 of the Anats of the New york Academy of Sciences, 691, pp. 232-237, 1993. 2 tables, 7 refs. Authors' abstract.

Intestinal uptake and lymphatic absorption of ß-carotene in ferrets: a model for human ß-carotene metabolism

Xiang-Dong Wang, N.I. Krinsky, R.P. Marini, Guangwen Tang, Jing Yu, R. Hurley, J. G. Fox, R.M. Russell

To determine the appropriateness of the ferret as a model for human ß-carotene (ß-C) metabolism, we have perfused both 15,15´-ß-[^{14}C]C and unlabeled ß-C through the upper 30-cm protein of the small intestine of ferrets in vivo. The effluents of a mesenteric lymph duct cannulation and a common bile duct cannulation, as well as portal vein blood periodically sampled via an in dwelling catheter, were collected. Ten percent ($9.5 \pm 0.06\%$) of the total administered ß-C was taken up by the intestine after a 4-h perfusion. Of the radioactivity taken up, $68.6 \pm 6.5\%$ remained in the intestinal mucosa, $3.2 \pm 0.2\%$ was recovered in the lymph, and $28.2 \pm 6.5\%$ (calculated) was absorbed via the portal system. The total uptake/absorption of ß-C was 12.9 ± 6.8 nmol·h^{-1}·30 cm intestine^{-1}. Large amounts of unchanged ß-C and relatively small amounts of both ß-apo-12´-carotenal and ß-apo-10´-carotenal were isolated in the intestinal mucosa after a 4-h perfusion with ß-C. Considerable amounts of metabolites more polar than retinol were formed and comprised 35% of the total radioactivity recovered in the intestinal mucosa. Polar metabolites were absorbed mostly into the portal venous system, whereas retinol and retinyl esters were absorbed mainly into the mesenteric lymph. Of the total absorbed radioactivity in lymph, $10 \pm 1.0\%$ appeared as unchanged ß-C, with peak absorption



occuring at 3 h after beginning the perfusion. The absorption of ß-C in the lymph increased linearly for 3 h ($r=0.94$, $P<0.01$), and the absorption rate of ß-C was 9.1 ± 1.2 pmol·h^{-1}·30 cm intestine^{-1}. These studies indicate that the ferret can absorb intact ß-C and is a useful model of human ß-C metabolism.

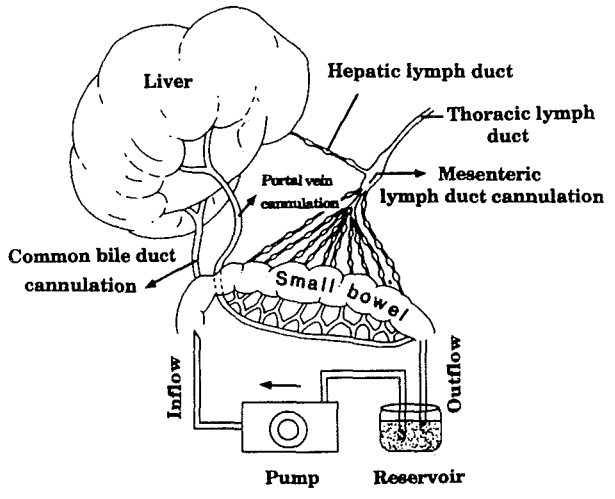


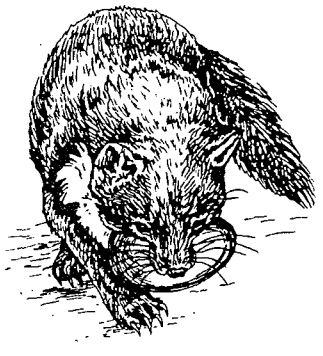
Fig. 1. Study design. Presentation of sites of cannulation and sampling in ferret model

American Journal of Physiology, 263, 4, pp. G480-G486, 1992. 2 tables, 5 figs., 30 refs. Authors' abstract.

Influence of dietary sources of fat on lipid synthesis in mink (*Mustela vison*) mammary tissue

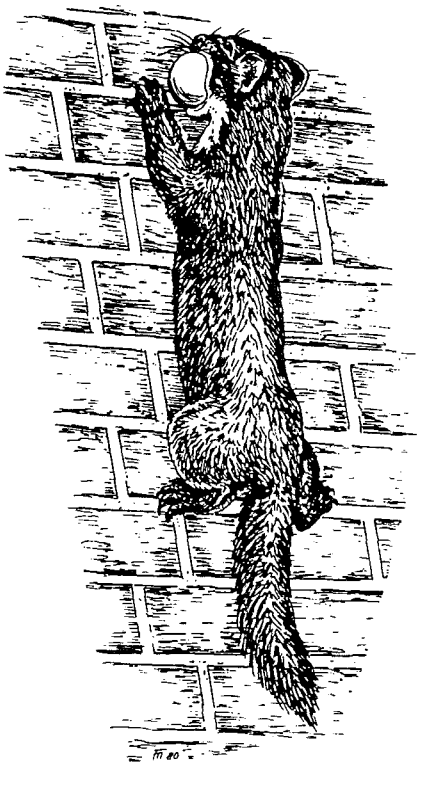
S. Wamberg, C.R. Olesen, H.O. Hansen

1. The fatty acid composition of the triglyceride fraction of mink milk sampled during mid-lactation (day 28 post partum) from two nursing mink was compared to that of plasma samples and to the fatty acid composition of the feed rations used.



2. Chemical analysis of the triglyceride composition of mink milk demonstrated only minute concentrations of fatty acids with a chain length below C_{14}.
3. The saturated $C_{16:0}$ and $C_{18:0}$-unit fatty acids in mink milk made up 24-40% of the total amount of fatty acids extracted, the remainder being represented by mono and polyunsaturated long-chain (C_{16}-C_{24}) fatty acids.
4. Preliminary *in vitro* experiments proved the incorporation of ^{14}C-labelled glucose, acetate or palmitate into triacylglycerols in cultures of mink mammary tissue to be linear for at least 2 hr.
5. The *in vitro* capacity for *de novo* fatty acid synthesis in mink mammary tissue using ^{14}C-labelled glucose or acetate was low, i.e ranging from 0.096-0.109 nmol/g (fresh tissue)/min, and amounted to only about 5% of that obtained in the case of [^{14}C]palmitic acid incubation.
6. Following ^{14}C-labelled acetic or palmitic acid incubation of mink mammary tissue neither desaturation nor chain elongation was observed
7. In response to long-term feeding on rations with two different sources of animal fat (F=fish oil or L=lard) the influence of compositional changes in dietary neutral lipids on the fatty acid composition of the lipids of mink milk is discussed.

Comp. Biochem. Physiol. Vol. 103A, No. 1, pp. 199-204, 1992. 6 tables, 22 refs. Authors' abstract.



Original Report

The Electrophoretic Pattern of Serum Proteins in Silver and Polar Foxes

J. Cofta[1], K. Kostro[2], M. Sobieska[1], K.E. Wiktorowicz[1]

[1] - Dept. of Clinical Immunology, High School of Medicine, Poznan, Poland

[2] - Dept. of Epizootiology, Clinic for Infectious Diseases of Animals, Vet. Academy, Lublin, Poland

Summary

Serum proteins from polar and blue foxes were separated electrophoretically on cellulose acetate membranes in a routine laboratory system from SARTORIUS, Germany. The results are shown to be similar to previously described. Differences between polar and blue foxes did not show any statistically significant differences.

Introduction

The electrophoretic analysis of serum proteins is one of the methods widely used in human and animal diagnostic procedures. For clinical diagnostic purpose, the reference values of biochemical estimations in serum are already available for many domestic and ranch animals, including dogs (refs. 2, 3, 6), cats (ref. 3) and foxes (refs. 1, 4, 7). The objective of this study was to establish the electrophoretic pattern of serum proteins in silver and polar foxes, using standard diagnostic equipment.

Materials and methods

The studied group of animals comprised 16 silver and 14 polar foxes of both sexes, aged between one and three years. The foxes, clinically healthy, were housed in a reproduction ranch and fed a balanced diet according to scandinavian standards with a steady access to water.

The samples of venous blood were collected in non-heparinized tubes. The serum was separated by centrifugation and samples with visible haemolysis or lipaemia were discarded.

Total serum protein concentration was estimated using the biuret method, according to the routine procedure of DR. LANGE, Germany (Dr. Lange Test, LCN 510).

The electrophoretic values were determined by the Sartophor Electrophoresis System (SARTORIUS, Germany), using cellulose acetate strips (SM 12200) and veronal (barbital) buffer pH 9.0, ionic strength 0.05. The buffer was prepared as follows:

solution A: Veronal (Diethylbarbituric acid) 2.763 g/L H_2O . . . . . 163 ml

solution B: Veronal sodium salt 103.09 g/L H_2O100 ml

distilled water . . . . . to 1 litre

For each run eight samples (about 0.5 μl volume each)

were applied to the strip, using a sample applicator (Sartorius). After the completion of an electrophoretic run (U=250V, t=20 min.) the strips were removed, stained for 5 min. with Poinceau S solution (Sartorius, SM 14226) and passed through 4 rinsing baths (SM 14226-1 for SM 12200 stripes), 5 min. in each. Next, the strips were dried at 90°C for 10 min., and scanned at 525 nm in densitometer (Elphograph 5, BENDER & HOBEIN, Germany).

Results

The scanned serum proteins pattern from a representative electrophoretic strip is shown in Fig. 1.

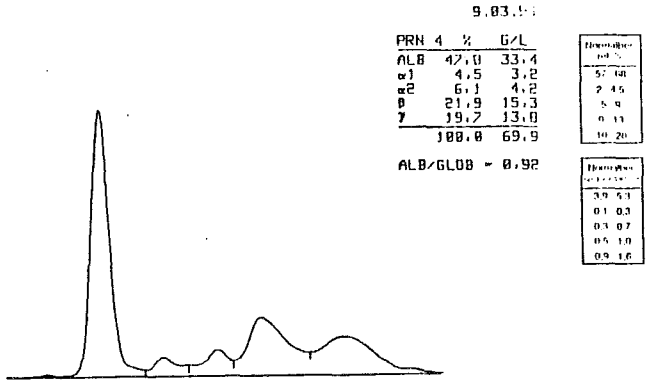


Fig. 1. Scanned fox normal serum proteins after electrophoresis in cellulose acetate. Normalber. - normal values for human plasma, rel% - relative values expressed as %. Ges.Eiw. - total protein (in g/dl)

The mean, standard deviation, maximum and minimum of total protein concentration and each protein fraction, as well as corresponding percentages are given in Table 1.

The mean concentrations and percentages of protein fractions in the sera of silver and polar foxes did not show any significant differences.

Discussion

The Sartorius electrophoretic system seems to be useful in analysis of fox plasma proteins. The main modification in electrophoresis parameters, as compared to human blood, concerned pH (higher than for electrophoresis of human serum proteins). In densitometric traces of fox serum proteins, the five protein zones: albumins, alpha$_1$, alpha$_2$, beta$_1$ and gamma-globulins are clearly distinguishable.

This result resembles standard electrophoretic separation of human serum proteins (shown in fig. 1 as table entitled Normalber.), with some differences in percentage values: the mean percentage of albumin is lower and alpha$_1$ and beta globulin slightly higher than in humans.

Similar observations were published by Mohn and Nordstoga (ref. 4), who carried out separation on cellulose acetate membranes in the Beckman Microzone Electrophoresis Cell system (ref. 5). The only difference concerned the presence of an extra alpha$_3$ fraction in the majority of examined sera. This may be due either to separation conditions (e.g. higher ionic strength, lower pH as compared to our conditions) or to lower storage of sera, especially the fact that in 24% of cases only four globulin fractions were detected (ref. 4). According to our experience, electrophoresis should be carried out as quickly as possible after centrifugation of the clotted blood or serum should be stored on the clot, which allows avoidance of changes between albumin and globulin content and ratio. Although in agarose gel electrophoresis up to 9 fractions may be detected in canine serum (ref. 3), the main protein fractions distribution (refs. 2, 6) is similar to that observed in cellulose acetate electrophoresis in foxes. However, the gamma-globulin fraction in dog serum was only half of that in foxes (ref. 6). The evaluated total protein concentration and albumin to globulin ratio are in good agreement with reference data for ranch foxes (ref. 1), and similar to that of dogs (refs. 2, 6). Thus, the electrophoretic system used in our work seems to provide reliable and reproducible results, allowing us to obtain a quick routine analysis of fox serum proteins.

Acknowledgement

This work was supported by a Polish Research Committee grant, No. PB 55902.03.

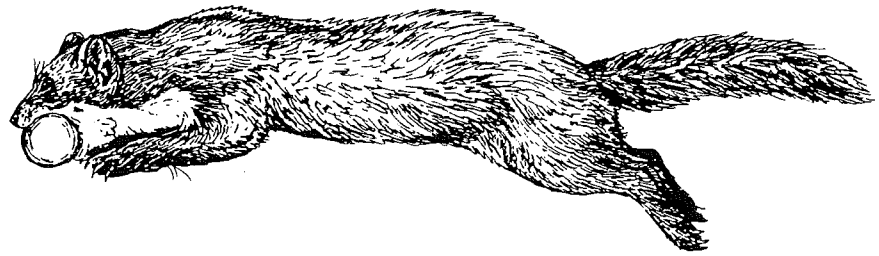
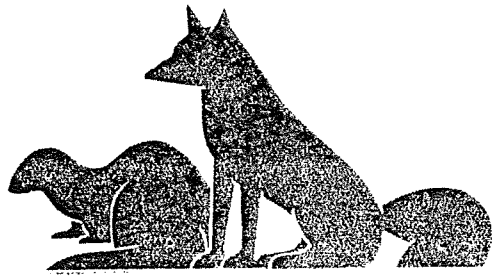


Table 1 Absolute concentration and percentage composition of serum proteins in silver and polar foxes (SD - standard deviation)

	Silver foxes		Polar foxes	
	Absolute concentration [g/l]	Percentage composition [%]	Absolute concentration [g/l]	Percentage composition [%]
Total protein	Mean 70.3 SD 10.8 Range 55.5 - 89.5		Mean 66.6 SD 5.3 Range 56.2 - 77.0	
Albumin	Mean 34.5 SD 5.2 Range 25.4 - 40.7	Mean 48.7 SD 10.5 Range 30.0 - 62.6	Mean 34.7 SD 3.1 Range 30.4 - 40.7	Mean 52.5 SD 5.5 Range 40.5 - 60.7
alpha-1-globulin	Mean 4.4 SD 1.2 Range 3.0 - 7.4	Mean 6.2 SD 1.4 Range 4.3 - 8.7	Mean 4.9 SD 1.0 Range 3.4 - 7.5	Mean 7.4 SD 1.5 Range 5.6 - 11.2
alpha-2-globulin	Mean 5.4 SD 1.1 Range 3.8 - 8.0	Mean 7.8 SD 1.2 Range 6.1 - 9.6	Mean 4.4 SD 0.5 Range 3.8 - 5.6	Mean 6.7 SD 0.6 Range 5.8 - 7.5
beta-globulin	Mean 15.2 SD 4.6 Range 10.3 - 22.8	Mean 21.3 SD 3.5 Range 16.7 - 27.6	Mean 12.6 SD 3.3 Range 8.3 - 21.6	Mean 18.7 SD 3.4 Rang 14.7 - 28.0
Gamma-globulin	Mean 11.9 SD 6.4 Range 4.6 - 22.7	Mean 16.1 SD 6.7 Range 7.8 - 26.8	Mean 9.9 SD 2.8 Range 4.9 - 14.3	Mean 14.8 SD 3.9 Range 8.0 - 20.5
Albumin/ Globulin		Mean 1.04 SD 0.42		Mean 1.19 SD 0.32

References

1. Benn, D.M., McKeown, D.B., Lumsden, J.H. 1986. Hematology and biochemistry reference values for the ranch fox. Can. J. Vet. Res., 50: 54-58.
2. Irfan, M. 1967. The electrophoretic pattern of serum proteins in normal animals. Res. vet. Sci., 8: 137-142.
3. Keay, G., Doxey, D.L. 1981/82. Species characteristic of serum proteins demonstrated after agarose gel electrophoresis. Vet. Res. Commun., 5: 263-270.
4. Mohn, S.F., Nordstoga, K. 1975. Electrophoretic pattern of serum proteins in blue foxes with special reference to changes associated with nosematosis. Acta vet. scand., 16: 297-306.
5. Mohn, S.F., Nordstoga, K. 1975. Serum proteins in mink with endotoxin-induced amyloidosis and infectious plasmacytosis. Acta vet. scand., 16: 288-296.
6. van den Broek, A.H.M. 1990. Serum protein elec trophoresis in canine parvovirus enteritis. Br. vet. J., 146: 259.
7. Zhan, Y., Yasuda, J., Too, R. 1991. Reference data on the anatomy and serum biochemistry of the silver fox. Jpn. J. Vet. Res., 39: 39-50.



Seroprevalence of *Toxoplasma gondii* in Danish farmed mink (*Mustela vison* S.)

P. Henriksen, H.H. Dietz, Aa. Uttenthal, M. Hansen

One hundred and ninety-five mink sera randomly selected from 17 Danish mink farms were evaluated for the presence of *Toxoplasma gondii* antibodies in the latex agglutination test. Six (3%) sera contained *T. gondii* antibodies in titres of 1:64 or more. The estimated 3% prevalence means that 300,000 mink out of a total mink population of ten million might be infected with *Toxoplasma gondii*. This large number of possible seropositive mink in Denmark indicates that there exists a potential risk of acquiring toxoplasmosis by pelting mink.

Veterinary Parasitology 53, pp. 1-5, 1994. 2 tables, 12 refs. Authors' abstract.

A study on the predilection sites of *Trichinella spiralis* muscle larvae in experimentally infected foxes (*Alopex lagopus, Vulpes vulpes*)

Chr. M. Kapel, Sv. Aa. Henriksen, H.H. Dietz, P. Henriksen, P. Nansen

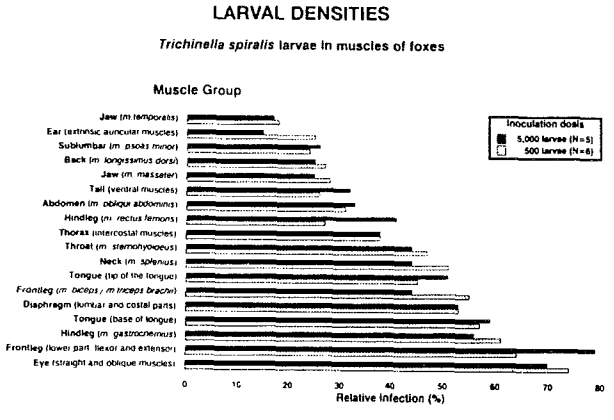


Fig. 1. Relative values of the number of *Trichinella spiralis* muscle larvae in selected muscles/muscle groups from 8 arctic foxes and 3 silver foxes

Studies were carried out on the predilection sites of *Trichinella spiralis* muscle larvae in experimentally infected arctic foxes (*Alopex lagopus*) and silver foxes (*Vulpes vulpes*) reared in cages. The highest number of larvae per gramme tissue was found in the muscles of the legs, eyes, diaphragm, and tongue. The 2 fox species showed no significant differences with regard to predilection sites.

Acta vet. scand. 35,pp. 125-132, 1994. 1 table, 1 fig., 12 refs. Authors' abstract.

Acute interstitial pneumonia in mink kits inoculated with defined isolates of Aleutian mink disease parvovirus

S. Alexandersen, S. Larsen, B. Aasted, Å. Uttenthal, M.E. Bloom, M. Hansen

The present study addressed the causal role of Aleutian mink disease parvovirus (ADV) in acute interstitial pneumonia in mink kits. All the examined isolates of ADV caused interstitial pneumonia in newborn kits, although the severity of disease and the mortality varied. These findings indicate that ADV is the direct causal agent of this disease in mink kits and that cofactors, which could have been present in the original ADV-K isolate, do not play a role. Acute intersititial pneumonia characterized by hypertrophy and hyperplasia of alveolar type II cells, intranuclear viral inclusions, interstitial edema, and hyaline membrane formation was experimentally reproduced in mink kits infected as newborns with five different isolates of ADV. Four hundred forty-nine newborn mink kits were included in the study, of which 247 were necropsied. The lesions caused by the different isolates were indistinguishable by histopathologic examinations, but the incidence (50-100%) and severity (mortality of 30-100%, n=218) of disease among the mink kits varied. Also, the content of ADV antigens in the lungs of infected kits varied among the groups. According to these features, the examined isolated could be placed in groups of high and low virulence. ADV-K, ADV-Utah I, and ADV-DK were in a highly virulent group producing a mortality of 90-100% (n=110) in mink inoculated as newborns. ADV-GL and ADV-Pullman belonged to a group of low virulence, with an incidence of clinical disease of 50-70% and a mortality of approximately 30-50% (n=118) in kits inoculated as newborns. The mortality in the control group receiving a mock inoculum was around 12% (n=34). The period from infection to development of fatal disease varied from approximately 12 days for the highly virulent isolates up to around 20 days for the isolates of low virulence. The 107 mink kits that survived inoculation with ADV as newborns developed lesions typical of

classical Aleutian disease irrespective of the ADV isolate used. The lesions consisted of chronic immune complex-mediated glomerulonephritis and infiltrations with mononuclear cells, including plasma cells in lung, liver, spleen, kidney, mesenteric lymph node, and intestine. Surviving kits also had hypertrophy of the bronchus-associated lymphoid tissue and focal subpleural, intraalveolar accumulations of large cells with foamy cytoplasm, so-called lipid pneumonia.

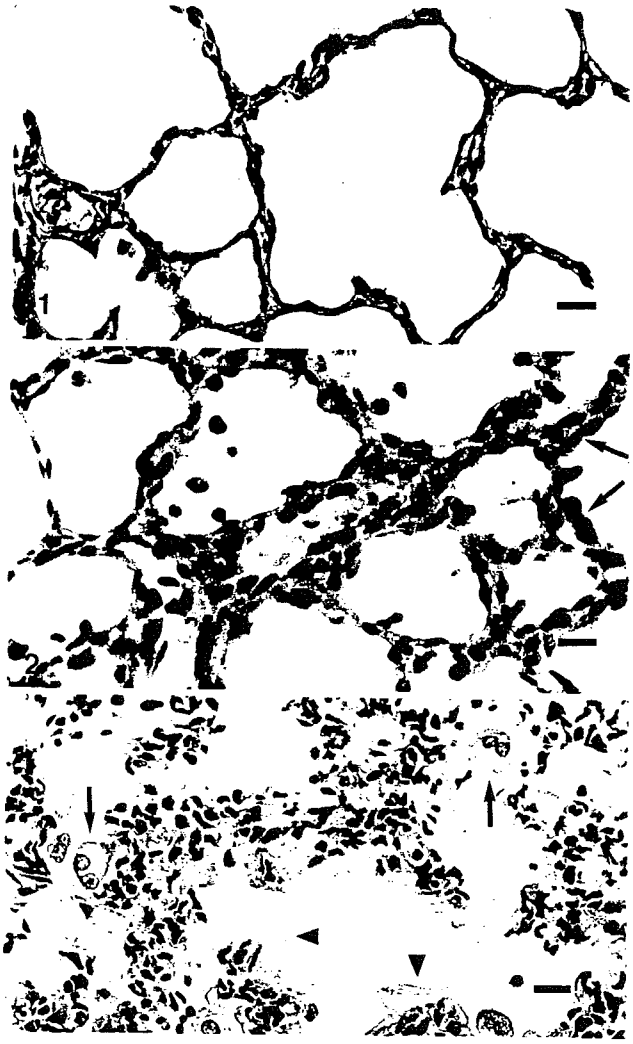


Fig. 1. Lung; control mink kit No. 50 killed at 12 days of age. HE. Bar = 15 μm.

Fig. 2. Lung; mink kit No. 140 inoculated as newborn with ADV-K inoculum and killed at 10 days. Early lesions consisting of thickening of alveolar walls due to cellular hypertrophy and hyperplasia of type-II alveolar cells (arrows) and interstitial edema. A few desquamated cells can be observed in the alveoli. HE. Bar = 15 μm.

Fig. 3. Lung; mink kit No. 70 inoculated as newborn with ADV-K inoculum, died at 14 days. Lesions severe with large hypertrophic type-II cells, often with two nuclei (arrows). Note conspicuous hyaline membranes (arrowheads). HE. Bar = 15 μm.

Vet. Pathol. 31, pp. 216-228, 1994. 1 table, 9 figs. 48 refs. Authors' abstract.

Estradiol-17ß-secreting adrenocortical tumor in a ferret

N.S. Lipman, R.P. Marini

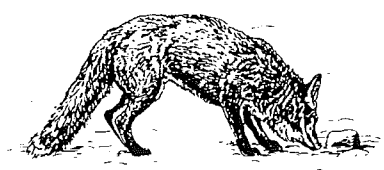
Severe generalized alopecia and marked vulvar enlargement were observed in a 5-year-old spayed ferret with high serum oestradiol concentrations. A neoplastic left adrenal gland was removed. Staining of the neoplastic cells for oestradiol was demonstrated by use of immunohistochemistry. Clinical findings in this ferret were typical of adrenal-associated endocrinopathy, a syndrome characterized by increased secretion of adrenocortical hormones by hyperplastic or neoplastic adrenal glands.

JAVMA, Vol. 203, No. 11, pp. 1552-1555, 1993. 2 figs., 22 refs. CAB-abstract.

Molecular cloning of a mink prion protein gene

H.A. Kretzschmar, M. Neumann, G. Riethmüller, S.B. Prusiner

Transmissible mink encephalopathy (TME) is a rare disease which is presumably transmitted to ranch-raised mink from scrapie-infected sheep offal or bovine spongiform encephalopathy-infected cattle products. Although the infectious agent of TME has not been isolated, there is circumstantial evidence that TME is caused by prions. The experimental host range of TME includes sheep, cattle, monkeys and hamsters. However, TME has never been transmitted to mice. Since experiments in transgenic animals have shown that the prion protein (PrP) gene modulates the susceptibility, incubation time and neuropathology of prion-induced disease, we have started to analyse the mink PrP gen. PrP, as deduced from a genomic DNA sequence, consists of 257 amino acids and overall shows similarity of 84 to 90% with the sequences of the PrPs of other mammalian species. It remains to be determined



whether these differences in the primary structure of Prp will explain the peculiar host range of TME.

Journal of General Virology 73, pp. 2757-2761, 1992. 1 table, 3 figs., 27 refs. Authors' abstract.

Transmissible mink encephalopathy

R.F. Marsh, W.J. Hadlow

Transmissible mink encephalopathy (TME) is a rare disease of ranch-raised mink caused by exposure to an as yet unidentified contaminated food ingredient in the ration. The clinical and pathological similarities between TME and scrapie, together with the indistinguishable physiochemical characteristics of their transmissible agents, suggest that sheep may be the source of infection. However, experimental testing of oral susceptibility of mink to several different sources of sheep scrapie have been unsuccessful. These results indicate that either the feeding of scrapie-infected sheep tissues to mink is not the cause of TME, or that there exists a strain of sheep scrapie having high mink pathogenicity that remains unknown. Additional sources of sheep scrapie need to be tested in mink, and epidemiological investigations of new incidents of TME need to emphasise obtaining a thorough history of past feeding practices.

Revue Scientifigue et Technigue de l'OIE (France), Vol. 11 (2), pp. 539-550, 1992. 33 refs. Authors' summary.

Experimental infection of mink with bovine spongiform encephalopathy

M.M. Robinson, W.J. Hadlow, T.P. Huff, G.A.H. Wells, M. Dawson, R.F. Marsh, J.R. Gorham

To determine whether the aetiological agent of bovine spongiform encephalopathy (BSE) is pathogenic for mink, standard dark mink were inoculated with coded homogenates of bovine brain from the U.K. Two homogenates were from cows affected with BSE. The third was from a cow that came from a farm with no history of having had BSE or having been fed ruminant-derived, rendered by-products, the proposed vehicle for introduction of the BSE agent. Each homogenate was inoculated intracerebrally into separate groups of mink and a pool of the three was fed to a fourth group. Signs of neurological disease appeared in mink an average of 12 months after intracerebral inoculation and 15 months after feeding. Decreased appetite, lethargy and mild to moderate pelvic limb ataxia were the predominant clinical signs, quite unlike the classic clinical picture of transmissible mink encephalopathy (TME). Microscopic changes in brain sections of most affected mink were those of a scrapie-like spongiform encephalopathy. Vacuolar change in grey matter neuropil was accompanied by prominent astrocytosis. Varying greatly in severity from one mink to another, the degenerative changes occurred in the cerebral cortex, dorsolateral gyri of the frontal lobe, corpus striatu, diencephalon and brainstem. Although resembling TME, the encephalopathy was distinguishable from it by less extensive changes in the cerebral cortex, by more severe changes in the caudal brainstem and by sparing of the hippocampus. The results of this study extend the experimental host range of the BSE agent and demonstrate for the first time the experimental oral infection of mink with a transmissible spongiform encephalopathy agent from a naturally infected ruminant species.

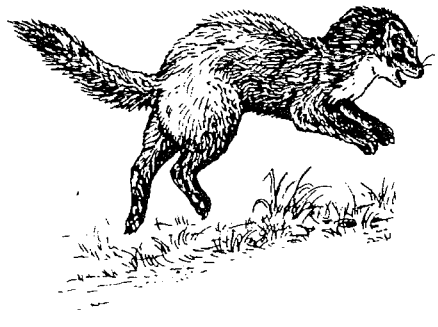
Journal of General Virology 75, pp. 2151-2155, 1994. 1 table, 3 figs., 17 refs. Authors' symmary.

Physiochemical and biological characterizations of distinct strains of the transmissible mink encephalopathy agent

R.F. Marsh, R.A. Bessen

Inoculation of the Stetsonville, Wisconsin source of transmissible mink encephalopathy (TME) into Syrian hamsters has identified two strains of the TME agent having distinct biological properties and producing disease-specific prion proteins (PrP^{TME}) having different physiocochemical properties. Although several strains of the sheep scrapie agent have been identified in Great Britain, this is the first indication that agents producing transmissible spongiform encephalopathies in the United States also are capable of producing distinct strains.

Phil. Trans. R. Soc. Lond. B, 343, pp. 413-414, 1994. 4 refs. Authors' summary.



Code of practice for the care and handling of farmed mink, fitch and fox in Europe

Based upon the Council of Europe's Recommendation concerning fur animals CEFBA has established an important "Code of Practice for the care and handling of farmed mink, fitch and fox in Europe". This Code is also in line with EU legislation on the protection of animals at the time of slaughter or killing. This Code of practice has been adopted by all of CEFBA's member associations.

CEFBA is a member of the European Confederation of Agriculture (CEA).

Coordinated and issued by
Council of European Fur Breeders' Associations

Council of European Fur Breeders' Associations

Member associations in

Belgium:	Belgian Fur Farmers' Association
Denmark:	Danish Fur Breeders' Association
Finland:	Finnish Fur Breeders' Association
France:	*Syndicat Francais des Eleveurs de Visons*
Germany:	Zentralverband Deutscher Pelztierzüchter e.V.
The Netherlands:	Dutch Fur Breeders' Association
Ireland:	Irish Fur Breeders' Association
Italy:	Associazione Italiana Allevatori Visoni
Norway:	Norwegian Fur Breeders' Association
Spain:	Spanish Fur Breeders' Association
Sweden:	Swedish Fur Breeders' Association
United Kingdom:	Fur Breeders' Association of U.K.

Adopted, at the Annual Meeting, April 1994, this **Recommended code of *practice for the care and handling of farmed mink, fitch and fox* in Europe**, as far as its provisions are in accordance with studies and scientific results in the coming years and the code isn't in contradiction with the rules and legislation that are already in force in their country.

Council of European Fur Breeders' Associations

Molenweg 7, 6612 AE Nederasselt, The Netherlands.
Phone: +31 8892 1980. Fax: +31 8892 1465

Vejlesøvej 36, 2840 Holte, Denmark.
Phone: +45 42425566. Fax: +45 42423311

STANISŁAW JAROSZ

HODOWLA ZWIERZĄT FUTERKOWYCH

The book consist of the following chapters: structure of skin and hairs, characteristics of more important species of fur animals, principles of the ferm buildings, reproduction of the fur animals, rearing of young animals, feeding and nutrition, breeding functions, utilization of animals for fur, diseases fo the fur animals.

My Dear Friend dr Jorgensen,

Enclosed is the book edited in 1993, titled "Husbandry of Fur Animals. It is addressed to students as well as to more educated farmers. I know that it will be difficult for you to read this book in Polish, so please accept it as some kind of a gift.

KIEROWNIK KATEDRY
Prof. dr hab. Stanisław Jarosz

PROJEKT OKŁADKI
Adam Baczyński

REDAKTOR
Renata Włodek

KOREKTA
Zespół

Panstwowe Wydawnictwo Naukowe; Warszawa-Krakow (Poland), 274 pp, 41 tables, 78 figs., 113 refs. In POLH. ISBN 83-01-11176-3.

List of addresses

Alasuutari, S. Muddusjarvi Undervisnings- och Forsöksgård, Muddusjarvi, Finland.
Alden, A. Pälsdjursenheten, SVA, Uppsala, Sweden.
Alexandersen, S. Laboratories of Molecular Pathobiology, The Royal Veterinary and Agricultural University, DK-1870 Frederiksberg C, Denmark.
Asikainen, J. Joensuun Yllopisto, Slikasalmen Tutkimus-ja Koeasema, Liperi, Finland.
Baumgarten, A. Päldjurscentret, Sölvesborg, Sweden.
Berg, P. Natl. Inst. of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele.
Bruning-Fann, C.S. Population Medicine Center, College of Veterinary Medicine, A109 Veterinary Medical Center, Michigan State Univ., East Lansing, Michigan, USA 48824-1314.
Bush, C.R. c/o Aulerich, R.J. Department of Animal Science, 132 Anthony Hall, Michigan State University, East Lansing, MI, USA 48824-1225.
Børsting, C.F. Natl. Inst. of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.
Cameron, J.K. Dept. of Anim. Sci., Michigan State Univ., East Lansing, MI 48824-1225.
Cappelletti, C.A. Faculty of Veterinarian Sciences, University of Buenos Aires, Av. Chorroarin 280, CP 1 427 Bs.As, Argentina.
Claussen, J. Danish Fur Breeders Association, Langagervej 60, DK-2600 Glostrup, Denmark.
Cofta, J. Department of Clinical Immunology, High School of Medicine, Poznan, Poland.
Crum, J. Depart. of Anim. Sci., Michigan State Univ., East Lansing, MI 48824-1225, USA.
Damgaard, B.M. National Institue of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.
Engberg, R.M. National Institute of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.
Farstad, W. Department of Forensic Medicine, Norwegian College of Veterinary Medicine, P.o. Box 8146, N-0033 Oslo, Norway.
Giesy, J.P. Dept. of Fisheries and Wildlife, Pesticide Research Center and Inst. of Environ. Toxicology, Michigan State University, East Lansing, Michigan 48824-1222, USA.
Groot, J. Danish Fur Breeder Association, Langagervej 60, DK-2600 Glostrup, Denmark.
Hansen, S.W. National Institute of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.
Hansen, J. Research Centre West, Herningvej 112, Tvis, DK-7500 Holstebro, Denmark.
Hanusová, E. Research Institute of Animal Production, Hlohovská 2, 949 92 Nitra, Slovakia.
Henriksen, P. National Veterinary Laboratory, DK-8200 Århus N, Denmark.
Hyttel, P. Department of Reproduction, Royal Veterinary and Agricultural University, Bülowsvej 13, DK-1870 Frederiksberg C, Denmark.
Jarosz, S.J. University of Agriculture in Krakow, Department of Fur Animal breeding, 30-059 Krakow, Al. Mickiewica 24/28, Poland.
Jezewska, G. Dept. of Biological Basis of Animal Prod., Univ. of Agriculture in Lublin, Poland.
Johannessen, K.R. Norwegian Fur Breeders Ass., P.O. Box 145, Økern, N-0509 Oslo, Norway.
Johnson, D.R. Dept. of Biological Sciences, University of Idaho, Moscow, ID 83843, USA.
Kapel, Chr. M. Danish Centre for Experimental Parasitology, Royal Veterinary and Agricultural University, Bülowsvej 13, DK-1870 Frederiksberg C, Denmark.
Kenttämies, H. University of Helsinki, Department of Animal Breeding, SF-00710 Helsinki, Finland.
Koldaeva, E.M. Res. Inst. for Fur Animals and Rabbits, NIIPZK, Scient. Div. 140143 Rodniki, Russia, Moscow Region
Korhonen, H. Forskningsstationen for Pälsdjursnäringen, LFC, Kannus, Finland.
Kretzschmar, H.A. Institute of Neuropathology, University of Göttingen, Robert-Koch-Strasse 40, D-3400 Göttingen, Germany.
Lagerkvist, G. Department of Animal Breeding and Genetics, Swedish University of Agricultural Sciences, Funbo-Lövsta Research Station, 755 97 Uppsala, Sweden.
Lipman, N.S. University of Chicago, ARC/CCMP, 5841 S. Maryland Avenue, MC 1030, Chicago, IL 60637.

Lipscomb, T.P. Department of Veterinary Pathology, Armed Forces Institute of pathology, Washington, DC.

Marsh, R.F. Department of Veterinary Science, Animal Health and Biomedical Sciences, College of Agriculture and Life Sciences, University of Wisconsin-madison, 1655 Linden Drive, Madison, Wisconsin 53706-1581, USA.

Mason, G.J. Sub-depart. of Animal Behaviour, University of Cambridge, Cambridge CB3 8AA.

Michelsen, S. National Institue of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.

Møller, S. National Institute of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.

Najakshin, A.M. c/o A.V. Taranin, Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Nielsen, U.L. Research Centre West, Herningvej 112, Tvis, DK-7500 Holstebro, Denmark.

Osadchuk, L.V. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Pak, J.I. Faculty of Agriculture, Hokkaido University, Kita-ku, Sapporo-shi 060, Japan.

Pasanen, S. Joensuu Universitet, Karjalan Tutkimuslaitos, Joensuu, Finland.

Pedersen, V. Research farm "North", Hundelevvej 75, DK-9480 Løkken, Denmark.

Plyusnina, I.Z. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Prasolova, L.A. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Rasmussen, P.V. National Institue of Animal Science, Research Centre Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.

Ribaya-Mercado, J.D. U.S. Department of Agriculture, Human Nutrition Research Center on Aging at Tufts University, 711 Washington Street, Boston, Massachusetts 02111.

Robinson, M.M. USDA-ARS Animal Disease Research Unit, Bustad 337, WSU, Pullman, Washington 99164-7030, USA.

Rouvinen, K. Nova Scotia Agricultural College, Department of Animal Science, P.O. Box 550, Truro, Nova Scotia, Canada B2N 5E3.

Santin, I. Danish Fur Breeder Association, Langagervej 60, DK-2600 Glostrup, Denmark.

Skírnisson, K. Institute for Experimental Pathology, University of Iceland, Keldur, P.o. Box 8540, IS-128 Reykjavik, Iceland.

Skjøth, F. National Institute of Plant and Soil Science, Department of Biometry and Informatics, Research Centre Foulum, P.O. Box 23, DK-8830 Tjele, Denmark.

Smeds, E. Finnish Fur Breeders Association, P.O. Box 5, SF-01610 Vantaa, Finland.

Smeds, K. Finnish Fur Breeders Association, P.O. Box 5, SF-01601 Vantaa, Finland.

Tanaka, D. Department of Anatomy and Animal Science, Michigan State University, East Lansing, Michigan 48824, USA.

Tauson, A.-H. Department of Animal Nutrition and Management, Funbo-Lövsta Research Station, Uppsala, Sweden.

Trut, L.N. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Valberg, N.M. Department of Animal Science, Agricultural University of Norway, P.O. Box 25, N-1432 Ås, Norway.

Vasilyeva. L.L. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.

Wamberg, S. Dept. of Physiology, Institute of Medical Biology, Odense University, Winsløwsparken 19, DK-5000 Odense, Denmark.

Wang, X.D. c/o R.M. Russell, Gastrointestinal Nutrition Laboratory, USDA Human Nutrition Research Center, School of Medicine, Tufts University, Boston, MA 02111, USA.

Wang, S.-D. Gastrointestinal Nutrition Laboratory, USDA Human Nutrition Research Center, School of Nutrition, School of Medicine, Tufts University, Boston 02111, USA.

Zhelezova, A.I. Institute of Cytology and Genetics, Academy of Sciences, Siberian Branch of the Russian Academy of Sciences, 630090 Novosibirsk, Russia.