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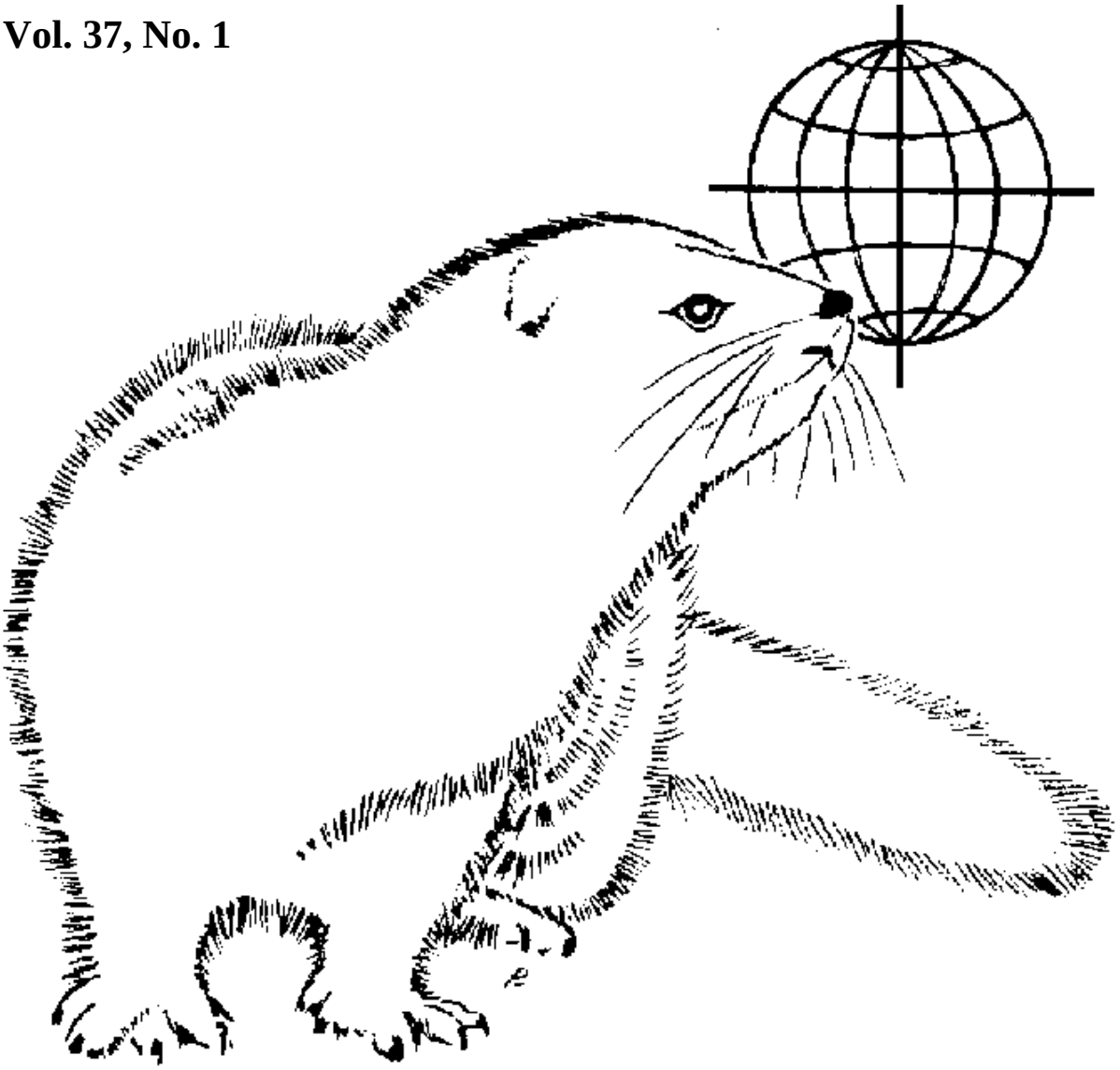
Vol. 37, No. 1



IFASA

INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

SCIENTIFUR - scientific information in Fur Animal Production.

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SCIENTIFUR is the contact link between fur animal researchers all over the world and serves as an outlet for scientific and other communication between researchers and others who are interested in the production of fur bearing animals. As such **SCIENTIFUR** contains reports of scientific and applied nature as well as abstracts of information published elsewhere and information regarding congresses, scientific meetings etc.

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Notes from the Editor

Scientifur has until now been published in a printed version and electronically on the IFASA-website: http://www.ifasanet.org/. At its meeting in August 2012, the board decided to only publish Scientifur electronically on the IFASA-website from 2013.

The Xth International Scientific Congress in Fur Animal Production held in Copenhagen in Denmark, August 21 -25, 2012 was a great success both with regard to the number of participating scientists and the scientific content.

The number of contributions from the participating countries based on first author nationality in the proceedings from the International Scientific Congress in Fur Animal Production in the Netherlands in 2004, in Canada in 2008 and in Denmark in 2012 is shown in Table 1. The number of participating countries has increased from 2004 to 2012 and e.g. in 2012 scientists from China contributed significantly to the congress in Copenhagen.

A meeting is held yearly at Aarhus University in Denmark with the aim of communicating the most recent research results to the fur animal industry including the fur animal production advisors. Abstracts from the meeting in 2012 are given in this volume of Scientifur.

Table 1. Number of contributions from the participating countries at the International Scientific Congress in Fur Animal Production in the Netherlands in 2004, Canada in 2008, and Denmark in 2012.

	The Netherlands 2004		Canada 2008		Denmark 2012	
	No	%	No	%	No	%
Canada	6	11	21	25	9	11
China					8	10
Denmark	13	23	27	33	30	37
Finland	7	12	7	8	8	10
France					1	1
Iran					1	1
Japan	1	2				
Netherlands			2	2	5	6
Norway	3	5	3	4	3	4
Poland	13	23	13	16	5	6
Russia	12	21	3	4	10	12
Spain			3	4		
Sweden			2	2	2	2
USA	2	4	2	2		
Total	57	100	83	100	82	100

Scientifur also contains abstracts and links to abstracts of publications dealing with e.g. the effect of residual feed intake on metabolic profiles in mink, understanding of embryonic diapause in mink, behavioral response to auditory stimuli in mink, improvement of the mink genetic map, molecular genetic studies of coat color phenotypes in mink, and diseases e.g. Aleutian disease in mink.

Vivi Hunnicke Nielsen
Editor Scientifur

Metabolomic study of plasma from female mink (*Neovison vison*) with low and high residual feed intake during restrictive and *ad libitum* feeding

M.S. Hedemann, B.M. Damgaard

Metabolite profiling may elucidate changes in metabolic pathways under various physiological or nutritional conditions. In the present study two groups of female mink characterised as having a high (16 mink) or low (14 mink) residual feed intake were investigated during restrictive and *ad libitum* feeding. Blood samples were collected three times during the experimental period; during restrictive feeding, and four days and three weeks after the change to *ad libitum* feeding. Plasma samples were subjected to liquid chromatography mass spectrometry non-targeted metabolomics. Subjecting data to principal component analysis showed that there was no grouping of the data according to the residual feed intake. In contrast, data were clearly grouped according to feeding level. Identification of the metabolites responsible for this grouping showed that the plasma level of metabolites related to mobilisation of energy was high during restrictive feeding, *e.g.* betaine, carnitine, and creatine. During *ad libitum* feeding the plasma level of metabolites that can be characterised as biomarkers of meat intake (creatinine, carnosine, 1- and 3 methylhistidine) was high. The plasma level of lysophosphatidylcholine species was highest after four days of *ad libitum* feeding suggesting a short term imbalance in the transport or metabolism of these metabolites when changing the feeding level.

Comparative Biochemistry and Physiology, Part D, Genomics Proteomics 7(4), 2012: 322-327

http://www.sciencedirect.com/science/article/pii/S1744117X12000482

Food transit time, nutrient digestibility and nitrogen retention in farmed and feral American mink (*Neovison vison*) - a comparative analysis

A. Gugołek, D. Zalewski, J. Strychalski, M. Konstantynowicz

The aim of this study was to determine whether farming leads to changes in gastrointestinal function and nitrogen metabolism in farmed mink (FA), as compared with their wild-living counterparts. Three digestibility and balance trials were carried out. Experiment I was performed in May, and experiments II and III were conducted in September 2011. Farmed mink with the standard coat colour were purchased from a production farm in south-eastern Poland. Feral mink were harvested using cages in the hunting grounds of the Polish Hunting Association, Branch in Olsztyn. The experimental materials comprised of the following: trial I – adult males (eight animals per group), trial II – young females (six animals per group), trial III–young animals (five males and five females per group). Food transit time was measured during digestibility trials, on 10 consecutive days. The coefficients of nutrient and energy digestibility and daily nitrogen balance values were compared between groups in each experiment. It was found that farming contributed to changes in gastrointestinal function and nitrogen metabolism in mink. Farmed animals were characterized by a longer bowel transit time, a tendency towards higher nutrient digestibility and higher nitrogen retention, which resulted from selection for higher productivity.

J. Anim. Physiol. Anim. Nutr. (Berl), 2012: [Epub 2012 Sep 30]

http://onlinelibrary.wiley.com/doi/10.1111/jpn.12006/abstract

Embryonic diapause: advances in understanding the enigma of seasonal delayed implantation

B.D Murphy

Embryonic diapause is an evolutionary strategy by which a reversible arrest in embryo development occurs. In its two forms, facultative and obligate, it assures that offspring are born when optimal maternal and environmental conditions are present to ensure maximal survival. We have explored obligate delayed implantation in the mink (*Neovison vison*) over four decades: first by evaluation of the environmental regulation, then by determination of the pituitary factors that maintain diapause and provoke implantation followed by exploration of the ovarian contribution to the process. As the uterine environment is the proximal regulator of diapause, we employed a strategy of global gene analysis to discover differentially expressed pathways during

embryo arrest and reactivation. These trials revealed that the synthesis of polyamines was increased in the uterus with reactivation of the embryo *in vivo*. Subsequent experiments demonstrated that the polyamine, putrescine, was capable of inducing escape of the embryo from obligate diapause, providing strong evidence that the paucity of polyamines induces developmental arrest, and reactivation is coupled to renewed uterine and/or embryonic synthesis of these polycations.

Reprod. Domest. Anim., 2012: 47(6): 121-124

http://onlinelibrary.wiley.com/doi/10.1111/rda.12046/abstract

The Causes of the Low Breeding Success of European Mink (*Mustela lutreola*) in Captivity

K. Kiik, T. Maran, A. Nagl, K. Ashford, T. Tammaru

High among-individual variation in mating success often causes problems in conservation breeding programs. This is also the case for critically endangered European mink and may jeopardize the long-term maintenance of the species' genetic diversity under the European mink EEP Program. In this study, breeding success of wild and captive born European minks at Tallinn Zoological Garden are compared, and the mating behavior of the males is analyzed. Results show that wild born males successfully mate significantly more often than captive born males (89% and 35%, respectively). On the basis of an extensive record of mating attempts, both male aggressiveness and passivity are identified as primary causes of the observed mating failures. All other potential determinants have only a minor role. Mating success as well as a male's aggressiveness and passivity are shown to depend more strongly on the male than the female partner. We did not find any evidence that the behavior of an individual is dependent on the identity of its partner. We suggest that aggressiveness and passivity are two expressions of abnormal behavior brought about by growing up in captivity: the same individuals are likely to display both aggressive and passive behavior. The results point to the need to study and modify maintenance conditions and management procedures of mink to reduce the negative impact of the captive environment on the long-term goals of the program.

Zoo. Biol., 2013: [Epub 2013 Feb 20]

http://onlinelibrary.wiley.com/doi/10.1002/zoo.21062/abstract

Environmentally enriched rearing environments reduce repetitive perseveration in caged mink, but increase spontaneous alternation

D.L. Campbell, J.A. Dallaire, G.J. Mason

Behav. Brain Res., 2013: 239:177-187

http://www.sciencedirect.com/science/article/pii/S0166432812007243

Responses of mink to auditory stimuli: prerequisites for applying the "cognitive bias" approach

P.M. Svendsen, J. Malmkvist, U. Halekoh, M. Mendl

Behav. Processes, 2012: 91(3): 291-297

http://www.sciencedirect.com/science/article/pii/S0376635712001982

A re-assigned American mink (*Neovison vison*) map optimal for genome-wide studies

R. Anistoroaei, V. Nielsen, M.N. Markakis, P. Karlskov-Mortensen, C.B. Jørgensen, K. Christensen, M. Fredholm

Gene, 2012: 511(1): 66-72

http://www.sciencedirect.com/science/article/pii/S0378111912010347

A frameshift mutation in the LYST gene is responsible for the Aleutian color and the associated Chédiak-Higashi syndrome in American mink

R. Anistoroaei, A.K. Krogh, K. Christensen

One of the colors of mink is Aleutian (aa)-a specific gun-metal gray pigmentation of the fur-commonly used in combination with other color loci to

generate popular colors such as Violet (aammpp) and Sapphire (aapp). The Aleutian color allele is a manifestation of mink Chédiak-Higashi syndrome (CHS), which has been described in humans and several other species. As with forms of CHS in other species, we report that the mink CHS is linked to the lysosomal trafficking regulator (LYST) gene. Furthermore, we have identified a base deletion (c.9468delC) in exon 40 of LYST, which causes a frameshift and virtually terminates the LYST product prematurely (p.Leu3156Phefs*37). We investigated the blood parameters of three wild-type mink and three CHS mink. No difference in the platelet number between the two groups was observed, but an accumulation of platelets between the groups appears different when collagen is used as a coagulant. Microscopic analysis of peripheral blood indicates giant inclusions in the neutrophils of the Aleutian mink types. Molecular findings at the LYST locus enable the development of genetic tests for analyzing the color selection in American mink.

Anim. Genet., 2013: 44(2): 178-183

http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2052.2012.02391.x/abstract

Exclusion of candidate genes for coat colour phenotypes of the American mink (*Neovison vison*)

R. Anistoroaei, M.N. Markakis, K. Vissenberg, K. Christensen

In a previous project, we screened the American mink Bacterial Artificial Chromosome library, CHORI-231, for genes potentially involved in various coat colour phenotypes in the American mink. Subsequently, we 454 sequenced the inserts containing these genes and developed microsatellite markers for each of these genes. Here, we describe a lack of association between three different 'roan-type' phenotypes represented by Cross, Stardust and Cinnamon in American mink and six different genes that we considered to be potentially linked to these phenotypes. Thus, c-KIT (HUGO-approved symbol KIT), ATOH-1 (HUGO-approved symbol ATOH1) and POMC were excluded as potential candidates for these three phenotypes. In addition, MITF and SLC24A5 were excluded for Cross and Cinnamon, and KITL (HUGO-approved symbol KITLG) for Cross and Stardust. Although most of these genes have been implicated as the cause of similar phenotypes in other mammals, including horses, pigs, cows, dogs, cats, mice and humans, they do not appear to be responsible for comparable phenotypes found in American mink.

Anim. Genet., 2012: 43(6): 813-816

http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2052.2012.02339.x/abstract

Complete genome sequence of a mink calicivirus in China

B. Yang, F. Wang, S. Zhang, G Xu, Y. Wen, J. Li, Z. Yang, H. Wu

We report the complete genome sequence of a novel calicivirus isolated from a diseased mink in China. The complete viral genome is approximately 8.4 kb in length and consists of three open reading frames. The availability of the complete genome sequence is helpful for further investigation into the molecular characteristics and epidemiology of calicivirus in mink.

J. Virol., 2012: 86(24): 13835

http://jvi.asm.org/content/86/24/13835.abstract?sid=05acbe42-4243-46b4-911a-9a94fdbdf4bc

The melatonin influences on neutrophils/ lymphocytes ratio of mammals blood depends on age of animals

L.B. Uzenbaeva, I.A. Vinogradova, A.G. Kizhina, O.A. Prokopenko, A.I. Malkiel, A.I. Goranskiĭ, S. Lapinski, V.A. Iliukha

The influence of melatonin on age dynamics of neutrophils and lymphocytes in blood of laboratory rats kept under different light conditions and predatory mammals--farmer silver fox, raccoon dog kept under natural light (NL) was investigated. The decrease of lymphocyte level, increase neutrophils content and alteration of neutrophils/lymphocytes ratio of aged rats (24 months) kept under natural light (NL) and standard light (LD) and adult silver foxes (2-5 years) kept under natural light in

comparison with juvenile animals were detected. The reduced lymphocytes level and increased neutrophil level in rats under constant light (LL) were revealed in younger ages. The melatonin effect was detected in aged rats and adult silver foxes and not observed in juvenile animals.

Adv. Gerontol., 2012: 25(3): 409-414.

http://www.ncbi.nlm.nih.gov/pubmed/23289215

Aleutian mink disease virus in furbearing mammals in Nova Scotia, Canada

A.H. Farid

Aleutian mink disease virus (AMDV) is widespread among ranched and free-ranging American mink in Canada, but there is no information on its prevalence in other wild animal species. This paper describes the prevalence of AMDV of 12 furbearing species in Nova Scotia (NS), Canada.
Samples were collected from carcasses of 462 wild animals of 12 furbearing species, trapped in 10 NS counties between November 2009 and February 2011. Viral DNA was tested by PCR using two primer pairs, and anti-viral antibodies were tested by counterimmunoelectrophoresis (CIEP) on spleen homogenates.
Positive PCR or CIEP samples were detected in 56 of 60 (93.3%) American mink, 43 of 61 (70.5%) short-tailed weasels, 2 of 8 (25.0%) striped skunks, 2 of 11 (18.2%) North American river otters, 9 of 85 (10.6%) raccoons, and 2 of 20 (10.0%) bobcats. Samples from six fishers, 24 coyotes, 25 red foxes, 58 beavers, 45 red-squirrels and 59 muskrats were negative. Antibodies to AMDV were detected by CIEP in 16 of 56 (28.6%) mink and one of the 8 skunks (12.5%). Thirteen of the mink and one skunk were positive for PCR and CIEP, but three mink and one skunk were CIEP positive and PCR negative. Positive CIEP or PCR animals were present in all nine counties from which mink or weasel samples were collected.
The presence of AMDV in so many species across the province has important epidemiological ramifications and could pose a serious health problem for the captive mink, as well as for susceptible wildlife. The mechanism of virus transmission between wildlife and captive mink and the effects of AMDV exposure on the viability of the susceptible species deserve further investigation.

Acta. Vet. Scand., 2013: 55(1): 10

http://www.actavetscand.com/content/55/1/10/abstract

Identification of biosecurity measures and spatial variables as potential risk factors for Aleutian disease in Danish mink farms

G. E. Themudo, H. Houe, J.F. Agger, J. Ostergaard, A.K. Ersbøll

Prev. Vet. Med., 2012: 107(1-2): 134-141

http://www.sciencedirect.com/science/article/pii/S0167587712001651

Prevalence of the Aleutian mink disease virus infection in Nova Scotia, Canada

A.H. Farid, M.L. Zillig, G.G. Finley, G.C. Smith

Prev. Vet. Med., 2012: 106(3-4): 332-338

http://www.sciencedirect.com/science/article/pii/S0167587712001080

Phylogenetic analysis of the VP2 gene of Aleutian mink disease parvoviruses isolated from 2009 to 2011 in China

Y. Sang, J. Ma, Z. Hou, Y. Zhang

Aleutian mink disease parvovirus (AMDV) is a non-enveloped virus with a single-stranded DNA genome that causes a fatal, usually persistent immune complex disease in minks. In this study, a total of 18,654 serum samples were collected from minks that were farmed in China from 2009 to 2011. After testing by counter-current immuno-electrophoresis (CIE), the seroprevalence of AMDV was found to be 68.67 %. The results show that there is a serious epidemic among Chinese minks used for breeding. To gain detailed information regarding the molecular epidemiology of AMDV in China, nine strains of AMDV were isolated from mink samples that were collected from four of the primary mink farming areas in China. The full-length capsid protein VP2 gene from each strain was

sequenced after PCR amplification, and a phylogenetic analysis was performed on the VP2 gene sequence, including the VP2 genes from the other 10 AMDV strains available in the GenBank database, which were submitted from the 1970s to 2009. The phylogenetic analysis showed that the AMDV isolates were divided into five independent clades. The Chinese AMDV strains were distributed among all five groups and showed a high level of genetic diversity. Over 50 % of the Chinese AMDV strains were classified into two clades that consisted only of isolates from China and that were distinct from AMDV strains found in other countries. This finding indicated that both local and imported ADMV species are prevalent in the Chinese mink farming population

Virus Genes., 2012: 45(1): 31-37

http://link.springer.com/article/10.1007/s11262-012-0734-9

Genetic characterization of Aleutian mink disease viruses isolated in China

Y. Li, J. Huang, Y. Jia, Y. Du, P. Jiang, R. Zhang

Aleutian mink disease virus (AMDV) is a parvovirus that causes an immune complex mediated disease in minks. To understand the genetic characterization of AMDV in China, the genomic sequences of three isolates, ADV-LN1, ADV-LN2, and ADV-LN3, from different farms in the Northern China were analyzed. The results showed that the lengths of genomic sequences of three isolates were 4,543, 4,566, and 4,566 bp, respectively. They shared only 95.5-96.3 % nucleotide identity with each other. The nucleotide and amino acid homology of genome sequence between the Chinese isolates and European or American strains (ADV-G, ADV-Utah1, and ADV-SL3) were 92.4-95.0 % and 92.1-93.8 %, respectively. The amino acid substitutions randomly distributed in the genome, especially NS gene. ADV-LN1 strain had a 9-amino-acid deletion at amino acid positions 70 and 72-79 in the VP1 gene, comparing with ADV-G strain; ADV-LN2 and ADV-LN3 strains had 1-amino-acid deletion at amino acid positions 70 in the VP1. Some potential glycosylation site mutations in VP and NS genes were also observed. Phylogenetic analysis results showed that the three strains belonged to two different branches based on the complete coding sequence of VP2 gene. However, they all were in the same group together with the strains from United States based on the NS1 sequence. It indicated that Chinese AMDV isolates had genetic diversity. The origin of the ancestors of the Chinese AMDV strains might be associated with the American strains.

Virus Genes., 2012: 45(1): 24-30

http://link.springer.com/article/10.1007/s11262-012-0733-x

An unusual case of spinal cord restricted mycobacteriosis in a European mink

D. Schaudien, C. Flieshardt, I. Moser, H. Hotzel, A. Tipold, M. Bleyer, M. Hewicker-Trautwein, W. Baumgärtner

Granulomatous myelitis due to infection with Mycobacterium avium was diagnosed in a 4-year-old male neutered European mink (Mustela lutreola). The causative agent was detected by an acid-fast stain and further characterized by polymerase chain reaction and DNA sequencing of the PCR product. A thorough histological evaluation of the remaining organs revealed no granulomatous lesions or detectable acid-fast organisms. Although minks are generally highly susceptible for mycobacteria, localised infections, especially of the central nervous system, are unusual and may represent an atypical chronic form of the disease.

Tierarztl. Prax. Ausg. K Kleintiere/Heimtiere, 2013: 41(1): 63-66

http://www.researchgate.net/publication/235604039_An_unusual_case_of_spinal_cord_restricted_mycobacteriosis_in_a_European_mink

Selection of antiviral peptides against mink enteritis virus using a phage display Peptide library

Q. Zhang, Y. Wang, Q. Ji, J. Gu, S. Liu, X. Feng, C. Sun, Y. Li, L. Lei

Mink enteritis virus (MEV) causes high morbidity and mortality in mink worldwide, and there are no effective treatments. This study used a phage display library to find specific peptides capable of binding MEV and preventing its replication in F81 cells. After three rounds of biopanning, the phage enrichment was 117 times higher than that after the first round. Twelve phage clones that showed threefold higher MEV-binding affinity than controls were selected by ELISA. Following sequence analyses, the peptides RLNNRARIILRA and LAHKSRLYERHM were synthesized and used for antiviral experiments. MTT assays demonstrated that both peptides increased cell viability by >20 % at 100 μg/ml when pre-incubated with MEV. However, no effect was seen if the peptides were added 2 h after viral inoculation of cells, indicating that the antiviral activity is due to inhibition of viral attachment to the cell surface.

Curr. Microbiol., 2013: 66(4): 379-384

http://link.springer.com/article/10.1007/s00284-012-0284-3

Evidence for natural recombination between mink enteritis virus and canine parvovirus

J. Wang, S. Cheng, L. Yi, Y. Cheng, S. Yang, H. Xu, H. Zhao, X. Yan, H. Wu

A virus was isolated from mink showing clinical and pathological signs of enteritis in China. This virus, designated MEV/LN-10, was identified as mink enteritis virus (MEV) based on its cytopathic effect in the feline F81 cell line, the hemagglutination (HA) and hemagglutination inhibition (HI) assay, electron microscopy (EM) and animal infection experiments. The complete viral genome was cloned and sequenced. Phylogenetic and recombination analyses on the complete MEV/LN-10 genome showed evidence of recombination between MEV and canine parvovirus (CPV). The genome was composed of the NS1 gene originating from CPV while the VP1 gene was of MEV origin. This is the first demonstration of recombination between a CPV and MEV in nature.
Our findings not only provide valuable evidence indicating that recombination is an important genetic mechanism contributing to the variation and evolution of MEV, but also that heterogeneous recombination can occur in the feline parvovirus subspecies.

Virol. J., 2012: 9: 252

http://www.virologyj.com/content/9/1/252

Typing of Pseudomonas aeruginosa from hemorrhagic pneumonia in mink *(Neovison vison)*

C.M. Salomonsen, G.F. Themudo, L. Jelsbak, S. Molin, N. Høiby, A.S. Hammer

Vet. Microbiol., 2013: 163(1-2): 103-109

http://www.sciencedirect.com/science/article/pii/S0378113512006815

Investigation of the presence of human or bovine respiratory syncytial virus in the lungs of mink (Neovison vison) with hemorrhagic pneumonia due to Pseudomonas aeruginosa

C.M. Salomonsen, S.Ø. Breum, L.E. Larsen, J. Jakobsen, N. Høiby, A.S. Hammer

Hemorrhagic pneumonia is a disease of farmed mink (Neovison vison) caused by Pseudomonas aeruginosa. The disease is highly seasonal in Danish mink with outbreaks occurring almost exclusively in the autumn. Human respiratory syncytial virus (RSV) has been shown to augment infection with P. aeruginosa in mice and to promote adhesion of P. aeruginosa to human respiratory cells.
We tested 50 lung specimens from mink with hemorrhagic pneumonia for bovine RSV by reverse transcriptase polymerase chain reaction (PCR) and for human RSV by a commercial real-time PCR. RSV was not found.
This study indicates that human and bovine RSV is not a major co-factor for development of hemorrhagic pneumonia in Danish mink.

Acta. Vet. Scand., 2012: 54: 70

http://www.actavetscand.com/content/54/1/70

DNA vaccines encoding proteins from wild-type and attenuated canine distemper virus protect equally well against wild-type virus challenge

L. Nielsen, T.H. Jensen, B. Kristensen, T.D. Jensen, P. Karlskov-Mortensen, M. Lund, B. Aasted, M. Blixenkrone-Møller

Immunity induced by DNA vaccines containing the hemagglutinin (H) and nucleoprotein (N) genes of wild-type and attenuated canine distemper virus (CDV) was investigated in mink (Mustela vison), a highly susceptible natural host of CDV. All DNA-immunized mink seroconverted, and significant levels of virus-neutralizing (VN) antibodies were present on the day of challenge with wild-type CDV. The DNA vaccines also primed the cell-mediated memory responses, as indicated by an early increase in the number of interferon-gamma (IFN-γ)-producing lymphocytes after challenge. Importantly, the wild-type and attenuated CDV DNA vaccines had a long-term protective effect against wild-type CDV challenge. The vaccine-induced immunity induced by the H and N genes from wild-type CDV and those from attenuated CDV was comparable. Because these two DNA vaccines were shown to protect equally well against wild-type virus challenge, it is suggested that the genetic/antigenic heterogeneity between vaccine strains and contemporary wild-type strains are unlikely to cause vaccine failure.

Arch Virol., 2012: 157(10): 1887-1896

http://link.springer.com/article/10.1007%2Fs00705-012-1375-y

Disease-associated prion protein in neural and lymphoid tissues of mink (*Mustela vison*) inoculated with transmissible mink encephalopathy

D.A. Schneider, R.D. Harrington, D. Zhuang, H. Yan, T.C. Truscott, R.P. Dassanayake, K.I. O'Rourke

J. Comp Pathol., 2012: 147(4): 508-521

http://www.sciencedirect.com/science/article/pii/S0021997512000734

Dietary contaminant exposure affects plasma testosterone, but not thyroid hormones, vitamin A, and vitamin E, in male juvenile arctic foxes (*Vulpes lagopus*)

I.G. Hallanger, E.H. Jørgensen, E. Fuglei, Ø. Ahlstrøm, D.C. Muir, B.M. Jenssen

Levels of persistent organic pollutants (POP), such as polychlorinated biphenyls (PCB), are high in many Arctic top predators, including the Arctic fox (Vulpes lagopus). The aim of this study was to examine possible endocrine-disruptive effects of dietary POP exposure in male juvenile Arctic foxes in a controlled exposure experiment. The study was conducted using domesticated farmed blue foxes (Vulpes lagopus) as a model species. Two groups of newly weaned male foxes received a diet supplemented with either minke whale (Balene-optera acutorostrata) blubber that was naturally contaminated with POP (exposed group, n = 5 or 21), or pork (Sus scrofa) fat (control group, n = 5 or 21). When the foxes were 6 mo old and had received the 2 diets for approximately 4 mo (147 d), effects of the dietary exposure to POP on plasma concentrations of testosterone (T), thyroid hormones (TH), thyroid-stimulating hormone (TSH), retinol (vitamin A), and tocopherol (viramin E) were examined. At sampling, the total body concentrations of 104 PCB congeners were 0.1 ± 0.03 µg/g lipid weight (l.w.; n = 5 [mean ± standard deviation]) and 1.5 ± 0.17 µg/g l.w. (n = 5) in the control and exposed groups, respectively. Plasma testosterone concentrations in the exposed male foxes were significantly lower than in the control males, being approximately 25% of that in the exposed foxes. There were no between-treatment differences for TH, TSH, retinol, or tocopherol. The results suggest that the high POP levels experienced by costal populations of Arctic foxes, such as in Svalbard and Iceland, may result in delayed masculine maturation during adolescence. Sex hormone disruption during puberty may thus have lifetime consequences on all aspects of reproductive function in adult male foxes.

J. Toxicol. Environ. Health A., 2012: 75(21): 1298-1313

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Mustelidae are natural hosts of Staphylococcus delphini group A

L. Guardabassi, K.R. Schmidt, T.S. Petersen, C. Espinosa-Gongora, A. Moodley, Y. Agersø, J.E. Olsen

Vet. Microbiol., 2012: 159(3-4): 351-353

http://www.sciencedirect.com/science/article/pii/S0378113512002325

Determination of sperm acrosin activity in the arctic fox (*Alopex lagopus* L.)--using method developed for human spermatozoa

K. Stasiak, B. Janicki, J. Glogowski

The aim of the study was to adapt a method to determine acrosin activity of human spermatozoa to arctic fox (Alopex lagopus L.) spermatozoa. We modified this method by reducing sperm count per sample from 1 divided by 10 x 10(6) to 25 divided by 200 x 10(3), incubation time from 180 minutes to 60 minutes, and Triton X-100 concentration in the reaction mixture from 0.01% to 0.005% per 100 cm3. It has also confirmed that arctic fox seminal plasma is rich in proteinases and their inhibitors. To completely abolish the inhibitory effect of seminal plasma on acrosin activity it is recommended to wash the spermatozoa four times. Benzamidine served an inhibitor of acrosin activity

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http://www.ncbi.nlm.nih.gov/pubmed/?term=Determination+of+sperm+acrosin+activity+in+the+arctic+fox+(Alopex+lagopus+L.)--using+method+developed+for+human+spermatozoa.

Actual Mink Research 2012

Meeting at Research Centre Foulum

Faculty of Science and Technology

Aarhus University, Denmark

Can farm feeding be adjusted to better comply with the foraging behaviour of mink?

J. Malmkvist

We investigated whether (A) provision of additional appetitive and consummatory elements of foraging and (B) the timing of feeding, reduce the development of abnormal behaviour (stereotypies and fur-chewing) in farmed mink (*Neovison vison*). In study A, we included 225 juvenile mink (n=100 males and females) during the 5-month growth period with plenty of feed, and subsequently adult females during the 2-month period of feed restriction before mating. These mink were distributed in four equal-sized groups: (i) FARM, commercial farm feeding without foraging enrichment; (ii) ROPE, access to biting ropes; (iii) CHNK chunky feed, i.e. same type of farm feed but less fine-grinded; (iv) BOTH, access to both biting ropes and chunky feed. In study B, we observed 50 mink females during the winter period until mating, divided into two equal-sized groups fed normal farm feed at sunrise vs. 4 hours later. Mink in study A (groups ROPE, BOTH) manipulated biting ropes mainly prior to feeding in both observation periods (November, February). In growing mink, access to biting ropes reduced fur-chewing (occurring in 16 % vs. 29 % of mink without biting ropes; P=0.044), and access to chunky feed reduced both fur-chewing (occurring in 16 % vs. 33 % of females without chunky feed, NS in males, treatment*sex interaction P=0.019) and the rather low amount of stereotypic behaviour (0.1 % vs. without chunky feed: 0.8 % of scanning observations; P=0.038). During the season of feed restriction the wear/tear of biting ropes increased. In the restrictively fed adult females, fur-chewing was reduced both by access to biting ropes (P=0.005) and chunky feed (P=0.007). Consequently, 54 % of group FARM mink showed fur-chewing whereas this proportion was reduced to 21 % in group BOTH. The amount of stereotypic behaviour was higher in February than in November, and peaked during the pre-feeding hours (h 08-12: 28.8 %) compared to during the rest of the day (h 12-07: 5.2 % of observation time). Mink fed the same type of feed, being less fine-grinded (groups CHNK, BOTH), spent less time on pre-feeding stereotypic behaviour than mink fed normal farm feed (P = 0.013). There was no effect of biting rope access on the time spent in stereotypic behaviour (P = 0.87) in the adult females fed restrictively. In study B, females fed at sunrise had a higher increase in body weight at pelting, and consequently lost more weight during the period until mating, however, concurrent with a lower concentration of faecal cortisol metabolites (P=0.001), indicative of reduced stress/mobilisation of energy. Although sunrise fed females appeared less fur-chewed this was not statistically significant (P = 0.11) in the current study. Feeding time did not affect the time spent in stereotypic behaviour after prolonged fed restriction (P=0.63), which may be due to a high feeding motivation in these females. In conclusion, relatively small changes in feeding management (e.g. access to less fine-grinded daily feed, access to biting ropes in the cage for mink to manipulate with) and feeding in active period at sunrise during the winter period appear beneficial for farm mink.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 5-12. Authors' abstract.

Plastic tubes and straw briquettes reduce fur chew

S.W. Hansen

Subjects were 264 mink kits kept in groups of two males plus two females from weaning and until pelting. In August the kits were distributed on 5 different groups (C, T, B, BT, A).Group C: Control group without access to tubes or straw briquettes. Group B: Permanent access to straw briquettes of 150 mm long and a Diameter of 70 mm. Group T: Permanent accesses to plastic tubes of 150 mm length and a diameter of 40 mm. Group BT: Permanently access to both straw briquettes and plastic tubes. Group A: Alternate access to either straw briquettes or plastic tubes for two weeks at a time. The aim was to examine whether access to a plastic tube and/or straw briquettes has various effect on the occurrence of fur chewing, ear suck, bite marks and stereotypy. A reduction of these occurrences of these types of abnormal behaviour indicates increased welfare in mink. Permanent access to straw briquettes and/or a plastic tube during the period from August to November or alternating access to either a plastic tube or straw briquettes reduced the extent of fur chew in November compared to mink in the control group and is thus an enrichment in the cage environment increasing the welfare of mink.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 13-19. Authors' abstract.

Bite marks indicate aggression in mink

S.W. Hansen

Does aggression in Danish mink production occur more often in mink kept in groups than in mink kept in pairs? The question was examined on four farms, by comparing the number of deaths, removals of animals, wounds and bite marks in brown mink kept in groups and mink kept in pairs (male + female). Through several years, the four farms had practiced group housing in parts of the farm. The result showed that it is possible to keep mink in groups with a low occurrence of deaths and wounds. However, the result also showed that the occurrence of deaths, wounds and bite marks can become high and that we still do not know which factors are involved when things go wrong. On the contrary, we have proved that the number of bite marks are bigger in mink kept in groups than in mink kept in pairs and thus the risk of injuries are highest when mink are kept in groups.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 20-24. Authors' abstract.

Pathological examination of skin ulcers in mink

A.S. Hammer, A. Jespersen, H.E. Jensen

EUs Scientific Committee on Animal Health and Animal Welfare has concluded that skin ulcers in mink should be considered an indicator for reduced welfare. However, there are only a few investigations and reports considering ulcers in mink. In all mammalian species, the healing process is characterized by specific steps, but many factors affect the process, resulting in considerable species differences in how and how fast wound healing occurs.
The project presented is in the initial phase and will be continued through the coming years. The investigations of skin ulcers are part of a new 3-year project initiated in April 2012.The purpose of the project is to define a simple and clinically relevant classification system for skin ulcers in mink. Such a classification system can be applied as a tool to evaluate spontaneous skin ulcers in practice and will enable targeting of research with the purpose of improving management and prevention of ulcers. Preliminary results from examination of mink kits collected in June 2012 indicate that most prevalent ulcers in this period are located in the head region (ear and neck ulcers), while post mortem changes inflicted after the death of mink kits most often are located to the abdominal region and limbs of the animals. The preliminary investigations of mink skin ulcers indicate that it is difficult or in most cases not possible to determine the age of the ulcers based solely on a visual inspection of the ulcers. More investigations, including experimental studies, are necessary to describe the healing processes of mink skin ulcers, in order to have a classification system established.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 25-28. Authors' abstract.

Optimal weaning procedure in mink

T. Clausen, P.F Larsen

Weaning of mink kits must be conducted in a way that takes account of the welfare of both female and kits. According to the Danish legislation mink kits are not allowed to be weaned before eight weeks of age. Studies on weaning of mink kits show that the number of bites among kits increases after day 42, especially in the period from day 42 to 49, and especially in the large litters. Therefore we need to point our attention towards prevention of bites by dividing the of big litters at day 42.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 29-33. Authors' abstract.

Learning behaviour in stereotyping and non-stereotyping mink

P. Svendsen

The aim of this study was to investigate whether variation in stereotypic behavior in two groups of mink, selected for performing high (HS) and none/low (LS) levels of stereotypic behavior, had an influence on differences in learning behavior and ability in an instrumental learning task. The two groups developed differently in the number of trials and correct lever presses over 19 sessions. LS mink had more correct lever presses in fewer trials and had lower latencies to respond in the test. The difference may be explained by LS mink pressing the lever more readily across sessions, which is interesting to investigate further.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 34-37. Authors' abstract.

Inbreeding, crossing and litter size in a seven generation mink population

J. Thirstrup, P.F Larsen, V.H. Nielsen, C. Pertoldi

Analyzes of litter size in a mink population, where litter sizes were registered through seven generations, implies that inbreeding reduces litter size. The litter size was increased by crossing mink from different lines. The effect of crossing lines on litter size was most pronounced in the first few generations after crossing. After few generations, the litter size dropped to a level comparable to the litter size in the original populations.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 38-42. Authors' abstract.

Protein reduction in mink feed towards 2015 – effects for mink production in Denmark?

P.F. Larsen, T.N. Clausen

This present study showed that the ongoing optimization of the protein content in mink feed towards 2015, i.e. a 15% reduction compared to 2009, is possible without negative effects on breeding result, skin size and health of the mink, whereas a reduction is observed on skin quality. We are almost "there" but needs more information in some critical periods to avoid reduction in skin quality on the research farm, Kopenhagen Farm.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 43-47. Authors' abstract.

Meat, vegetables and fatty liver in mink

B.M. Damgaard, P.F. Larsen, T.N. Clausen

The aim of the project was to investigate the possibilities of feeding reduced dietary protein content during the whole growing-furring period or parts of the growing-furring period and still support normal growth performance and ensure good health status in mink. Effects of the diets on body weight,

mortality rate, and blood and liver variables were followed.
The results showed that the dietary protein supply to mink in the late growth phase have to be at least 25 % of metabolizable energy. At lower dietary protein contents tendency to increased number of dead mink with fatty liver was observed. Furthermore, signs on negative effects on the immune system were observed at low dietary protein content.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 48-52. Authors' abstract.

Can the choline status in mink be determined in a blood sample?

M.S. Hedemann

In two experiments; one with mink kits fed different levels and sources (choline chloride or soy lecithin) of choline and one with full-grown mink fed different levels of choline chloride, we determined the concentration of choline in plasma in order to find out whether the plasma concentration of choline was indicative of the choline status. Mink kits ate significantly more of the diets containing soy lecithin and hence these mink kits had a better growth. Only mink kits fed the highest concentration of choline (4000 mg/kg feed) had increased concentration of free choline in plasma when compared to the mink kits fed 400, 1000 or 2500 mg choline/kg feed. The feed intake and the weight loss during the experimental period did not differ in full-grown mink fed 40, 400, 1000 or 5000 mg choline/kg feed. The plasma concentration of free choline did not differ between the experimental groups even though the intake of choline differed 125 times between the highest and lowest group. Choline may be oxidized to betaine which is an irreversible process. In mink kits the concentration of betaine in plasma increased with increasing level of choline in the feed whereas the betaine concentration was only increased in the group feed the highest level of choline in the full-grown mink. In conclusion, the concentration of free choline in plasma cannot be used as an indicator of choline status. Betaine is a marker of the choline status in mink kits but this is not the case in full-grown mink and the current study does not show up to which age betaine is a valid marker of choline status.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 53-59. Authors' abstract.

Minks requirement for vitamin A and its importance for vitamin D and E status

S.K. Jensen, T.N. Clausen

A well balanced vitamin supplementation is a prerequisite for a good growth and wellbeing of mink. Fat soluble vitamins are most sensitive towards over or under supply, especially because several of them interact with each other with respect to dose and chemical form. The purpose of the present experiment was to investigate the effect of increasing amount of vitamin A and either synthetic vitamin E or natural vitamin E in the feed to growing mink on their vitamin A, D and E status. To the experiment two forms of vitamin E was used (synthetic *all-rac*-α-tocopheryl acetate and natural RRR-α-tocopherol (Immun E® Natur)). The experiment showed that mink already in the unsupplemented feed met their vitamin A requirement. Further the experiment showed that mink did not face a negative effect of large amounts of vitamin A on vitamin E status as pigs and calves. However, the experiment showed showed that vitamin D status in plasma decreased with increasing vitamin A in the feed. Also natural vitamin E in the feed decreased plasma vitamin D status compared to synthetic vitamin E. However feeding natural vitamin E had a positive influence on vitamin A status in the kidneys. Generally female had higher vitamin status than the males.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 60-64. Authors' abstract.

How can we avoid obesity in the autumn in juvenile mink selected as breeders?

S.H. Møller

The body size of mink increase by more than 2% a year, and obesity is an increasing problem in juveniles selected as next year's breeders. Individual feed restriction managed by 6 hours without feed

from Mid-September was tested as a potential solution. This investigation shows that mink juveniles increase their feed ingestion per hour when the feed allowance is less than ad libitum. Consequently the number of hours with no feed left before next feeding is difficult to use as a management tool for restricted feeding as at least 9 hours without feed is needed in order to reduce feed intake – and more hours are needed for females than for males to produce the same effect. There seems to be a limit in feed intake around 20 g per hour for a couple of male + female juvenile mink. This limit can be used to calculate the hours without feed needed in order to reach a given restricted feed allowance.

Meeting at Research Centre Foulum, Faculty of Science and Technology Aarhus University, Denmark. DCA Report no. 10, September 2012 (in Danish) p. 65-69. Authors' abstract.

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