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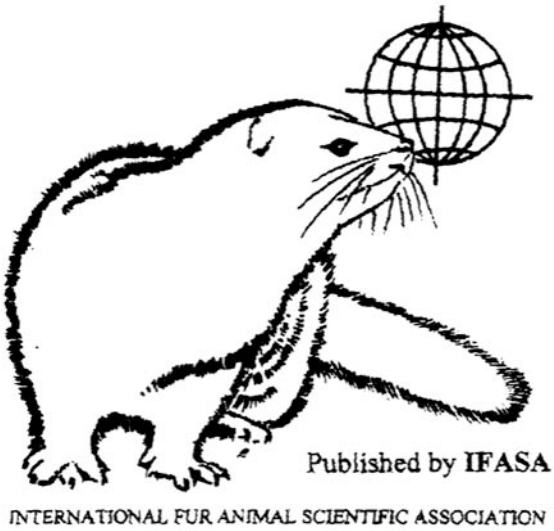

VIII International Scientific Congress in Fur Animal Production

September 15-18th, De Ruwenberg, 's-Hertogenbosch, The Netherlands

Volume 28 nr. 2: Scientific Program and Abstracts

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September 15th, 2004

To the Delegates of the VIII International Scientific Congress in Fur Animal Production

Welcome to the IFASA Congress! It is most pleasing to meet in the beautiful and historic De Ruwenberg Center. Its location provides a pastoral setting not only for the Congress lectures and presentations, but also for productive discussions and interactions among fur animal scientists. This Congress is sponsored by the Dutch Fur Breeders´ Association. We can thank the organizing committee, headed by Wim Verhagen, ably assisted by Louise Boekhorst and Jan de Rond for making the arrangements and for their considerable efforts over the last year in organizing the Congress. We are grateful to Dr. Bert Urlings and his Scientific Committee, who have developed an outstanding program, with keynote lecturers speaking on the state-of-the-art topics in fur animal production. The component of the program contributed by the delegates in the form of platform talks and posters has a diversity of presentations that will surely generate excitement and discussion.

Please take advantage of the opportunity provided by the Congress to discuss science with your colleagues, to reunite with old friends and to meet new friends. The vigor of our science and of IFASA depends on these interactions. Participate, ask questions, learn, and have fun at the Congress.

Bruce D. Murphy
President, IFASA

Preface

Fur animal production is an important global economic activity. In several regions of the world fur production is a major agriculture activity, thus providing high quality products, sustainability of local communities, often in remote area's and providing products that are asked for by the global consumers. In this respect we are very honoured to welcome the global fur animal scientific community in the Netherlands to have their four-annual scientific meeting.

This VIII International Scientific Congress in Fur Animal Production provides an unique forum for scientists and specialists in fur animal production to pool their expertise and to interact on basic scientific and practical issues of the global fur animal community. The history of these meeting shows that these four-annual meetings are an important reference point for scientists and above all every meeting, including this VIIIth, the participation of young scientists that start their professional career in fur animal research is abundant. This shows also the strength of fur animal science, that embraces young scientists who spent their most productive years in this field of science.

We are grateful to the sponsors of the Congress, they substantially facilitate the organisation of this Congress and attribute accordingly to the creation of an atmosphere that promotes the exchange of ideas and knowledge.

It is a pleasure for the scientific and organising committees to welcome so many delegates, from all over the world, including many abstracts and full papers that both cover all regions of the world and all scientific fields. It is encouraging to experience that so many colleagues took the opportunity to put a lot effort in conducting and reporting their research. The unconditional willingness of many colleagues from all over the world to help the scientific committee in reviewing and preparing all parts of the proceedings helped us to present all this scientific work both printed and electronically.

Finally what is a congress without all the delegates that participate in all the events and put their individual emphasis on this congress. Again welcome and have a fruitful and nice stay in the Netherlands.

Bert Urlings
Scientific Committee

Wim Verhagen
Organising Committee

General program

Time	Wednesday 15-9-2004
From 16.00	Registration
19.00	Opening Reception Dinner buffet

Time	Thursday 16-9-2004				Room
8.45 – 9.30	Opening				A 1
9.30 – 10.15	Management of health in mink, *Møller* **(keynote)**				A 1
10.15 - 10.45	Coffeebreak				
10.45 – 11.45	Parallel session Welfare and Ethics	Room D 2	10.45 – 11.45	Parallel session Nutrition	A 1
12.15 – 13.15	Lunch				
13.15 – 13.45	Ethical and societal discussion on fur production, *Brom* **(keynote)**				A 1
13.45 – 14.15	Swimming water for farmed mink: liking, wanting or needing? *Spruijt* **(keynote)**				A 1
14.30 – 15.00	Parallel session Health	Room D 2	14.30 – 15.00	Parallel session Nutrition	A 1
15.00 – 15.30	Coffeebreak				
15.30 - 16.15	Parallel session Welfare and Ethics	Room D 2	15.30 – 16.30	Parallel session Nutrition	A 1
16.15 - 16.30	Discussion Welfare and Ethics Posters	Room D 2	16.30 – 16.45	Discussion Nutrition Posters	A 1
17.00 – 20.00	Social program at ‘s-Hertogenbosch				
20.00	Dinner				A 1

Time	Friday 17-9-2004				Room
8.30 – 13.00	Field visit and technical excursion				
13.00 – 14.00	Lunch				
14.00 – 15.00	A systematic approach to sustainable fur farming, with special reference to feed and feeding, *Polonen/Sønderup/Koenen* **(keynote)**				A 1
15.00 – 15.30	Coffeebreak				
15.30 – 16.30	Parallel session Genetics and Reproduction	Room A 1	15.30 – 16.45	Parallel session Health	D 2
16.30 – 17.30	Parallel session Nutrition	Room A 1	16.30 – 16.45	Discussion Health Posters	D 2
17.30 – 18.00	Board meeting				
20.00	Galadinner at ‘s-Hertogenbosch				

Time	Saturday 18-9-2004				Room
9.00 – 9.45	Automated assessment of fur properties and its use in fur farming, *Fallenius* **(keynote)**				A 1
9.45 – 10.15	Coffeebreak				
10.15 – 11.00	Parallel session Fur Porperties	Room D 2	10.15 – 11.15	Parallel session Health	A 1
11.00 – 11.15	Discussion Fur Properties Posters	Room D 2	11.15 – 12.30	Discussion Wet kits	A 1
11.15 – 12.30	Parallel session Genetics and Reproduction	Room D 2			
12.30 – 12.45	Discussion Genetics and Reproduction Posters	Room D 2			
13.00	Closing ceremony				A 1
13.30	Lunch				

Oral presentations

		Thursday 16-9-2004		
Time	**Author**	**Title**	**Number**	**Room**
		Keynote Health		
9.30	Møller	Management of health in mink, *Møller* (keynote)	II – 1	A - 1
		Welfare and Ethics (parallel session) *Chair: Bakken*		
10.45	Barabasz	Productive value of confident temperament raccoon dags	I – 3	D2
11.00	Ahola	Group housing may impair fur quality in raccoon dogs	I – 4	D 2
11.15	Korhonen	Comparison of hall and shed as housing environments for blue foxes	I – 6	D 2
11.30	Jeppesen	Mink welfare improved by combined implementation of several small initiatives	I – 7	D 2
		Nutrition (parallel session) ***Chair: Rouvinen-Watt***		
10.45	Brzozowski	Influence of using enzymatic preparations: α-amylase, β-glucanase and xylanase on fur quality and nutrient digestibility in polar foxes	III - 2	A 1
11.00	Hansen	Different ratio between n-6 and n-3 fatty acids in diets for lactating mink (Mustela vison) dams – effect on milk and kit tissue fatty acid composition.	III - 3	A 1
11.15	Laerke	Physico-chemical properties of different carbohydrate sources in the gut of mink	III - 4	A 1
11.30	Valaja	Effect of lactic acid bacteria and β-glucanase treatments on the nutritive value of barley for growing blue fox	III - 5	A 1
		Keynote Welfare and Ethics		
13.15	Brom	Ethical and societal discussion on fur production (keynote)	I – 1	D 2
13.45	Spruijt	Swimming water for farmed mink: liking, wanting or needing? (keynote)	I – 2	D 2

		Thursday 16-9-2004		
Time	**Author**	**Title**	**Number**	**Room**
		Health (parallel session) ***Chair: Tove Clausen***		
14.30	Christensen	A preliminary linkage map of the mink (Mustela vison) genome	II – 2	D 2
14.45	Slugin	Not diagnosed stage of aleutian disease.	II – 3	D 2
15.00		Coffee break		
		Nutrition (parallel session) ***Chair: Sandbol/Lassen***		
14.15	Sandbol	Ideal Protein for Mink (Mustela vison) in the Growing and Furring Period.	III – 6	A 1
14.30	Rouvinen-Watt	Effect of feeding intensity on body condition and glycemic control in mink Mustela vison	III – 7	A 1
14.45	Nielsen	The effect of ad libitum and restricted feeding on growth curves and growth rate curves in mink selection lines	III – 8	A 1
16.00	Leoschke	Sodium BiSulfate As A Mink Feed Preservative	III – 9	A 1
16.15	Ahlstrom	Gas-producing microorganisms in formic acid preserved poultry by-products	III – 10	A 1
16.30	Vuure, van	Stability of processed blood and gelatine ingredients in mink feed.	III - 11	A 1
		Welfare and Ethics ***Chair: Spruijt***		
16.00	Hansen	The anticipatory behaviours of mink expecting a positive or negative reward	I – 8	D 2
16.15	Trapezov	Have fur bearers become domesticated ?	I – 9	D 2
16.30	Vinke	Play behaviour of juvenile farmed mink in the presence and absence of swimming water	I –10	D 2

		Friday 17-9-2004		
Time	**Author**	**Title**	**Number**	**Room**
		Keynote Nutrition		
14.00	Polonen/ Sonderup/ Koenen	A systematic approach to sustainable fur farming, with special reference to feed and feeding **(keynote)**	III - 1	A 1
		Nutrition III *Chair: Ahlstrom*		
15.30	Kulikov	The importance of protein for young mink fed with dry feed	III – 12	A 1
15.45	Kvartnikova	Nourishing qualities of APK concentrate for minks, cubs	III – 13	A 1
16.00	Møller	Individual ad libitum feeding of male + female pairs of mink kits during the growth period increases feed intake, weight gain and feed efficiency	III – 14	A 1
16.15	Nenonen	Effects of intensive fasting and methyl groups of feed on liver metabolism and welfare in breeding blue fox (Alopex lagopus) vixens	III - 15	A 1
		Genetics & Reproduction IV *Chair: Brzozowski*		
16.45	Hansen	Stochastic simulation of breeding schemes to improve economic genetic merit in mink production	IV – 1	A 1
17.00	Johannessen	Inbreeding in a commercial fur animal breeding programme	IV – 2	A 1
17.15	Peura	Genetics of littersize, age at first insemination and animal size in blue fox (Alopex lagopus)	IV – 3	A 1
17.30	Pyykönen	Lower housing density combined with stable social environment improves reproductive performance of primiparous silver fox vixens	IV - 4	A 1
		Health (parallel session) *Chair: Parker*		
16.45	Parker	Bacterial diskospondylitis associated with posterior paresis and paralysis in North American farmed mink (Mustela vison)	II – 4	D 2
17.00	Fedoseeva	Characteristics of some morphological and biochemical indices of marmots bred in cages	II – 5	D 2
17.15	Bis-Wencel	A level of some indices of the oxidation state in blood plasma of mink at slaughter period under the definite maintenance and feeding conditions	II – 6	D 2
17.30	Rouvinen-Watt	Mink nursing sickness survey in North America	II – 7	D 2
17.45	Hynes	Body condition and glycemic control in mink females during reproduction and lactation	II – 8	D 2

		Saturday 18-9-2004		
Time	**Author**	**Title**	**Number**	**Room**
		Keynote Fur Properties		
9.00	Fallenius	Automated assessment of fur properties and its use in fur farming **(keynote)**	V - 1	A 1
		Fur properties (parallel session) *Chair: Johannessen*		
10.15	Blomstedt	The influence of pelting time on pelt characteristics in blue fox (Alopex lagopus)	V - 2	D 2
10.30	Trapezov	Population genetics and registration of fox pelts in warehouses. (khlebnikov's travel notebooks revisited in terms of the hardy-weinberg law by borodin)	V - 3	D 2
10.45	Kondo	Hair density and morphology of medulla in Mustelidae	V - 4	D 2
		Health (parallel session) ***Chair: Koenen***		
10.15	Czifra	Mink astrovirus associated with pre-weaning diarrhoea in mink kits (an update)	II – 9	A 1
10.30	Clausen	Wet kits in mink, a review	II – 10	A 1
10.45	Koenen Kleijn van Willigen Rond, de	Wet kits, an update of the Dutch situation 2004 Wet kits, pathological and microbiological results in The Netherlands 2002/2004 Feed levels, mink milk composition and weighting inquiry; efforts in order to understand the "Wet kits problems"	II – 11 II – 12 II – 13	A 1
11.15		Discussion wet kits		A 1
		Genetics and Reproduction IV ***Chair: Murphy***		
11.00	Asikainen	Adaptation of the raccoon dog (Nyctereutes procyonoides) to wintering; effects of restricted feeding or periodic fasting on energy metabolism and reproduction	IV - 5	D 2
11.15	Murphy	Diapause, implantation and placentation in the mink: A critical role for embryonic signaling.	IV - 6	D 2
11.30	Nowakowicz -Debek	The effects of air pollutants on the cortisol and progesterone secretion in polar fox (Alopex lagopus)	IV - 7	D 2
11.45	Sugrobova	The influence of antioxidant emicidin on minks' physiological condition and reproduction	IV - 8	D 2

Poster presentations

Posters		
Author	**Title**	**Number**
	Welfare and Ethics	
Plotnikov	Evaluation of comfort of fur-bearing animal keeping by analyzing behaviour	I – 11
Trapezov	Conflicts arise between minks of different behavioral types	I – 12
Trapezov	Effect of coat color mutation in mink on the adrenal cortex function at pelting time in siberian climate	I – 13
Bespyatykh	Young nutria behaviour in runs of different types	I - 14
Hänninen	Group housing of farmed mink (Mustela vison) in climbing-cages	I - 15
	Health	
Domski	Oral immunization of fur-bearing animals against salmonellosis	II – 14
	Nutrition	
Bis-Wencel	The biochemical parameters in serum of mink fed high energy feedstuff with antioxidants and preservatives supplement.	III – 16
Clausen	Correlation between liver fat and dry matter in mink (Mustela vison)	III – 17
Damgaard	Effects of feeding strategy on behaviour, physiological parameters and feed residues in mink females	III - 18
Glover	Regulation of lipid and glucose metabolism in the mink (Mustela vison) – Sequence analysis and development of molecular probes	III - 19
Hejlesen	The effect of protein level on N-balance in adult mink (Mustela vison)	III - 20
Skrede	Bacterial protein produced on natural gas as a protein scource in dry diets for the growing-furring blue fox	III - 21
	Genetics and Reproduction	
Sciesinski	The measurements of the skin electrical conductivity in the acupuncture points affecting reproduction in female polar foxes, Alopex lagopus, during the estrus period	IV - 9
Farid	Isolation of microsatellite markers for American mink (Mustela vison)	IV - 10

Posters		
Author	**Title**	**Number**
Felska	Liter size, weaning success, and nursing mortality in chinchillas (Chinchilla lanigera) in relation to cage illumination	IV -11
Jakubczak	Evaluation of pastel fox breeding results in Poland - body confirmation	IV - 12
Jezewska	Genetic variability of choosen conformation traits in chinchilla	IV - 13
Socha	Genetic and phenotypic parameters of animal size and fur traits in Common Silver Fox (Vulpes vulpes L.)	IV - 14
Socha	Genetic parameters of size and fur quality in a mink population (mustela vison sch.)	IV - 15
Sulik	Comparison of reproduction management intensity of three genetic lines of female chinchillas (Chinchilla lanigera M.)	IV - 16
Szeleszczuk	Morphological changes of spermatozoa in breeding Raccoon dogs semen during cryopreservetion	IV - 17
Szeleszczuk	Induction of estrus and ovulation in breeding chinchilla by GnRh analogues	IV - 18
Collins	Growth parameters and organ size of American marten (Martes americana) born in captivity	IV - 19
Fur Properties		
Piórkowska	Variation in parameters of raccoon dog hair coat with different degrees of fur matting	V - 5

Welfare and Ethics

I – 1

Ethical and societal discussion on fur production

Frans W.A. Brom

The use of live animals for fur production gives rise to severe societal and ethical debate. On the one hand most of the animals used are sentient beings. These animals may be harmed by fur production. On the other hand fur production is – like other less contested fields of animal husbandry – an economical activity for which there is a market. In this debate strong views, intense emotions and even the use of force play a role. As an ethicist I tray to take a step back. I want to analyze the debate from some distance.
If we take a step back we see that the debates about fur production have – at least – five dimensions:
-The acceptability of animal husbandry in general;
-The acceptability of fur as production goal;
-The protection of the welfare of the animals involved;
-The way we handle fundamental differences of opinion in a democratic and free society;
-The possibility of countries to ban import and/or production of fur.
In my presentation I will not defend a final answer on one of these dimensions, nor will I defend or attack fur production as an economic activity. I hope to clarify the arguments used in the societal debate and point to strengths and weaknesses of these arguments.
My target audience are those persons and companies involved in fur production who aim to take up Corporate Social Responsibility and Corporate Social Responsiveness. Is this possible? Can we identify possibilities for CSR in fur production in a pluralist democratic society?

I – 2

Swimming water for farmed mink: liking, wanting or needing?

B.M. Spruijt & C.M. Vinke
Ethology & Welfare, Department of Animals, Science & Society, Faculty of Veterinary Sciences, Yalelaan 17, 3584-CL Utrecht, The Netherlands.

Mink are known for their semi-aquatic life-style. A water bath, therefore, is an often-discussed requirement for farmed mink. Last years many studies are devoted to assess the relevance of swimming water for farmed mink: do they like it, want it or even need it?
The studies address topics such as: 1) the levels of abnormal behaviour and physiology in the presence and absence of a water bath, and after deprivation; 2) working for the access to a water bath; 3) mink's reward-sensitivity in the presence and absence of a water bath; 4) individual differences in water bath motivation and 5) substitutability.
So far, indications are found that mink work hard for access to a water bath. A drinking bowl for easy drinking did not substitute for a water bath, but also a water bath did not substitute a running wheel. Individual differences for swimming water may exist. Furthermore, the studies indicate that farmed mink in the experimental set-ups show no differences in the levels of stereotypies and tail biting in the presence and absence of a water bath, but that not all studies were consistent in their results. The deprivation of a previous experienced water bath increased the level of stereotypical and tail biting behaviour after the subjects were deprived of the water bath by blocking the entry door. This finding was confirmed by findings of increased levels of urinary cortisol, after deprivation. However, removing the water and leaving the empty bath did not result into different levels of stereotypies indicating on less frustrating conditions. The level of reward-sensitivity of subjects confirmed this last finding.
It is tentatively concluded that wanting water is incentive-induced motivation with rewarding properties for mink, but that it cannot be classified as an indispensable essential need in the sense that the absence of a swimming bath results into chronic stress and pathology.

FA003: Steffen Hansen; Project title: Quantitative Evaluation of the Need for Occupation in Farm Mink.
- Access 24 hours a day
- Mink work for the running wheel and water bath if other sources are free, but

mink work more for access to the running wheel
- Swim and empty bath: less work for empty bath;
- Running wheel might substitute water bath.
- Bath is incentive induced motivation and not a behavioural need/innate motivation.
- Some individuals never used the bath.

FA004: Jaakko Mononen; Project title: Individual Variation in Swimming Motivation in Mink: Effects of Natural and Artificial Deprivation.
- Mink with swimming water have less stereotypical behaviour than mink without. Deprivation gives a further increase.
- An artificial deprivation resulted into higher increases of stereotypical behaviour as compared to a natural deprivation paradigm when the water was frozen in winter.
- 6 of the 97 subjects never swim.
- Behaviours in the water: Diving into the water; ice was manipulated.

FA006: Claudia Vinke; Project title: How Essential is the Need for Swimming Water for Farmed Mink?
- More play behaviour of juveniles in the presence of swimming water; consequences for welfare in adulthood unclear.
- No significant differences in stereotypical behaviour between mink with swimming water and water naive mink. Confirmed by data of anticipatory activity.
- Removal of swimming gave an increased level of stereotypical behaviour only if the access to swimming water is blocked, but not when the water was removed and the bath was left.

FA007: Georgia Mason; Project title: Is out of Sight out of Mind? Minks' Demand for Resources in the Absence of Eliciting The Cues.
- Test subjects: Food, swimming water, toys and social contact. Cues versus No Cues treatment.
- The treatments did not affect the measures for the access to the swimming bath.
- Cues important for the use of toys.

I – 3

Productive value of confident temperament raccoon dogs

Boguslaw Barabasz, Dominika Fortunska

Attempts to evaluate the dependence between confident temperament of raccoon dogs and their production indices were undertaken in the research. Study was carried out in 2001-2003 using young raccoon dogs during rearing and selected group of adult females originating from 3 farms. Applying empathic tests (four times during rearing), experimental raccoon dogs were assessed and classified referring to their temperament. On a base of achieved results, the observed animals were divided into three groups: aggressive, confident and fearful. Following items were analyzed: final body weight, conformation assessment, as well as numerous reproduction indices. Confident raccoon dogs (on three studied farms) had the highest scores referring to the final body weight, hair cover traits and final score (16.48 points). Achieved results confirmed the thesis that raccoon dog is animal easy to breed and in majority is characterized with confident temperament that is favorably correlated with growth indices, hair cover traits and reproduction performance. Aggressive and fearful animals, being in general at lower percentage on a farm, become much larger problem in raccoon dog breeding.

I – 4

Group housing may impair fur quality in raccoon dogs

L. Ahola, S. Hänninen, T. Pyykkönen, J. Mononen

According to the Recommendations concerning fur animals laid down by the European Convention, the requirements for the welfare of farmed fur animals consist e.g. of a stimulating environment appropriate to meet the species-specific needs, including for social species an opportunity to show social investigation and behaviour. In the wild, the raccoon dog (Nyctereutes procyonoides) is a rather social species: both parents take care of the young and the cubs may stay their first winter with their mother. Accordingly, group housing of farmed raccoon dogs

could be considered as an alternative, enriched way of housing these animals. Housing fur animals in larger groups may, though, affect the quality of furs e.g. due to occasional aggressiveness or play behaviour between the group mates. In the present study, the effects of group housing on production-related parameters were established in farmed raccoon dogs (N=168). One half of the animals was housed as litters (three males and three females) throughout their growing season, the other half was housed as conventional male-female sibling pairs. Space allocation was 0.6 m2/animal in both groups. The body mass of the animals at pelting (10.9±0.3 and 11.1±0.3 kg in litters and in pairs, respectively) and the length of the skin (103±1 and 104±1 cm) did not differ between litters and pairs ($p>0.05$, GLM for repeated measures). Neither were there more bite scars in litters than in pairs (scar score: 1.7±0.3 and 1.6±0.2, $p>0.05$). Pelt quality was worse ($p<0.05$) in litters than in pairs (mass 5.6±0.4 and 7.0±0.1; cover 5.7±0.3 and 6.5±0.2; quality 6.0±0.5 and 7.9±0.1). Despite impaired fur quality in litters, no difference in the price of the furs was emerged between litters and pairs (84±6 and 90±6 euros, $p>0.05$). In conclusion, group housing of farmed raccoon dogs may, due either to altered physical conditions or to inappropriate social conditions, impair the fur quality of the animals.

I – 6

Comparison of hall and shed as housing environments for blue foxes

Hannu T. Korhonen, Teppo Rekilä , Tapani Kivinen and Lauri Jauhiainen

The study evaluated differences in housing environments between a brand-new fox hall (16 m wide x 75 m long x 7 m high) and a traditional shed. The experiment was carried out during the growing season on two groups of juvenile blue foxes, one housed in a shed and the other in a hall. Each group comprised 50 males and 50 females kept in male-female pairs. The results showed that the temperature was 2-3 ºC higher in the hall than in the shed and that relative humidity was 2-4% lower in hall than in the shed. The NH3 concentration ranged from 4.5 to 9.5 ppm in the hall but was less than 1 ppm in the shed. The dust concentration ranged from 1 to 2.9 mg/m3 in the shed and from 0.9 to 3.2 mg/m3 in the hall. Wind speed was from 0.2 to 0.4 m/s in the shed and from 0.09 to 0.26 m/s in the hall. Average light intensity was 4.7 lux in the hall and 5.2 lux in the shed. Sense-based impressions revealed that investigators experienced higher levels of smell and dust in the hall than in the shed but less draught. Substantial differences were not found in body weights, welfare-related variables or fur properties between the groups. Hall conditions seem to be suitable for the commercial raising of juvenile blue foxes.

I – 7

Mink welfare improved by combined implementation of several small initiatives

L.L.Jeppesen

Several small initiatives, supposed to have minor or short lived improving effects on welfare, were implemented at one half of a mink farm population, the experimental group, in order to see if these initiatives together would have a marked effect on the welfare of the animals. The other half of the population served as a control group. (N = 2 x 300 wildmink females including males and kits). The initiatives comprised selection for confident behaviour, appropriate winter-feeding, an empty cage between lactating dams, separation of the litter 1-2 weeks after weaning at 8 weeks of age, and furnishing cages with shelves and occupational objects. The initiatives were implemented in the order mentioned from early spring 2003, and the synergistic effect of the initiatives on stereotypies, temperament and pelt damages was measured in kits and in dams during summer and autumn 2003. The experiment is planned to continue for two or more production cycles. The preliminary results showed that confident behaviour was increased and that frequency of stereotypies and of damages was reduced in the experimental group. Although each initiative was a minor changes compared with normal farm practice, the combined implementation of all initiatives exerted a considerable influence on welfare as measured by confidence, stereotypies and damages.

I – 8

The anticipatory behaviours of mink expecting a positive or negative reward

S.W.Hansen

In the present study, the anticipatory behaviours of high and low stereotyping female mink were observed in relation to either a positive (a tit-bit) or a negative reward (capture in a mink trap).The results demonstrated a substantial decrease in activity out in the cage during anticipation of a negative reward. Especially high stereotyping mink decreased their activity out in the cage. Low stereotyping mink also decreased their activity. The decreasing activity was reflected by an increase in the time spent in the nest box as well as at the opening of the nest box. The announcement of a positive reward had more impact on low stereotyping mink than on high stereotyping mink. Low stereotyping mink increased their stay in the front of the cage, were more active running in and out of the nest box, and spent more time in unspecific activity out in the cage than low stereotyping mink receiving negative rewards. High stereotyping mink expecting a negative reward performed less stereotypies during the test situation than before the test situation, however the test situation did not significantly reduced the stereotypies in high stereotyping mink expecting a positive reward. The value of the anticipatory behavioural elements, including stereotypies as a valuable tool to assess welfare, is discussed.

I – 9

Have fur bearers become domesticated ?

O.V. Trapezov, N.N. Voitenko, V.A. Kulikov

The highest number of minks with domestic behaviour occurred among the Sapphire colour phase. In minks showing nondomestic response to human, the level of serotonin in the hypothalamus and corpus striatum was reduced and so was the content of its metabolite 5-hidroxyindolactic acid in the corpus striatum. Significant changes in serotonin metabolism were demonstrated in more domesticated Sapphire mink. The pleiotropic effect of such colour phase is manifest as changes in the major metabolic enzymes of serotonin, i.e. the key enzyme of serotonin biosynthesis, tryptophan hydroxylase, and the catabolic enzyme MAO A.

I - 10

Play behaviour of juvenile farmed mink in the presence and absence of swimming water

C.M. Vinke[1], J. van Leeuwen[1], B.M. Spruijt[1]*
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**Correspondence: C.M.Vinke@las.vet.uu.nl*

The opportunity to perform play behaviour might be important as one of the early life activities that stimulates behavioural variability and may enhance an individual's coping capacity later in life. Rewarding stimuli such as cage enrichments might enhance play behaviour in juveniles- often proposed as a sign of well-being of the individual.
The present study aimed to investigate the occurrence of play behaviour in juvenile farmed mink reared and housed with standard cage enrichments of the Dutch housing system (cylinder and platform; C-group) and an experimental group with the same standard enrichments, but with additional access to swimming water (W-group). If swimming water is a naturally rewarding behaviour it is assumed that play behaviour is released.
On average, W-group subjects showed more play behaviour in the main cage (17.5% ± 0.8 S.E.M.) than C-group subjects (14.1% ± 0.9 S.E.M.), which was significant (MWU: $U = 230.5$, $P \leq 0.01$, $N_{C,W} = 28$). Additionally, C-group subjects spent significantly more time on solitary active behaviour (13.6 % ± 0.6 S.E.M.) than W-group subjects (10.4% ± 0.6 S.E.M.) (MWU: $U = 177.0$, $P \leq 0.01$, $N_{C,W} = 28$).
The results suggest that swimming water present some relevant stimuli that may directly or indirectly stimulate the display of play behaviour in juvenile mink. At the short-term swimming water may contribute to mink's well-being; at the long-term, however, implications for animal welfare are still unclear, as this highly depends on the individual's future experiences and whether these "extra skills" will be required for better coping capacities in the adult situation: correlations between play behaviour and stereotypical behaviour should be elucidated in future studies.

I – 11

Evaluation of comfort of fur-bearing animal keeping by analyzing behaviour

I.A. Plotnikov, O.Ye Yevenko, O.Yu Bespyatykh

Conditions of fur-bearing animal keeping in different cages: usual ones and those constructed according to the recommendations of the Council of Europe were studied. The comfort of animal keeping was evaluated by behaviour. Animals' behaviour was observed in two ways: visually and with video cameras. The latter way is more universal and makes its possible to observe the animals not disturbing them in their covers and in dark time of a day. The paper describes the method of registering and analyzing the elements of behaviour of fur-bearing animals. 170 elements of behaviour were totally found, about 35 elements were used more often. The analysis of behaviour gives an opportunity to evaluate the comfort of keeping conditions, the efficiency of using a new way or element of technology of fur-bearing animal keeping.

I – 12

Conflicts arise between minks of different behavioral types

O.V. Trapezov, I.N. Oskina, R.G. Gulevich

The researches of behaviour role in conflict development in conditions of forage shortage are carried out at pair placed breeding of young minks, selected during 15 generations for manual and aggressive behaviour regarding to the man. It was revealed that in conditions of competitive struggle for forage, body mass of manual males, in difference from aggressive ones, does not essentially influence on cortisol and transcortin levels. Apparently, aggressive males, being not as massive as their partners, experience the greatest stressing action, because they have not only the maximum cortisol concentration in blood, but also the minimum transcortin level. These animals appear to be less stress-resistant in competitive struggle for a forage in comparison with manual males.

I – 13

Effect of coat color mutation in mink on the adrenal cortex function at pelting time in siberian climate

O.V. Trapezov

The effect of coat colour mutations "hedlund" and "aleutian" on stress reactivity was studied in males of American mink (Mustela vison Schreber, 1777). It was shown that minks heterozygous for the mutant alleles are more tolerant to stress produced by maintenance conditions. This is genetically determined by the functional features of the pituitary-adrenal axis which is more adequately reactive in heterozygous minks. This advantage of heterozygotes for the coat colour alleles may underlie the fur animal breeding.

I – 14

Young nutria behaviour in runs of different types

Dr. O. Yu. Bespyatykh

The comfort of cages of different types for nutria keeping was estimated with the method of ethological observations. The behaviour of nutria females and males at the age of six months was studied. Animals were visually watched during 24-hour periods. 36 elements of behaviour were totally registered, 13 of them being the main ones. Some cages have a typical wire mesh floor. In other cages metal shelves that occupied 1/3 of a floor area were set in. Young nutria use shelves not only for eating food, but also for different elements of intensive and local activity, for rest and sleep. As compared with a wire mesh floor, young animals rested on shelves for a longer time, the length of comfort behaviour increased. Thus, shelves in a cage raise the comfort of nutria.

I - 15

Group housing of farmed mink (Mustela vison) in climbing-cages

Sari Hänninen, Jaakko Mononen, Ilpo Pölönen and Maija Miettinen

Group housing of mink, especially in so-called climbing-cages, has been quite common topic when the mink farmers have met in Finland during last year. The aim of this study was to examine whether it is economically reasonable to house mink in these climbing-cages. The climbing-cage consists of a standard mink cage (31x84x45 cm, WxLxH) with a wooden nest box (31x34x36 cm) and an extra cage (31x56x45 cm) built on the top of the standard cage. The kits born in climbing- cages were housed in climbing-cages as groups of two males and two females. The kits born in standard cages were housed either in climbing-cages as groups of two males and two females or as male-female pairs in standard cages. Overall performance was good in all groups and none of the animals had to be removed for unsuitability to group housing. All sections of the cages were used. The mink kept in climbing-cages were lighter, than the mink in standard cages, but there was no difference between the groups in the skin length. There were no differences between the cage types in the incidence of fur chewing or tail biting. However, the mink housed in climbing-cages had more scars on leather side of the skins. These scars were assumed to be caused by biting. The amount of hair was better in the skins of mink housed in standard cages, but there was no difference between the cage types in the general impression and only a slight difference in the overall quality of the fur. Keeping mink in climbing-cages during the growing season was successful from economical point of view. It may also provide the mink with more enrichment (both social and physical) than the traditional housing system.

Health

II - 1

Management of health in mink
A HACCP plan for energy allowance during winter and gestation in order to control sticky kits

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Mink production is characterised by a strict annual production cycle in which all animals are naturally synchronous and the number of animals in a given mink production period is high. Each age group presents its own health problems and the whole herd is at risk to period-specific hazards. Due to a significant time lag in the feedback-loop of mink management, health management should focus strongly on preventive measures. The HACCP principles offer a systematic approach to the development of preventive measures aimed at annually recurrent health problems. The hazard of inadequate energy supply during the winter and during pregnancy has been identified as a risk factor for pre-weaning diarrhoea. The severity and seriousness of the consequences of this hazard has been analysed at farm level based on production data from 5 years (1994-1998) from a total of 125 farms in Denmark. Two hazards for pre-weaning diarrhoea at farm level have been identified: 1). Severely restricted feeding during the winter followed by a high energy allowance during the flushing period. A difference between the Flushing and Conditioning periods of 90 kcal/female/day at farm level increases the risk (OR = 3.03; p=0.01). 2). A high energy allowance during the implantation period and the first part of the gestation period followed by a drastic decrease in the later part of the gestation period. By each kcal/female/day in difference between the Implantation and Prenatal two periods the risk of pre-weaning diarrhoea at farm level increases by OR=1,013 ($p<0,05$). A difference between the two periods of 50 kcal/female/day at farm level increases the risk by OR = 1,91. Following the hazard evaluation the average feed allowance in kcal/female/day can be identified as Critical Control Point for both hazards. Critical limits may be established as the average ± one unit of STD for the group of farms without pre-weaning diarrhoea or ± 20 kcal relative to an estimated "need" of 210 kcal/female/day.

II – 2

A preliminary linkage map of the mink (Mustela vison) genome

R. Anistoroaei, K. Christensen and A. Farid

Genome research is progressing in an astonishing pace providing new frontiers in animal improvement. Genetic and physical maps for a large number of livestock species have been constructed during the past decade. These maps have been used for the identification of genes that modulate monogenic traits, or for the identification of chromosomal regions which contain genes having a major effect on economically important traits (QTL). Despite the economic importance of mink production in Northern Europe and North America, mink genomics research is lagging far behind other livestock species. The mink industry would benefit tremendously from information derived from linkage and cytogenetic maps of the mink genome, affording an opportunity to speed up genetic improvement. The objective of our work is to create the first generation of linkage map with at least 20 cM resolution. This will serve as a basis for further refinement. Genotypes of a reference population consisting of two males, five females and 37 F1 progeny were determined at 50 polymorphic microsatellite loci. These markers were assigned to several linkage groups using Crimap software. Physical mapping of the microsatellites was also performed using a panel of mink-hamster hybrid somatic cell lines, showing consistent results with the linkage map.

II – 3

Not diagnosed stage of aleutian disease.

V.S. Slugin

The purpose of researches - to establish the cause of mass cases of negative reaction of a counter immunoelectrophoresis (CIEP) and iodine agglutination test (IAT) at the kits from the positive reacting mothers, i.e. to define the cause of abaissement (petering, disappearance) of positive reaction at mink infected by a AD virus (ADV).Material and methods. Simultaneously investigated by methods CIEP and IAT more than 100 thousand blood samples at adult mink various colours and at their pups in conditions of the largest farm of Russia with AD. Besides we exposured with ADV by different methods of the adults females and their offsprings (about 300 animals) and with the help CIEP-test studied dynamics of accumulation antibody and it titers against ADV on an extent from pregnancy up to 10-months age and sometimes more. In necessary cases we made laparotomy for study of an opportunity of transplacental transfer of a ADV. Also we observed efficacy of exposure and course of AD.Results. The mass cases (almost up to 70 %) of a petering antibody against ADV at the kits, infected intrauterine or in the first birthdays from mother (or stepmother) are fixed. The abaissement descends soon after weaning and often remains until autumn. At about 15-20% of animals antibody to ADV to be absent in the course several months. The conclusion. The stage of development ADV is fixed temporarily inaccessible to diagnostics by means CIEP and IAT. The cause it is the particulate (not 100%) temporary tolerance of the kits if they was infected vertically. The colostric, passive or own antibodies to ADV do not inhibit a development AD.

II – 4

Bacterial diskospondylitis associated with posterior paresis and paralysis in North American farmed mink (Mustela vison)

E.J. Olson, J.B. Parker, and C.S. Carlson

Posterior paresis and paralysis in farmed mink is responsible for significant economic losses in North America, with individual farms reporting the loss of as many as 700 animals each year. Although this disease has been recognized by North American mink farmers for approximately 40 years, there are few published reports focusing on this entity. The objective of the present study was to investigate the pathogenesis of the disease. A farm visit revealed no history or evidence of trauma in these animals and the diet appeared to be adequate for skeletal development. Complete necropsy examinations were done on over 100 mink [normal and clinically affected] from one mink farm, ranging in age from newborn to 12 weeks of age. Age-matched unaffected animals from a different farm having a lower incidence of this disease were also examined. Clinically affected animals were always in a narrow age range of 7-10 weeks, and all of these animals had an isolated vertebral lesion characterized by bone lysis and proliferation that was usually localized to an intervertebral disk space in the mid-thoracic area. An inflammatory reaction, composed primarily of neutrophils, was present within many of these tissues and in some cases, gram-positive cocci were identified within and/or adjacent to the vertebral lesions. Bacterial cultures from 8 affected animals yielded beta-hemolytic Streptococcus sp. from the lytic vertebral site in 8/8 animals and from heart blood from 6/8 animals. Bacterial cultures from the oral cavity and urinary bladder of these same animals revealed a mixture of bacteria or were nondiagnostic. Animals younger than 7 weeks of age had evidence of vertebral osteopenia histologically; however, radiographs of the spine were normal. We conclude that posterior paresis/paralysis in farmed mink is associated with bacterial diskospondylitis, likely occurring secondary to bacteremia/septicemia.

II – 5

Characteristics of some morphological and biochemical indices of marmots bred in cages

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N. A.Balakirev, I. A.Plotnikov**,*
*N. A.Suntsova***,*
*N. N.*Shevlyuk****

This research is the main part of complex of experiments, directed to the creation of a population of species of Marmots (Marmota bobac) bred in cages on the state pedigree farm Pushkinskiy, situated in Moscow region. Its aim was the

evaluation of haematological indices: haemoglobin, erythrocytes and leukocytes, indices of blood coagulation and selected chemical indices: total protein and its fractions, lactatdehidrohenasa, triglycerides, ceruloplasmin in marmots bred in cages. With the use of macroscopic, histological, histochemical and electro-microscopic methods characteristics of organs of immune, digestive, urino-genital and reproductive systems were studied. It was found out that males of marmots before hibernation have a serious reconstruction of testicles, which is followed by the enlargement of their weight (almost in 3 times). There was also registered activation of endocrine and herminative structures of testicles before the beginning of hibernation. In female marmots there were found processes of activation of herminative function of ovaries.

II – 6

A level of some indices of the oxidation state in blood plasma of mink at slaughter period under the definite maintenance and feeding conditions

H.Bis-Wencel, L.Saba, A.Liczmanski, B.Nowakowicz-Debek

The oxygen radical excess is hazardous for animal health due to their high non-specific reactivity. It may the imbalance between antioxidants and prooxidants in favour of the oxidation, that results in so called oxidation state occurrence. Numerous clinical examinations confirm the relations between the oxidation stress and health state disturbances. This state need not be caused by a direct influence of free radicals, yet it plays a significant role in the whole chain of events giving rise to a polyetiological disease along with the concurrent symptoms development. Thus, the free radical sources seem to be significant as they are formed in organism under the endo- and exogenous conditions. The latter ones include, among others nutrition, ultraviolet radiation and environmental pollutants in particular. The objective of the present work was to determine values of some blood plasma parameters considered the oxidation state markers in the minks aged one year and maintained at the definite farm conditions. The investigations were performed at the mink farm "C" situated in the south eastern part of Poland. The yearlings chosen for the experiment were meant for slaughter. Blood was collected twice in December. It was taken from heart of 60 minks into the polypropylene test tubes with granulate for the fast coagulation. The examinations on blood plasma covered determination of glutatione peroxidase (GPx), glutatione reductase, superoxide dismutase (EC-SOD) and total glutathione strength (GSH-GSSG). Moreover, there was established total oxidation activity (TAS) and soluble protein level. The following antioxidation parameter values were fixed: glutatione peroxidase activity ranged from 21605,31-18798,60 U/l, glutathione reductase 123,54-80,97 U/l, Superoxide dismutase 20,05-10,23 U/l, glutatione 0,103-0,218 U/lTAS 0,605-0,575 U/l, protein 85,08-79,38 g/l.

II – 7

Mink nursing sickness survey in North America

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Nursing sickness is a metabolic disorder of large economic importance to the mink industry. In 2002, North American mink ranchers were surveyed to examine the incidence of nursing sickness and the related ranch history and management practices. Fifty (50) ranches responded, housing a total of 91,229 breeder females with a production of 333,417 pelts. Forty-four (44) % of the ranches reported problems with nursing sickness with 13% of the farms having 10-40% of females affected, while 17% had an incidence rate of 5-9%. The farms with nursing sickness had a higher litter size per female housed (5.2 born, 4.5 weaned) in comparison to farms without (4.9 born, 4.2 weaned). On healthy farms, the breeder female selection criteria focused more on body length, whereas body weight was emphasized on farms with nursing sickness. The farms that handled their females more during nursing and weaning time also reported more nursing sickness. The feed composition differed greatly between the farms. The farms without nursing sickness fed much more fish in their diet (38-50%) throughout the production year than the farms, which encountered problems (19-30%). As expected, mink ranches selecting for good mothers with large litters experienced more nursing sickness.

Selection for heavier body weight appeared to increase the occurrence while selection for body length reduced the problem. Crowdedness in the nest box and handling of females during nursing increased the incidence of the disease. Regarding feeding management, fish-based diets appeared to be strongly associated with a reduced occurrence of nursing sickness. Several on-farm management practices were identified in the survey, which were characteristic of ranches not experiencing problems with nursing sickness. It is evident that these factors are all associated with improving the glycemic control in the lactating female.

II – 8

Body condition and glycemic control in mink females during reproduction and lactation

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A two-part diagnostic pilot study was conducted. Firstly, 98 breeder females were weighed and scored for body condition at breeding, late gestation, and mid and late lactation. The mink were tested for urine parameters at the above time points and blood glucose before and after weaning. Glucosuria was found to be present in the mink females at all stages of the reproductive cycle. There was a strong negative relationship between body weight and blood glucose levels late in the nursing period. Females with measurable quantities of glucose in their urine had average blood sugar levels of about 8 mmol/l, whereas females with no glucosuria had blood sugar levels around 6 mmol/l. One week after weaning most females were normoglycemic indicating that the hyperglycemia observed was transitory. Secondly, 518 adult and juvenile mink females were scored for body condition and tested for urine glucose prior to breeding, late gestation, and around the time of weaning. The study included 3 farms with black and 3 farms with the brown colour type mink. The results indicated that 21% of the juvenile and 42% of the adult black type females were heavy or obese prior to breeding with 24 % and 18 % of these mink showing glucosuria. The brown colour type mink were generally in much heavier body condition throughout the reproductive season. Of the brown type kit females 54% were in heavy or obese condition at breeding whereas over 68% of the adult females were in these categories. 51% and 56% of the brown type kit and adult females showed sugar in their urine prior to breeding. The results of the diagnostic testing pilot study indicate that a varying percentage of mink breeder females exhibit glucosuria and that the occurrence is related to the body condition of the females. In other species, this diagnostic finding is associated with obesity, and the acquired insulin resistance syndrome, indicating impaired glycemic control.

II – 9

Mink astrovirus associated with pre-weaning diarrhoea in mink kits (an update)

G.Czifra, C. Mittelholzer, K.O. Hedlund, H.H. Dietz and L. Englund

Pre-weaning diarrhoea is a recurrent disease problem for mink farms. A project has been started in order to investigate the possible roll of infectious agent(s) in the "sticky kits" syndrome. A case-control study showed positive correlation between disease symptoms and the presence of astrovirus detected in mink faecal samples. The novel virus has been identified as an important risk factor both at farm level and at mink kit level. The genome of the mink astrovirus has been sequenced. It has a positive-stranded RNA genome containing 6610 nt, encoding three proteins; a serine protease, an RNA-dependent RNA polymerase and the structural capsidprotein. Phylogenetic analysis revealed that the mink astrovirus is distantly related to established astroviruses with ovine astrovirus being the closest relative (67% similarity at the nucleotide level). A species-specific reverse transcriptase-PCR has been constructed and found to be suitable for the analysis of clinical samples.In order to be able to detect and survey the spread of astrovirus infection in mink farms and among mink farms, development of diagnostic tools is in progress.

II – 10

Wet kits in mink, a review

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Greasy kits / sticky kits is a multifactorial disease in the lactation period with few known definitive releasing factors. The disease is known in all mink producing countries in the northern hemisphere, and it has been observer in commercial mink farm in Denmark for more than 40 Years (Svennekjær, 1954).
Greasy kits has been defined as mink kits suffering a greasy, sticky exudate on the skin surface especially in the neck, on the claws and tail, red and swollen perianal region, often a yellowish-white diarrhoea and invariably a moaning behaviour. A number of eliciting factors have been tested in Denmark in usually unpublished investigations. It has turned out to be very difficult to perform prospective as well as experimental studies of greasy kits as the annual morbidity rate varies between 0 to > 20 % of the litters in a farm. Furthermore there is no obvious pattern in disease outbreaks among farms. Bacteria, virus, management, feed, immunological status of the animals and environmental factors are discussed.
A lack of consistency in pathogenicity of bacteria and viruses isolated from greasy kits and non-greasy kits is complicating experimental investigations. An infectious etiology similar to diarrhoea in newborn calves and pigs has been postulated. Radostits et al. (1994), concluded that there is not a single etiology of calf and piglet diarrhoea but rather a complex interplay between enteropathogenic bacteria and viruses, other pathogens such as protozoa, the immunity of the animals, and the effects of the environment. With the addition of management factors to this list the same theory might be valid for the etiology of greasy kits in mink. However the recent finding of an astrovirus in diseased mink kits indicates that this virus may be one of the more important triggering factors in the greasy kit syndrome.

II – 11

"Wet kits", an update of the Dutch situation 2004

Haiko Koenen, Pecon b.v., The Netherlands

In 2002, 2003 and 2004 Dutch mink breeders had significant production losses because of "wet kits". "Wet kits" is the general name for diarrhoea of kits between 2 and 4 weeks of age. Losses are primary caused by a higher mortality under the kits and an decreased growth. At the same time high costs are made by the demanded intensive nursing of the diseased kits and the administration of antibiotics and other supportive medications.
"Wet kits" are found with a various incidence, but spread over the complete Dutch population.
The direct cause of the disease is unknown, but it's likely the cause is multifactorial. In the Netherlands research on the subject of "wet kits" has been done on a small scale only. In 2003 a working committee on the subject of "wet kits" has founded. The committee consists of the Dutch fur breeders association, feed kitchens en veterinarians.
The main goal of the committee is to increase the insight and knowledge about the disease to decrease or even prevent the incidence of "wet kits" in the future. Therefore three main projects on pathology and microbiology, a clinical trial and feed management have been designed to obtain more structural data on this disease.

II - 12

Wet kits: pathological and microbiological results in The Netherlands 2002-2004.

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In 2002 very great problems with wet kits appeared in the Netherlands. The first cases raised in the first two weeks of May. Staphylococces Aureus mastitis of the female and a staphylococces aureus in the rectum swabs of the kits were found. Medical treatment of the mother with amoxicilline, parenteral and in drinking water, cured the problems in one or two days. In this period there was found

the first case of E.Coli enteritis in 12 days old wet kits. Before the knowledge of the bacteriological culture and the sensitive for antibiotics, the treatment of the mother was started with amoxycilline. The kits did not improve with this treatment. After bacteriological research it appeared that E. Coli bacteri's gave the problems. This E. Coli was not sensitive for amoxycilline. Oral treatment with colistine had the desired result.
After the 21th of May in 2002 a severe increase of farms with a high morbidity of wet kits was seen. By histological research of the small intestine was a reduction of the villi and small abcesses in the Crypte of Lieberkühn seen. E.Coli bacterial's and Campylobacter spp bacteria's were isolated in al these cases. Oral treatment of the kits with polymixine sulphate (colistine) was an add in the control of the wet kits problems at these farms, along hygienic measures of the nest boxes as daily new dry wooden shavings and/or straw.
In 2003 wet kits did not develop.
Several new cases appeared in 2004. These cases were characterized by small outbreaks of wet kits. The mortality was in average low, but the morbidity at the farms could rather vary. The intestines of the kits showed dysbacteriosis and signs of small intestine inflammation. E.coli and campylobacter bacterials were found. The E.Coli bacterials were typed. A connection between the different E.Coli types was not proved. Al the E.Coli types were sensitive for polymixine sulphate (colistine)

II - 13

Feed levels, mink milk composition and weighting inquiry; efforts in order to understand the "Wet kits" problems.

Jan de Rond, NFE, The Netherlands, 2004.

This study consist of 2 trials carried out on the research farm 'het Spelderholt' and a field trial conducted by the Dutch Breeders association (NFE). The aim of this study was to search for items which help us understand more of the 'wet kits' problems. 'Wet kits' is the general name for diarrhoea of kits between 2 and 4 weeks of age which can lead to high losses and costs.
The first trial describes the effect of 3 different feed levels 90 – 100 –110% (feed intake) and 1 feed with higher energy level (by adding oil) on the occurrence of 'wet kits'. Three groups of females with different whelping date (1-7-12 Mai) got the different feed levels, starting a few days after whelping. The females had an almost equal litter size of 6 – 8 kits. We measured weekly the weight of the females as well as the kits. During the period of 5 weeks in lactation, there were no 'wet kits' found in the test groups. We did notice differences in growth of kids and also in females. To our opinion there is a big variation in ability of producing milk which is only slightly affected by the different feed levels at different whelping dates.
The second trial shows the milk composition of females from 2 different whelping dates (30/4 and 9/5) on a Dutch feed ration. The purpose of these analyses is to look into the standard levels of fat, protein, celcount and urea. Later on we would like to examine these levels in milk of females with 'wet kits'. The mink milk (± 9 ml) was gathered every ± 4 days from 4 or 5 females of equal whelping date and litter size, starting minimum a week 7 or 10 days until 32 days after whelping. Every time different females were used. The milk composition found from the 2 groups are very similar after 3 weeks lactation. In the first 3 weeks of milk collection in group 1 lower levels of protein and fat were found. Reason: the way of collecting or analysing method. Protein and fat level in this mink milk are 3-4 times higher as in cow milk. Also the celcount and the urea level were analysed. The celcount varies a lot, but the urea level was steady in relation with the protein level. The urea level is similar to the level found in cow milk (corrected to protein level).
In 2003 a working committee on the subject of "wet kits" has been founded. Consisting of the Dutch fur breeders association, feed kitchens and veterinarians. The committee organised a field trial in corporation of 7 fur breeders who had suffered severe 'wet kits' problems in 2002. An inquiry was set up and the farmers were instructed to feed the mink more or less restricted. The mink had to be active to receive food, not stressed. To control the feed instruction, the farmers measured every 2 weeks the weights of females starting week 9 until whelping. During lactation period, there were several farms with severe 'wet kits' problems, several farms with small problems but no losses and the most of them without 'wet kits'. These last farms had the feeling they were 'close to it'. This report gives an enumeration of circumstances where 'wet kits' occurred. Unluckily, it does not give the solution how to prevent for 'wet kits'.

II – 14

Oral immunization of fur-bearing animals against salmonellosis

I.A. Domski, Z.N. Beltyukova

One of the main prophylactic measures against salmonellosis is vaccination. For the recent time live attenuated salmonella strains are used more and more often for that disease prophylaxis in agricultural animals and birds. Lately the works on the use of those strains for fur-bearing animals were successfully carried out. Live vaccine salmonella strains give an opportunity to use them for an oral method of immunization. The use of those vaccines in fur animal breeding is not known. For an oral immunization of fur-bearing animals (Arctic fox, common fox, raccoon dog and nutria) suppressor streptomycin dependent revertants (Salmonella typhimurium ? 3, Salmonella choleraesuis ? 9, Salmonella dublin ? 6) were used. The above-mentioned vaccine antigens were mixed with food and were given to animals. A double vaccination of young animals was carried out from the age of 40-45 days. Adult animals were immunized singly before the heat. Immunized animals did not refuse eating "vaccine food" and did not lose their appetite. Vomiting and an alimentary canal upset were not noted. Animals remained active and clinically healthy. Whelps' growth and females' pregnancy were without any physiological abnormalities. An antigen and immunogen activity of a new vaccine was assessed by the agglutination test, opsonophagocytic reaction, NST-test, the indices of T and B lymphocytes, control infecting of experimental animals with virulent strains. The use of live salmonella antigens for oral vaccination results in the immune reaction of an organism that acquires a strong immunity against salmonella infection. At the same time an oral vaccination guarantees a high survival rate of young animals and an easy way of carrying out prophylactic measures. It significantly decreases labour expenditures of animal breeders and veterinary specialists. The results of experiments on the prophylaxis of salmonellosis show that a new method of immunization is promising for its introduction into a veterinary practice of fur-bearing animal breeding.

II-15

Congestive cardiomyopathy in a fox colony

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E. Bautista3 and M.A. Petruccelli2

A retrospective investigation of a Lung-heart syndrome outbreak by Escherichia coli in a major patagonian farm of foxes in south region of Argentina was conducted. More than a thousand blue (Alopex lagopus) and silver (Vulpes fulva) captive foxes died over a 2-month-period by a rapidly fatal course showing substantial pulmonary and myocardium involvement at autopsy. Haemolytic and non-haemolytic Escherichia coli, in pure culture in many cases, were consistently isolated from the compromised organs in practically all of the animals examined, meanwhile most of the accessions had histologic evidence of bacterial infection. None of these strains produced Verocytotoxins, heat-labile, heat stable, or have the eaeA gene, as determined by in vitro immunoassay and by Polimerase Chain Reaction (PCR). It is suggested that E. coli could be the most likely pathogen involved in the syndrome but the precise mode of transmission and its ecology on foxes is still undefined. Although being the focus of much attention in the past few years, a firm correlation with dietary taurine remains doubtful as plasma concentration levels of the affected animals resulted between the normal range.

II –16

Distemper virus infection – fur animal-wildlife interface. Including a study of comparison of three diagnostic methods

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Distemper virus infection in fur animals is a potential devastating and costly infection with a varying morbidity and mortality influenced positively by vaccination. In recent years 2 major

distemper virus epidemics in marine mammals have been described in 1988 and 2002 respectively. Both outbreaks started at the Danish island of Anholt and caused a very high mortality in the North Sea and Kattegat populations of Harbour Seals. During the first outbreak it was shown that mink may acquire distemper virus infection from marine mammals. An introduction to the spread and dissemination of distemper virus within and between domestic fur animals and susceptible wildlife populations will be given. The application of reverse transcriptase polymerase chain reaction (RT-PCR) for detection of morbillivirus nucleic acid in Danish fur animals with suspected distemper infection was the aim of this study. 149 mink and three foxes with suspected canine distemper infection were subjected to macroscopic, histological and virologic examination. Immunofluorescence testing, S3-staining and RT-PCR were applied to biological samples collected from all animals. 53 mink were found positive for distemper virus antigen by the immunofluorescence method, 51 mink were found positive by S3-staining for distemper virus inclusion bodies. 54 mink were found positive for morbillivirus nucleic acid (the phosphoprotein (P9 gene) of canine distemper virus) by the RT-PCR method. The sensitivity (98.1 %) and specificity (98.0 %) of the RT-PCR method was established. Furthermore, the specificity was confirmed by the sequencing of genetic material obtained from PCR products from 22 mink.

Nutrition

III - 1

A systematic approach to sustainable fur farming with special reference to feed and feeding

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The concept of sustainability was first created by Bruntlandt Commission in 1987 and later developed more in United Nations Agenda 21 (Rio de Janeiro 1992). According to Bruntland Commission sustainability means 'meeting the needs of the present without compromising the ability of future generations to meet their own'. More practically, sustainability is understood as wise use of natural resources.
Fur animal feed contains high percentages of by-products and thus bears 'a sustainable image'. Remarkable amounts of e.g. phosphorus in the form of fish bones are recycled back into soil as fertilizer and save inorganic phosphorus sources. However, sustainability is much more than that. Real, sustainable results can be achieved only when the whole process, i.e. feed selection, feed manufacturing as well as transportation processes, even costs of handling and transportation of faeces and urine are taken into account in calculations. Therefore, even though remarkable results have been achieved in determining nutritional requirements of animals which is the main principle to follow in sustainable development, much needs to be reconsidered to make fur animal feeding more sustainable as a whole. The greatest challenge to be overcome is energy consumption, especially the kind of energy that originates in non-renewable natural resources. Nutrient balances of fur animal feeding and examples how to decrease use of energy will be discussed.

Veterinary care, in fur business, has many tangent planes with other disciplines like welfare and nutrition. An open discussion between these various disciplines is required, leading to a balanced and sustainable method of fur production. To control health and production of furanimals at a specialized farm different actions should occur, including analysis of production disturbances, creating awareness of the farmer, planning, monitoring and corrective measures. To obtain this, a system of hazard analysis critical control points (HACCP) have to be followed. Weak points in the production cycle of mink are clarified and a general preventive management system is designed and adapted to individual farms and farmers. Two examples of preventive feeding management will be discussed leading to a sustainable fur product.

It is now possible to minimize the use of energy per produced skin at the farm, which will result in a more sustainable fur production. Lowered use of energy will also cause a reduction in the amount of waste to the environment. A new feeding system makes it easy to register the need of feed, to feed the animals and collect data about the amount of delivered feed. The first barrier to breed more feed efficient fur animals, a possibility to register the delivered amount of feed per cage is now removed.

The new feeding system will change the way of fur farming .The background of the new feeding system, the system, preliminary results and future possibilities will be discussed.

III – 2

Influence of using enzymatic preparations: α-amylase, β-glucanase and xylanase on fur quality and nutrient digestibility in polar foxes

M. Brzozowski, E. Zakrzewska-Czarnogorska

The aim of the study was to determine the influence of adding enzymatic preparations: Bio-Feed Alpha® (active enzymes: α -amylase and β -glucanase) which increases starch hydrolysis and Bio-Feed Wheat® (active enzyme: xylanase), which increases hydrolyze fractions of fiber from cellular walls, on

fur quality parameters and nutrient digestibility in polar foxes.
The enzymatic preparations used in this experiment were added in proportions 200 or 400 mg of each per 1 kg of fresh food for experimental animals groups; 21% of cooked grain was used in animals feeding diet. Slightly better results observed in experimental groups were not statistically significant.

III – 3

Different ratio between n-6 and n-3 fatty acids in diets for lactating mink (Mustela vison) dams – effect on milk and kit tissue fatty acid composition

M.U. Hansen, T.M. Lassén, A.H. Tauson, H. Sørensen and T.N. Clausen

The objective of this project was to study the effects of different ratios between n-6 and n-3 fatty acids on lactating mink and their kits. Parameters studied were reproductive performance, weight changes and fatty acid secretion in milk and deposition of the fatty acids in the tissues of the kits. Three groups of females (n=25) were fed with the experimental diet from late February (before mating) until weaning when the kits were 8 weeks old. The experimental diets were composed of a basal diet supplemented with sunflower oil, rapeseed oil and herring oil to achieve the different ratios between n-6 and n-3 fatty acids at 12.4:1 (High, H); 4.1:1 (Medium, M) and 0.25:1 (Low L). Females and kits were weighed. Organs (liver, brain and adipose tissue) were taken form newborn kits and 28 days old kits. Milk samples were taken from females on day 2 and 28 pp. Fatty acid composition were determined in brain, liver and adipose tissue as well as in milk and feed. Female body weight was affected by treatment. The females in group M (13 %±1.9) had the lowest weight loss during the lactation period compared to the L (19%±1.9) group ($p>0.005$).Kits weight gain from day 28 to day 42 was affected by dietary treatment. The female kits in the L group had a significantly lower weight gain (79 %±6.2) compared to the female kits from group M (100 %±6.0) ($P<0.001$).
Fatty acid composition of milk was affected by treatment. This was seen as an increase in total n-6 fatty acids in the milk in the H group and a higher level of n-3 fatty acids in the L group. Liver and adipose tissue from 28 days old kits showed the same pattern as the milk. Brain tissue from newborn and 28 days old kits showed the same patterns as seen in milk, liver and adipose tissue. DHA and AA were detected in larger amounts in brain tissue than in the other tissues.
In conclusion this study showed that fatty acid secretion in milk and deposition of fatty acids in the tissues of the kits was clearly affected by the supplemental fat in the maternal diet. It was also concluded that fish oil in the maternal diet had negative effects on the performance of both females and kits.

III – 4

Physico-chemical properties of different carbohydrate sources in the gut of mink

H.N. Laerke, C. Hejlesen, M.S. Hedemann

Recent research in mink and other monogastric animals such as pigs and chickens has increased focus on the carbohydrate sources as controllers of feed intake, satiety and animal behaviour. The chemical composition and physico-chemical properties of both the starch and the fibre fraction and the microstructure of the carbohydrate sources may change the properties not only of the feed but also the gastrointestinal environment. Studies e.g. in pigs and chickens have shown that in vivo viscosity and water binding capacity influence feed intake, rate of passage, enzymatic activity, rate and extent of digestion of nutrients. Similar studies have not been undertaken in mink. We aimed to study the physico-chemical properties of 4 different diets with the carbohydrate source comprising either expanded wheat, expanded barley, rolled oats or gelatinized maize starch + sugar beet pulp. The diets were adjusted to have 29 % of the energy coming from protein, 50 % from fat and 21 % from carbohydrates. During a period of 10-12 d where the mink were offered 300 kcal once daily the first 4 days followed by 250 kcal per day. On the 2nd 6th and 10th day the feed intake was registered at 4, 8, 10, 12, 14 and 24 h post feeding. On the 10-12 d the mink euthanized three hours after a new ration of feed was offered. After euthanization the gastrointestinal tract was removed and separated by ligatures for quantitative collection of contents, allometric measurements of the gut, and measurements of dry matter content, viscosity, and water binding capacity. The diet containing sugar

beet pulp increased the water binding capacity of the gut contents, but otherwise the diets showed no or only marginal differences in the gastrointestinal environment. In all groups, there were large variations in the amount of feed consumed 3 hours after feeding, which was reflected in the amount of digesta collected. The large variation in eating pattern was also seen during the registrations of feed intake, where no significant effect of diet was found either. There were no systematic differences in eating pattern between the different days of recording.

III – 5

Effect of lactic acid bacteria and β – glucanase treatments on the nutritive value of barley for growing blue fox

Jarmo Valaja, Ilpo Pölönen, Eija Valkonen and Taina Jalava

The effect of lactic acid bacteria or ß-glucanase supplements on the chemical composition of mixtures of barley - water (1:1.33) or barley – slaughter by-product-water (1:1.66:1.33) was studied in a laboratory-scale experiment. Changes in the content of barley ß-glucans and water-extract viscosity were monitored over 24 or 48 hours storage at room temperature. In an additional experiment, the effects of cooking, lactic acid bacteria or ß-glucanase supplementation on the digestibility of barley diets were evaluated using 20 growing male blue foxes. Barley fed to foxes was either untreated (control), cooked (1:3.3 barley:water, 20 min.), lactic acid fermented or supplemented with ß-glucanase enzyme. Diets consisted of barley (50% of diet dry matter), preserved slaughter by-products, fish meal, rape seed oil, methionine and vitamins and minerals. The content of total ß-glucans decreased in all barley-water and barley-water-slaughter by-product mixtures during 48 hours. As expected, the degradation of total ß-glucans was greatest for the barley-water mixture supplemented with ß-glucanase. The viscosity of water extract decreased simultaneously during storage of all barley-water mixtures. Total tract digestibility of carbohydrates was clearly higher for cooked barley diet (63.7%) than for untreated (33.1%), fermented (33.7%) or ß-glucanase supplemented barley (34.0%) ($p<0.05$). Similarly, the digestibility of starch was highest when cooked barley was fed ($p<0.05$). No differences in the digestibility of carbohydrates or starch were observed between untreated, fermented or enzyme supplemented barley diets. Carbohydrate digestibility of all diets was lower than that in the previous studies, which may reflect the high levels of barley in all diets. The results indicate that the inherently low digestibility of raw barley starch is the limiting factor in utilisation of barley in growing foxes.

III – 6

Ideal protein for mink (Mustela vison) in the growing and furring period.

P. Sandbol, T.N. Clausen & C. Hejlesen

The investigation aimed at establishing the optimal protein requirement for mink in the growing and the furring periods. Based on the present amino acid norm for mink and cat and the amino acid composition of whole mink, an ideal protein was constructed. Two trials of each 5 groups of 120 males were carried out. Each male was housed with a female. A basal feed containing 32:55:13 % of the metabolisable energy (ME) from protein, fat and carbohydrate, was composed. Animals were weighed monthly and dead animals authopsied. At pelting livers were sampled and the pelts were graded. In trial 1 the diets contained 32, 28, 24, 20 and 16 % of ME from protein. The lower levels of protein were achieved by substituting the protein fraction with pregelatinized maize starch ans fat. The diets had identical amino acid profiles and almost identical energy contents. Based on earlier results from the furring season, Methionine Hydroxy Analog (MHA) was used instead of dl-methionine. The diets were fed from July to pelting. The longest skins ($p<0,0001$) were found in the groups with 24, 28 and 32 % of ME from protein. And the best pelt quality in the groups with 28 and 32 % of ME from protein. In trial 2 all groups received a diet containing 22 % of ME from protein from July to September. From September to pelting the diets contained 30, 26, 22, 18 and 14 % of ME from protein. There was no difference in skin length and only the group with 14 % of ME from protein had significantly lower pelt quality ($p<0,0006$) as compared to the other groups. It is concluded, that with the used amino acid profile (including MHA) the optimal skin length is achieved already at 24 %

of ME from protein and the optimal pelt quality from 28 % of ME from protein during the whole period. For the furring period, it seems that the requirement may be as low as 18% of ME from protein. In a parallel trial MHA showed inferior results in the growing period and we can not exclude that the effects found, are mere methionine responses.

III – 7

Effect of feeding intensity on body condition and glycemic control in mink Mustela vison

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This research studied the effects of feeding intensity on body condition and glycemic control in mink. Thirty kits from five litters were selected with one kit of each sex allocated to three feeding intensity groups. The mink were fed at 80, 100 or 120% of the recommended dietary allowance (RDA) of ME. The mink were weighed monthly (BW), scored for body condition (BCS), and sampled for blood and urine in August (start), October and December (end). In October, 9/10 mink in the 80%RDA group received a BCS 3 (ideal), while in the 120%RDA group 7/10 animals scored 4-5 (heavy-obese) (P=0.040). The blood glucose values measured in October were higher in the females in the 120%RDA group (6.04 mmol/l) compared to those in the 80%RDA (4.84 mmol/l) and 100%RDA (4.48 mmol/l) groups (SEM=0.23, P<0.01). At the end, the female groups no longer differed from each other in BW (80%RDA: 1172g; 100%RDA: 1386g; 120%RDA: 1487g), unlike the males (80%RDA: 1439g; 100%RDA: 2388g; 120%RDA: 2748g; SEM=120.6, P=0.038). In the 100%RDA group 6/10 mink scored 3, while in the 80%RDA group 7/10 mink received a BCS 2 (thin), and in the 120%RDA group 8/10 mink had a BCS 4-5 (P<0.001). The final blood glucose levels of all mink in the 120%RDA group were higher (6.55 mmol/l) in comparison to the 80%RDA (5.26 mmol/l) and the 100%RDA feeding intensity groups (4.94 mmol/l) (SEM 0.41, P=0.022). The males in the 120%RDA group showed hyperinsulinemia (2.06 ng/ml, SEM=0.164, P=0.043) in comparison to the rest of the mink (range 1.17-1.51 ng/ml). No glucosuria was detected in the mink. It is evident that the development of obesity during the fall is associated with elevated blood glucose concentrations and hyperinsulinemia in the mink suggesting insulin resistance. It is surmised that autumnal fattening may be a significant predisposing factor to the development of nursing sickness, the etiology of which is strongly linked to impaired blood sugar regulation.

III – 8

The effect of ad libitum and restricted feeding on growth curves and growth rate curves in mink selection lines

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Selection for growth on restricted feeding is assumed to improve feed efficiency. Technological progress has made this set-up possible in mink production. Thus the effect of selection on ad libitum and restricted feeding for high November weight on feed efficiency is studied in an experiment with mink. The way of presenting the problem is one of genotype-environment interaction and the restricted feeding has to cause a reduction in growth. The restricted line is fed 90% of the feed offered to a farm fed control line. This equals around 80% of the feed offered to the line fed ad libitum. The effect of feeding on the growth curves from July until pelting was studied. Body weight was recorded every three weeks. A random regression model with orthogonal Legendre polynomials was used in the analysis of data. Results show that the growth curves can be described by a higher order polynomial specific to line and sex and a significant difference is found between the line on ad libitum feeding and the line on restricted feeding. This suggests a moderate to

low genetic correlation between growth on the two feeding regimes that is the basis for a differentiated response to selection.

III – 9

Sodium bisulfate as a mink feed preservative

William L. Leoschke

For more than 50 years, phosphoric acid has been used as a mink feedstuff preservative and in mink ranch diets both as a feed preservative and as an effective prophylactic program for minimizing the formation of struvite urinary calculi in mink and fox. In recent years, there has arisen public concern in the United States about phosphate pollution of the environment. Sodium BiSulfate is an alternative mink feed and urine acidifier which ha been proven to be safe and effective in experimental studies and in field observations in the United States and Canada in recent years.

III – 10

Gas-producing microorganism in formic acid preserved poultry by-products

Ahlstrøm, Ø. , Haugen, J.E. , Kjos E.

In Norway, poultry by-products (viscera, heads, feet) for fur animal feed are preserved with formic acid to pH 3.5-3.8. Of unknown reasons the by-products occasionally expand and run over the containers, mainly during transport, causing extra work cleaning and sometimes the by-products are unsuitable as feed afterwards. Typical signs are bubbles and foaming similar to boiling, indicating that there is a gas production going on in the mass. A laboratory model study presented here showed that in anaerobe conditions as much as six liters of gas was produced per kg product within seven days. The course of the gas production during the seven days period was exponential like a microbiological growth curve. Gas chromatography analyses revealed that the gas contained hydrogen. Growth tests of micro organisms revealed two types of bacteria according two morphological signs of the colonies: Clostridium perfringens and Clostridium tetani. Both bacteria are known to produce hydrogen. The results of the study strongly indicate that the Clostridium bacteria are the main cause of the gas production. To prevent the growth of these bacteria, Na-bisulphite may have little effect, as they are sulfite reducing. Precautions like cooling of the by-products, correct timing for adding formic acid, and avoidance of long-term anaerobe conditions during storage may have better effect.

III - 11

Stability of processed blood and gelatine ingredients in mink feed.

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Feed ingredients for fur animal feed are mainly sourced from fresh animal byproducts and thus are a concern with regard to perishability. The ingredients currently used for fur animal feed are: fish byproducts, unprocessed slaughter byproducts and other byproducts of the food industry. Based on their different nature all these ingredients have their own specific way of biochemical and microbiological deterioration. Several feed ingredients, such as unprocessed poultry intestines and fish byproducts have already a certain level of intrinsic enzymatic activity that can provoke protein and amino acid degradation. Amino acid deaminating enzymes and decarboxylating enzymes, such as lysine decarboxylase have been shown in poultry byproducts immediately after harvesting at the slaughterline. This implicates that the addition of ingredients that contain free amino acids could cause an increased deterioration of the feed. Blood from slaughter animals and blood derived products constitute a high nutritional value because of its high protein content and also while many of the essential amino acids have a high availability in blood, e.g. lysine. Also with regard to the structural decreasing availability of fish byproducts, slaughter blood based ingredients could be used as high valuable alternatives for fish byproducts. The experiments were conducted in order to evaluate the

stability of fur animal feed mixtures enriched with blood or gelatine ingredients.
Experimental design. Commercial available minkfeed derived immediately after processing from a large fur animal feed processing plant was obtained. The composition of the feed was comparable to feed produced during the growing season of mink, using approximately 40% fresh broiler byproducts, 20% frozen broiler byproducts, 15% fresh fish byproducts, 10% ensilaged broiler byproducts preserved with 2% sodium metabisufite, 10% carbohydrates mixture with vitamins and minerals, completed with a few percent of water. The temperature of the feed was after production 0 to 4°C. The tested protein enrichment ingredients were: 20% v/v Bloodcoagulate (pork blood heated up to 80°C and concentrated to a DM of 27% and protein 98% on DM); 2% v/v bloodmeal (mixed slaughterblood, DM 94% and protein 90% on DM); 2% haemoglobin powder (derived from processing cattle and pork blood, DM 94% and protein 93% on DM) and 5% Gelco (a byproduct of gelatine processing, DM 51% and protein 70% on DM). The mixtures were prepared and stored at room temperature (core temp 18 to 21°C) or cooled (core temp 1 to 9°C). The change in pH and %TVN/tot N were assessed during a storage period up to 6 days.
The results showed that the pH of all cooled mixtures was stable at 6.1 to 6.5 during 6 days. In the feed mixtures at room temperature the pH in the mixtures with gelco and haemoglobin powder decreased during the second day of storage to 5.7 to 5.9, the other mixtures were stable in pH. The %TVN/tot N was in the commercial minkfeed at day 0, around 1.0%. In the mixtures cooled at 9°C all the mixtures stayed below 2% during the first 72 hours, there was no difference between the minkfeed with or without protein enrichment ingredients. The same observation was done for all the products stored at 1°C during the first 120 hours. For the products stored at room temperature the mixtures with bloodmeal, gelco and haemoglobin powder had at 24 hrs a %TVN/tot N between 2.0 to 2.7%, the not supplemented minkfeed 2.0% and the mixture with bloodcoagulate 1.7%. It was concluded that the used protein enrichment ingredients could be safely applied, provided that the minkfeed was produced properly, the bloodcoagulate ingredient even improved the feed quality, probably as a result of the mild processing conditions of bloodcoagulate that preserves the native protein structure.

III – 12

The importance of protein for young mink fed with dry feed

N. E.Kulikov, N. A.Balakirev

An aim of this research is to find out the main parameters of nitrous exchange in young minks coloured pastel. Minks were fed only with dry full ration granulated mixed fodder. There were used the results of 4 balance experiments which had been held in June. September and November (48 minks). During calculations there was used the method of extrapolation by the equation of regression y= bx+5. Endogen urinal nitrate turned out to be 1,0-1,1 a kg of metabolic mass (W0,75). The level of faecal metabolic nitrate was 0,258 g in 100 g of eaten dry food. It was found out that to support zero balance of nitrate, young minks need 30,2 g of protein a kg of live weight in June and 13,0-14,0 g – in September – November.

III – 13

Nourishing qualities of APK concentrate for minks, cubs

E. G.Kvartnikova, A. P.Kvartnikov

The exchange of expensive protein of traditional ration by the protein of mixed fodder makes the process of feeding minks much cheaper. This work represents the results of balance experiment on the use of nourishing substances APK concentrate, which was set on minks' cubs coloured demi-baff. APK concentrate is a homogenous mix of crumbled food of both animal and vegetable origin. Protein of APK consists of protein of animal origin at the rate of about 80 %.By the data of biochemical research, 100 g of APK concentrate contains, g: dry substance – 90,20; organic substance – 85,30; raw protein – 27,30; raw fat – 2,54; carbohydrates – 55,50; including raw cellulose – 9,97; ashes – 4,50; gross energy – 407,30 kcal (1706,58 KJ).

In the balance experiment there were found coefficients of digestion of nourishing substances of APK concentrate by minks' cobs, %: dry substance – 66,0; organic substance – 67,0; protein – 68,4; fat – 70,1; carbohydrates – 62,4; energy – 85,8.100 g of APK concentrate contains digestible nourishing substances, g: protein – 18,7; fat – 1,8; carbohydrates- 34,6; metabolic energy – 242,6 Kcal.

III – 14

Individual ad libitum feeding of male + female pairs of mink kits during the growth period increases feed intake, weight gain and feed efficiency

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Most farmed mink in Denmark are fed close to the average ad libitum intake during the growth period, based on feed residuals at farm, shed or row level. Variation in voluntary feed intake between male + female pairs is ignored apart from distribution of residual feed to cages without feed left over from the day before. Technological development has facilitated individual feeding and thus the possibility for true ad libitum feeding of mink. The variation in voluntary feed intake was studied in 173 male + female pairs of scanbrown mink kits during 15 weeks from July to November. The feed allowance was adjusted Tuesday and Friday based on residual feed registered Monday + Tuesday and Thursday + Friday. The average feed intake was 44.8±3.3 kg per pair of kits equivalent to 426±32 g per day. The average weight gain was 2501±447 g per male + female pair. The average feed efficiency (g gain/kg feed) was 56±8 g/kg and in general, the feed efficiency increased with feed intake and weight gain. The average difference between the lower and upper quartile was 29% equal to a difference in average feed consumption of 15 kg for the average weight gain of 2.5 kg during the 15 weeks of growth. Compared to the normal feeding practice, individual ad libitum feeding provides the opportunity to utilise the full potential of the mink kits for growth and feed efficiency, and thereby for effective selection for these traits.

III – 15

Effects of intensive fasting and methyl groups of feed on liver metabolism and welfare in breeding blue fox (*Alopex lagopus*) vixens

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The feeding trial was carried out on 60 blue fox vixens before the breeding season. The aims of the present study were: to find out to which extent low dietary protein supplemented with methyl donors affect fat and liver metabolism during rapid dieting and weight declining period in winter. Treatments were: control (blue fox feed, 20% protein from ME), Alimet® (control feed with supplemental methionine hydroxy analogue), betaine (control feed with supplemental betaine), choline (control feed with supplemental choline), methionine (control feed with supplemental DL-methionine) and positive control (normal blue fox feed, 35 % protein from ME). Weight loss, blood parameters, liver histology, enzyme activities, and cortisol:creatinine ratio of urine were measured. Animals maintained good health in all groups. The positive control feed was formulated on the basis of current recommendation from the Finnish Fur Breeders' Association. Therefore the recommended feed and a weight loss of approximately 29 % in three months could be safely recommended.

III – 16

The biochemical parameters in serum of mink fed high energy feedstuff with antioxidants and preservatives supplement .

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The investigations were designed to determine a variability range of reference values of some biochimical parameters in the serum of minks fed high level energy feed with dietary preservatives and antioxidants. The studies were performed at the mink farm "C" situated in the south eastern part of Poland. Blood was collected from heart of 60 mink yearlings twice in December. In serum of the animals examined there was determined activity of AST,ALT,ALP,LDH a level of urea, creatinine,

glucose, bilirubin and uric acid by the spectrophotometric method with monotests of Cormay. The energy value of 1kg feed ranged from 1700 to 1690 Kcal/kg depending on the growth and development stage, in that the energy from protein 35,1-33,0%, from fat 52,4-52,2%,from sugars 12,5-14,8%.of ready feed. The feed was supplemented with vitamin-mineral premix in such doses so that the elements requirements were met, i.e. Guyofox at a dose 1,0kg/tof ready feed. Till November an antioxidant additive (sodium pyrosulphite) was used at a dose making 0,2-0,3% of ready feed mass. Through the experimental period the feed was provided ad libitum, with permanent water access. The results obtained were analysed statistically computing mean arithmetic and standard deviation (Microsoft Exel NT).Mean activity of ALT reached the values 120,28 up to 224,80 U/l, while AST activity exceeded the reference value ranging from 95,66 to 133,49 U/l. The AP enzyme activity ran from 60,20 to 96,73 U/l. A cholesterol level was contained between 5,82 and 6,21 mmol/l. Alike, mean bilirubin level in serum oscillated between 2,05 and 3,66 umol/l, that is within the standards, whereas mean glucose level from 6,39 to 10,85 mmol/l with the standard limit up to 8,0mmol/l.A urea level ranged from 5,94 to 11,23 mmol/l and was found within the standard interval. The changes in creatinine level were of a regular character with the lowest level of 50,53 umol/l values and the highest 69,46 umol/l, not surpassing the reference values. A uric acid level was fairly equal and oscillated from 0,203 to 0,213 mmol/l, so it was contained within the reference value limits. From the obtained results it follows that the minks fed high energy fed exhibited a substantial activity increase of ALT,AST and LDH. The rest parameters were found within the ranges presented by other authors.

III – 17

Correlation between liver fat and dry matter in mink (Mustela vison)

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In our investigations on the protein requirement of mink in the growing period, we have often observed an increased fat content in the liver, when we reduced the protein / increased the fat content in the feed. A chemical analysis of the fat content in the liver is slow and expensive. We have used a semi quantitative test submerging liver samples into water and copper sulphate solutions with different specific gravities. On the basis of buoyancy in these liquids, liver samples were classified as containing > 34 % fat, 25 – 34 % fat, 13 – 25 % fat, or less than 13 % fat (Clausen, 1992; Damgaard et al, 1998a; Herdt et al, 1983). The method is cheap but rather inaccurate. Further the liquid can not be used for more then a few liver samples before it has to bee replaced. The dry matter content of fat is almost 100 percent, so we decided to look for a correlation between liver fat and liver dry matter. We took out liver samples from mink dying during October 2003. The livers were analysed for crude fat and dry matter content. The results showed a very fine correlation between the dry matter and the fat content: of the livers: Liver fat, in percent = 1.15 * liver dry matter – 24.9 (R2 = 0.97) It is concluded that this method can bee used for a quick, cheap and acceptably precise evaluation of liver fat content.

III – 18

Effects of feeding strategy on behaviour, physiological parameters and feed residues in mink females

B.M.Damgaard & S.W. Hansen

The effects of three feeding strategies were investigated in groups of 60 female mink from August to March. The three feeding strategies were: ad libitum feeding from October to February, ad libitum feeding but with a substantial diet from December to February, and restricted feeding from October to February. The body weight was registered approximately every second week. Behavioural observations were made using focal sampling before and after feeding in December, January, February and March. Physiological parameters were measured in November, February and March. Feed residues were recorded individually on a two level scale each morning. The results showed that restricted feeding increased stereotypic behaviour. It was demonstrated that it was possible to reduce the body weight of mink by feeding them a low energy feed without increasing the incidence of stereotypies. The feeding strategy had limited effects on physiological parameters. The

interaction between feeding strategy, behaviour and occurrence of feed residues was demonstrated.

III – 19

Regulation of lipid and glucose metabolism in the mink (Mustela vison) – Sequence analysis and development of molecular probes

K. E. Glover and K. Rouvinen-Watt

In the process of examining the molecular mechanisms governing lipid and glucose metabolism in the mink, we have developed laboratory procedures for the isolation and characterization of mink liver, skeletal muscle and adipose tissue mRNA. We will be evaluating changes in the gene expression of key enzymes and regulatory proteins of fat and glucose metabolism in response to dietary fatty acid composition and obesity. For the development of molecular probes for this work we have isolated and partially sequenced the mink acetyl coenzyme A carboxylase (ACC) using complementary DNA, which was prepared from reverse-transcribed mRNA. ACC is a key enzyme required in fatty acid synthesis and catalyses the conversion of acetyl CoA to malonyl CoA. This step is required for the synthesis of palmitate, a 16-carbon saturated fatty acid, which consists of eight two-carbon units derived from acetyl CoA. The partial nucleotide sequence is as follows: taaccaagta gagtccatct tcctttcagc aattgacatg tacggacatc agttttgcat tgagaactta cagaaactca tcttgtctga aacgtctatt tttgacgtcc taccaaactt cttctaccac agcaaccagg tagtgaggat ggcagctctg gaggtttatg ttcgaagggc ttatattgcc tatgaactta acagtgtaca gcatcgccag cttaaggaca acacctgtgt ggtggaattt cagttcatgc tgcccacatc tcatccaaac agagggaaca tccccacgct aaacagaa. This sequence shows a high homology (93%) with the corresponding nucleotide sequence encoding for the human acetyl CoA carboxylase. The conceptual translation to the corresponding amino acid sequence has resulted in the following protein structure: nqvesiflsa idmyghqfci enlqklilse tsifdvlpnf fyhsnqvvrm aalevyvrra yiayelnsvq hrqlkdntcv vefqfmlpts hpnrgniptl nr. The partial amino acid sequence of the mink ACC protein is identical to the corresponding enzyme sequence in the human. The now established nucleotide sequence will allow us to design primers specific for mink ACC for our future research in this area. These results also suggest that the ACC is highly conserved between the mink and the human.

III – 20

The effect of protein level on N-balance in adult mink (Mustela vison)

Carsten Hejlesen

Diets containing 14.9, 19.0 and 26.7 % of metabolizable energy (ME) from protein and identical amino acid profile were fed ad lib. to adult male mink for 11 days. The average voluntary energy intake decreased (343, 306 and 261 kcal/day/animal, $p<0.0001$) as dietary energy content increased. Daily energy requirement for maintaining constant weight was measured to 171 kcal ME/kg0.75 at a temperature of 9.4 °C.
In the last 4 days, nitrogen (N) intake and N excretion (collection of urine and faeces) was measured and the N-balance calculated. N-balance was positive (0.08-0.24 g/day, NS) where as weight change was negative (÷1.6 - ÷8.3 g/day, NS). Regardless of dietary treatment the urinary N excretion declined linearly as digested N decreased. The conflicting positive N-balance and negative weight change was assumed reflecting a incomplete recovery of urinary nitrogen. If weight loss was regarded as meat or fat, the average urinary N-recovery was calculated to 86.3% and 92.9% respectively. Oxidation of protein (OXP) per a calculated total heat production (HE) increased (11%, 16% and 19%, $p<0.05$) as dietary ME from protein increased.

III – 21

Bacterial protein as feed ingredient for blue foxes in the growth period

Skrede, A., Ahlstrøm, Ø

Bacterial protein meal (BPM) grown on natural gas as the carbon and energy source, and ammonia as the nitrogen source, was evaluated with respect to digestibility, feed intake, growth and fur characteristics in the growing-furring blue fox (*Alopex lagopus*). The BPM was produced by continuous aerobe bacterial fermentation, using

methanotrophic bacteria (*Methylococcus capsulatus* Bath, *Alcaligenes acidovorans*, *Bacillus brevis* and *Bacillus firmus*), and contained approximately 70% crude protein and 10% lipids. Four extruded dry diets containing 0, 4, 8 and 12% BPM, replacing fishmeal, soybean meal and meat meal in a 3:1:1 ratio on a crude protein basis, were fed to groups of 20 weaned blue fox cubs (10 males and 10 females) from August 8 to December 5. The highest level of BPM corresponded to 30% of total dietary crude protein. Digestibility studies showed no significant effect of increasing levels of BPM on digestibility of crude protein, fat or carbohydrate. The growth experiment was carried out without health problems and there was no mortality. Body weights and weight gain were not significantly different among the diets, but there was a tendency ($P<0.10$) towards increased body weight gain with increasing level of BPM. Feed conversion appeared to be slighly improved with increasing dietary inclusion of BPM. Skin size and fur characteristics were not significantly affected by dietary treatment. It is concluded that bacterial protein meal produced from natural gas-utilising bacteria seems to be a suitable alternative protein source for growing-furring blue foxes.

Genetics and Reproduction

IV – 1

Stochastic simulation of breeding schemes to improve economic genetic merit in mink production

B. K. Hansen & P. Berg

In this study selection within farms was compared with selection across farms and an exchange of breeding animals following a circular pattern between farms. We expected that a systematic exchange of animals in a group of farms would increase the total genetic gain. Genetic gain is influenced by several factors, among others population size, which can be increased by collaboration between more farms. The circular exchange of animals was analysed to test the effect of type and age of exchanged animals and the effect of the number and the size of farms in a collaboration group. In all cases the breeding goal includes body weight and litter size, and the genetic gain is estimated using stochastic simulation. The total economic gain is illustrated together with the rate of inbreeding during a period of 15 years. Economic genetic gain varied from 6.5 to 8.2 Dkk per mink per year. Increased weight gain was obtained by exchange of yearling breeding animals. Increased gain in litter size was obtained by exchange of either yearling males or females, and was further increased when jointly exchanging both males and females. Furthermore, the annual increase of inbreeding was reduced from 0.93% per year, when no exchange occurred, to 0.27% per year with exchange of animals between farms. It is concluded that the genetic gain in a mink population can be improved by intensive collaboration with other mink populations.

IV – 2

Inbreeding in a commercial fur animal breeding programme

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The normal mink breeding farm in Norway is rather small, with an average of approx. 500 breeding females, often divided into two or three colour types. Many of the farms are situated at long distances from each other and the exchange of animals between the farms can be difficult because of the danger of contagious deceases such as plasmacytoses. Most of the farms operate their own breeding programme, thus a mink farm can be looked upon as a closed population with a rather small effective population size.

A number of populations from 6 farms, which all uses the Norwegian field data recording system, Pelsdyrkontrollen, have been analysed for level of inbreeding and its possible effect on the reproduction results. Pedigree information is available for 36.299 mink over 6 to 10 years and 3.502 females have litter size recorded in 2002 or 2003.

Average inbreeding was 1.27 percent and the 1.585 females with inbreeding above zero have an average of 2,81 percent inbreeding produced 0,11 kits less then the females with no inbreeding.

The regression of litter size on inbreeding was – 0,023 , and the difference should thus be 0,06 in favour of the non inbred females. The difference may possibly be explained by an outbreeding effect in the non inbred group.

Approximately 150 Norwegian farmers use PELSDYRKONTROLLEN for selection of new breeders and the module for selection has been enhanced with a tool that can help the farmer to maintain as high effective population size as possible on the farm.

IV – 3

Genetics of littersize, age at first insemination and animal size in blue fox (Alopex lagopus)

J.Peura, I.Strandén, K.Smeds

Skin size of blue fox has increased considerably in Finland during the last decade. This may have lead to decreased fertility through unfavourable genetic correlation. The average number of pups per mated females has slightly decreased after the mid-90's. The objective of this study was to estimate the genetic parameters of the first three litter sizes, female age at first insemination and animal size using REML with single and multitrait animal models. The data was obtained from the Finnish Fur Breeders' Association. In the single trait analysis data and pedigree had 30268 and 44297 animals in litter size, 46295 and 62035 animals in age at first insemination and 68108 and 78775 animals in animal size, respectively. Multitrait analysis had 9126, 5115, 2525, 15381 and 23574 observations in 1st, 2nd and 3rd litter size, age at first insemination and animal size, respectively. Pedigree had 32356 animals in multitrait analysis. Heritability estimates were 0.08, 0.08 and 0.07 for first, second and third litter size, respectively. Heritability estimates in single and multitrait analysis were 0.16 and 0.18 for age at first insemination and 0.24 and 0.25 for animal size, respectively. The genetic correlations between animal size and age at first insemination and first, second and third litter size were -0.20, -0.40, -0.40 and -0.23, respectively. Genetic correlations between first and second litter size were 0.62, between first and third 0.51, and between second and third 0.60. This study supports the conclusion that there is an antagonistic genetic correlation between fertility and animal size.

IV – 4

Lower housing density combined with stable social environment improves reproductive performance of primiparous silver fox vixens

T. Pyykönen, H.T. Korhonen, L. Ahola, M. Mohaibes, S. Hänninen, J. Sepponen & J. Mononen

Social factors are known to affect the reproduction of both wild and farmed Vulpes vulpes. Therefore, it can be hypothesized that the practise of housing the breeding animals may have an effect on reproductive success. Our study was carried out to clarify whether lower animal density combined with stable social environment during breeding season influence the reproduction of farmed silver foxes. The primiparous (P) and multiparous (M) silver fox vixens were farmed with high (C) and low (E) animal densities. In addition, E vixens were transferred into their breeding cages already in January, C vixens just after insemination in March-April. The reproductive data between these two groups and age classes were compared. The C vixens came into heat (65±13 days from the beginning of the year) earlier than E vixens (72±12 days, $p<0.001$, T-test). Similarly, the multiparous females came into heat (64±10 days) earlier than the primiparous females (78±12 days, $p<0.001$, T-test). Furthermore, a higher percentage of multiparous females showed signs of oestrus (98% vs. 91%, $P<0.05$, x2).The total reproductive performance (RP=cubs/breeding female) was 2.9±2.5 cubs, and it did not differ between the age classes or experimental groups. However, age and group had an interactive effect on the reproductive performance ($P=0.052$, GLM for univariate measures). The primiparous females in high animal density (PC) had worse RP (2.0±2.3 cubs, N=31) than the females in the other groups (PE: 2.5±2.3, N=34; MC: 3.4±2.6, N=58; ME: 2.8±2.4, N=59). The present results show that low animal density combined with early established social environment delays heat development in silver fox vixens. Concurrently it seems to improve the total reproductive performance of primiparous females. Therefore, low animal density together with a year-round breeding cage could be recommended for silver fox vixens.

IV – 5

Adaptation of the raccoon dog (Nyctereutes procyonoides) to wintering; effects of restricted feeding or periodic fasting on energy metabolism and reproduction

Juha Asikainen, Anne-Mari Mustonen, Teija Pyykönen, Jaakko Mononen and Petteri Nieminen

The raccoon dog (Nyctereutes procyonoides) is an omnivore with autumnal hyperphagia and fattening followed by wintertime fast in boreal areas. We studied the effects of two different feeding levels (400 or 200 kcal/animal/day) or fasting (5-week fasting + 1-week feeding + 3-week fasting) between December 3rd 2002 and February 8th 2003 on plasma biochemistry, reproductive hormone levels and reproductive success of farm-bred raccoon dogs (n = 60 females and 24 males). There were no differences in the body masses, body mass indices or plasma lipids (triacylglycerol, total cholesterol, low and high density lipoprotein cholesterol) levels between the restrictedly fed and the fed animals. During fasting the plasma triacylglycerol concentrations increased ($p<0.05$, one-way ANOVA); but the body mass and the body mass indices decreased ($p<0.05$) indicating the release of fatty acids from adipose tissue. After the fasting periods the plasma cholesterol levels of the fasted animals were higher ($p<0.05$) than in the fed groups, and high density lipoprotein cholesterol levels increased ($p<0.05$, repeated measures ANOVA); but the triacylglycerol decreased ($p<0.05$) indicating rebuilding of energy reserves. The fact that different wintertime feeding regimes had no impact on the plasma glucose, cortisol, cholesterol, total protein, estradiol, progesterone or testosterone levels, or on the reproduction success, manifest versatile adaptative capacity in the species.

IV – 6

Diapause, implantation and placentation in the mink: A critical role for embryonic signaling.

Joëlle Desmarais, Flavia L. Lopes, Vilceu Bordignon and Bruce D. Murphy

During the first six days following mating and ovulation, the mink embryo follows the usual mammalian pattern of development to the blastocyst stage. These embryos then undergo a period of obligate developmental arrest, known as diapause. We have studied the mechanisms regulating the sequence of events between the escape from diapause to the postimplantation invasion of the uterus. We have demonstrated marked increases in embryo diameter within 24 h, and in DNA and protein synthesis beginning as early as 48 h after the reinitiation of development. Culture of cells harvested from embryos at intervals demonstrated that the trophoblast proliferated more readily during the early reactivation phase, while the inner cell mass proliferated later. The signal for trophoblast proliferation was fibroblast growth factor-4 (FGF4) presumed to be produced by the inner cell mass, and acting on its cognate receptors in the trophoblast. Embryos reached approximately 2.0 mm in diameter prior to implantation into the uterus, some 11-12 days after reactivation. During reactivation, the blastocyst produces prostaglandins, particularly PGE_2, which then acts on uterine receptors of the EP-2 and EP-4 subtypes. The vascular endothelial growth factor (VEGF), a promoter of angiogenesis, is strongly expressed by the trophoblast cells of the implanting embryo, and transcription of the VEGF gene was induced by PGE_2 and PGD. The embryo is necessary for the local expression of both known forms of the VEGF receptor associated with the early stages of vascularization of the placenta. Our investigations indicate that, following the escape of the mink embryo from its arrested state, cascade of embryonic signals promote trophoblast development, blastocyst invasion, and vascularization of the placenta.

IV – 7

The effects of air pollutants on the cortisol and progesterone secretion in polar fox (Alopex lagopus)

B. Nowakowicz-Debek, L. Saba, H. Bis-Wencel

The objective of the present work was to show the results of air pollutant impact on a cortisol and progesterone level at blue fox females in the first gravidity period (20-35 day). The animals caged in a pavilion system at the farm constituted the control group. The treatment group was made by the females kept in the close space with limited air movement, a chamber, thus exposed to gaseous contaminants. The female foxes from the treatment group exhibited higher levels of the released hormones that indicate the defense mechanisms activation against the exogenous factors.

IV – 8

The influence of antioxidant emicidin on minks' physiological condition and reproduction

I. S. Sugrobova, T. M. Demina, O. V. Rastimechina, E. A. Tinaeva, V. I. Melnichenko

Antioxidant emicidin has an expressed quality to connect free radicals, it stabilizes cells' membranes and helps to increase the indices of animals' productivity. Emicidin was injected (enterally and orally) in doses 7, 25 and 50 mg an animal a day. It was found out that emicidin helps to restore the level of general protein of blood serum in whelped female minks, increases their lactation and absolutely excludes females' lactational exhaustion. It also assists to increase the safety of cubs at the rate of 7-16 %, has growth assisting effect and helps to increase the quality of skins by 5-17 %.The strongest effect of using antioxidant emicidin was checked when injecting it orally to mature males in dose 25 mg an animal a day during the periods of whelping and lactation.

IV – 9

The measurements of the skin electrical conductivity in the acupuncture points affecting reproduction in female polar foxes, Alopex lagopus, during the estrus period

K. Sciesinski, M. Brzozowski

The aim of the investigation was the measurement of electrical conductivity (electric potentials in mkA) in the acupuncture points affecting reproduction in female polar foxes, during estrus. The measurements were taken in the acupuncture points situated on the urinary bladder meridian (points B22, B23, B25, B31, B32) which are stimulated in cases of estrus disturbances, parturition and postpartum period and on the meridian of the main back regulator (Lg2, Lg3, Lg4) which are stimulated during parturition and postpartum period. The chosen females normally gave birth and reared theirs cubs. The mean range of the skin electrical conductivity in the chosen points affecting reproduction in female polar foxes during estrus amounts to 81.2 - 88.1 mkA on the urinary bladder meridian (points B22, B23, B25, B31, B32) and to 86.0 -87.7 mkA on the meridian of the main back regulator (points Lg2, Lg3, Lg4). The received values can be counted as a standard during the estrus period in polar foxes females.

IV – 10

Isolation of microsatellite markers for American mink (Mustela vison)

A. Farid, I.R. Vincent, B.F. Benkel and K. Christensen

Creation of a rough linkage map of the mink genome requires approximately 300 polymorphic microsatellite markers, while fewer than 100 have so far been characterized. Our objective was to isolate and characterize additional microsatellite markers, especially tetranucleotide repeats that are easier to genotype. A mink genomic library was constructed by digesting DNA with Sau3AI enzyme and cloning 300 to 800 bp DNA fragments into the BamH I site of the dephosphorylated pGEM-3Z vector. The ligation product was used to transform competent E. coli. Recombinant colonies (n=2435)

were lifted onto Hybond-N+ nylon membranes after overnight growth. Membranes were screened with two pools of probes using a chemiluminescence DNA detection kit. One pool included (AAAC)8, (AAAT)8, (AACC)8, (ATGG)8, (AC)15 and the other contained (AAAG)8, (AAGG)8, (AGGG)8, (ATAG)8, (AG)15 oligonucleotides in equal amounts. Eighteen colonies were positively hybridized (0.74% of colonies), and DNA inserts were amplified by the polymerase chain reaction (PCR) using T7 and SP6 primers, and were bi-directionally sequenced. One GTTT, one GGAT, three AG and eight AC repeats were detected and five inserts had no repeat. Primers were designed and the loci were amplified by PCR. Nine of the loci were polymorphic in a panel of mink. Six of the primer sets amplified DNA of American pine marten (Martes americana).

IV – 11

Liter size, weaning success, and nursing mortality in chinchillas (Chinchilla lanigera) in relation to cage illumination

L. Felska, M. Brzozowski

The aim of this study was determine effects of light intensity on litter size, number of weaned per litter and mortality rate during nursing. Study was performed on a reproduction farm in western Poland, during1999-20003. The analysis covered reproduction performance of 250 females of the standard variety. Light intensity was measured with a photoelectric light meter LS-200 and ranged between 0 and 270 lx. The chinchillas were assigned to 9 groups, 30-lx interval each. The Kruskal-Wallis test was applied to estimate an effect of light on reproduction. No statistical differences were found between the groups in relation to light intensity. The highest litter size and number of weaned per litter was found at the highest light intensity level, i.e. 241-270 lx (group IX), respectively 2.25 and 2.17. The lowest litter size and number of weaned per litter was found in the group I and VIII. Both litter sizes and number of weaned per litter grew along with increasing light intensity. The highest death rate of the young during nursing was found at the lowest light intensity level, i.e. 0-30 lx (group I)– 17.19%, while the lowest mortality was found at the highest light level, i.e. 241-270 lx (group IX) – 4.17%. Nursing mortality showed a falling trend with growth in cage illumination level. The range between 241 and 270 lx was the optimal range of light intensity in this study.

IV – 12

Evaluation of pastel fox breeding results in Poland - body conformation

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Material for study was females of common fox different color varieties maintained in 1978-1997, from which 4155 progenies with pastel fur were achieved, were observed.
In order to estimate the efficiency of breeding work, evaluations of genetic and phenotypic trends were applied. Phenotypic trends were estimated as changes of phenotypic trait mean values in time. The basis for genetic trends estimation in population studied was the solution for the birth year of an individual describing the changes of genetical quality in time. Calculations were made using software BLUPf90, applying multi-trait animal model.
Selection differences for reproduction and conformation traits taken into account during selection were calculated in the paper to estimate the intensity of the process. They were accepted as differences between mean phenotypic value of a trait among young foxes chosen to general herd and mean phenotypic value of a trait for all young.
On a base of results achieved, the following conclusions were drawn positive values of genetic trends for conformation traits and number of reared animals testify to proper direction of breeding work. However, their low values point out to low efficiency of selection. It can be a result of large number of traits considered during selection. For all investigated traits with exception of litter size at birth an increasing tendency was found during the years under investigation which prove, the breeding work was conduced properly in this flock.

IV – 13

Genetic variability of chosen conformation traits in chinchilla

Grazyna Jezewska, Iwona Rozempolska-Rucinska, Grzegorz Zieba

The purpose of the studies was to evaluate genetic determination in chosen performance traits in chinchilla. Nine generations of standard chinchilla population was taken into consideration. Conformation evaluation carried on 1565 animals (59 males and 1506 females). Body size, colour type, fur colour purity, fur quality and belly-belt were taken into account. The estimates of variance components of examined traits were evaluated employing the REML with many-factor individual model by the DMU. Genetic analysis of particular traits were performed with respect to: random additive effects of animal, random additive effects of animal's mother, permanent effects of year and month of whelping, sex and regression on the number of weaned offspring. The factors were chosen on the basis of earlier analysis. Heritability coefficients ranged from 0.071 to 0.389. The highest value concerned colour type (0.389) as well as fur colour purity (0.363). Heritability coefficient values of studied traits could be a good prognosis of conducted selection efficiency. The mother's additive effect on the level of examined conformation traits oscillated from 0.054 to 0.672. The mother's effect turned out the significant variability source, particularly of body size and belly-belt. In case of those traits, the mother's effect surpassed the genetic variability resulting from additive effects of animal.

IV – 14

Genetic and phenotypic parameters of animal size and fur traits in Common Silver Fox (Vulpes vulpes L.)

S. Socha, D.Koldziejczyk, A.Gontarz

The aim of the work was to evaluate the parameters (heritability and genetic, phenotypic and environmental correlations) of Common Silver Fox. The research is a continuation of investigations conducted by the Department. The estimated traits were as following: animal size and fur quality traits: colour type, purity of silver colour and colour purity, fur quality (the length of hair and fur density), total evaluation (total number of scores). Coefficients were calculated from dam and sire variance components. Analysed groups consisted of at least three, related animals. Heritability coefficients was the highest for colour type: 0.900 and for other traits was as follows: animal size 0.070, purity of silver colour and colour purity 0.256, fur quality 0.547 and total number of scores 0.443. The estimated values were higher (except for animal size) than results obtained by other authors. The genetic correlations ranged from -0.550 (between animal size and fur quality) to 0.900 (between animal size and the total number of scores). The phenotypic correlations had lower scope and ranged from -0.160 (between animal size and fur quality) to 0.470 (between animal size and the total number of scores). The environmental correlations were on the similar level. Obtained values prove that foxes of larger dimensions were characterised by lower quality of fur. At the same time, the trait that most significantly influenced total evaluation, considerably more than other traits, was animal size. It should be also pointed out that differentiation of correlations (positive and negative correlations) in fox population make difficult the selection, all the more so as in selection all the traits are important. The data obtained from skin auctions prove that animal size most significantly influenced the price of the skin, which indicates that this trait should be taken into special consideration during selection. Obtained results prove that animal size depends mostly on environmental conditions, mainly on the feeding.

IV – 15

Genetic parameters of size and fur quality in a mink population (mustela vison sch.)

S.Socha

The aim of the work was to estimate the heritability and correlations between body size and fur quality, estimated in a minks farm. Genetic parameters of the traits were obtained by the REML method with a multitrait animal model. Since the fur traits were evaluated on a discrete scale and distribution of scores differs from a normal distribution, probit transformations of the obtained heritability and

phenotypic correlation estimates of traits were performed. Obtained heritability estimates: 0.515 for body size (based on point evaluation of animals) and 0.226 (based on body weight), 0.432 for colour purity, 0.387 for fur quality and 0.499 for the total score. Phenotypic correlation coefficients had both positive and negative values, similarly to the genetic correlations. Negative phenotypic correlations occurred between body size and colour purity (from –0.046 to -0.137); positive ranged from 0.011 (between colour purity and fur quality) to 0.733 (between fur quality and total score) and 0.815 (between body weight and body size in scores evaluation). High values characterised phenotypic correlations between body size (in points) and total score, 0.693, and between colour purity and total score, 0.669. The genetic correlations ranged from –0.125 (between body size and colour purity) to 0.802 (fur quality and total score). The phenotypic and the environmental correlations showed narrower ranges. The differences between the correlation coefficients might be a serious problem i.e in the selection of minks' where the detailed estimation of breeding value of animals is essential. While estimating the breeding value one should take into account the present situation at the skin auctions and take into consideration traits influencing the final prices of the skins.

IV – 16

Comparison of reproduction management intensity of three genetic lines of female chinchillas (Chinchilla lanigera M.)

B. Seremak, M.Sulik

The observations took place on a chinchilla farm located in West Pomerania, Poland, during 1991-2002 and included 359 females assigned to three basic groups that represented separate genetic lines: imports from Sweden (141 females), own-bred (98 females), and imports from Denmark (120 females). The females qualified for the studies had produced at least four litters during their reproductive life. The main goal of these investigations was to determine an effect of litter interval on selected reproduction parameters of female chinchillas. It was found from the studies that the mean litter interval was 221 days, which demonstrates that the females had been extensively managed in terms of reproduction. Litter interval that lasts 8-9 months positively influences litter size and is especially recommended for females that nurse large-size litters. In the Swedish line, a drop in services was observed in the fourth oestrus after delivery, as compared with the remaining genetic lines. The own-bred females achieved the worst nursing success for the young born from services during a post-lactation oestrus, while the Swedish females – for those born from services during the fifth oestrus post-partum.

IV – 17

Morphological changes of spermatozoa in breeding raccoon dogs semen during cryopreservation.

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Process of dilution and semen freezing provides in a smaller or bigger degree damage of cell membrane of spermatozoa, thereby decreasing its fertilization ability. We provide investigations which aim was to evaluate the damage degree of raccoon dog spermatozoa during freezing process, after administration of different extenders. Investigations were carried out on semen collected manually from 16 raccoon dog males. After evaluation, semen was diluted with EDTA extender with 4, 6 and 10 % glycerol addition. Morphology of spermatozoa was evaluated on thin smears on a slide stained with 5% eosin and 10% nigrosin (1:4 v/v). Spermatozoa normal and not damaged in fresh semen were 63%. Among those with secondary changes a majority of 34.3% were spermatozoa witch proximal droplets. In frozen-thawed semen smears, the observed highly significant decrease of intact spermatozoa was dependent on glycerol addition. Up to 52-54% highly significant increase of spermatozoa with coiled tail and "hair pin" was observed.

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IV – 18

Induction of estrus and ovulation in breeding chinchilla by GnRh analogues

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The chinchilla in comparison to other multiparous rodents have relatively low fecundity. During the heat in ovaries of sexual mature chinchilla we can observe up to 16 ovary follicles, of which only 4 ovulated. The authors undertook trial to increase fertility and fecundity of breeding chinchilla by using hormonal specimens containing busereline – a synthetic analogue of hypothalamus hormone – GnRH. First and second step of experiment was conducted on 48 females, which randomly were divided into 3 groups: 2 experimental and 1 control. Each experimental female was inoculated intramuscularly with 0,2 ml of Receptal Intervet – Group I; Biochef Bioreline – Group II, what correspond to 0,85 mg of busereline. Control group – Group III was inoculated intramuscularly with 0,2 ml of Aqua pro injection (Polfa).In the first stage of experiment, effect of busereline administrations was evaluated by structural changes observed in ovaries. In a second stage 24 females from stage I were housed for 60 days with males. Results from the stage I showed that both GnRH analogues caused ovulation, and female's ovaries showed presence of corpus luteum. Confirmation of this fact was kittening of females from groups: II and I.
Application of placebo in the control group did not show any folliculogenesis and any ovulation in this group. Research was supported by the State Committee for Scientific Research as a Solicited Project PBZ-KBN-084/P06/2002 from 2003 to 2005 year

IV – 19

Growth parameters and organ size of American marten (Martes americana) born in captivity

H. A. Collins, K. Rouvinen-Watt, J. Grant and M. Rankin

Very little is known about the growth parameters such as developmental and seasonal growth curves and organ size of American pine marten (Martes americana) born in captivity. The objectives of this research were to examine the body weight gain of captive-born juvenile and adult male and female marten, and to measure organ size in relation to body size of captive grown marten. Twenty-five male and twenty female marten from the NSAC marten colony were included in this study. The body weight data collected from 1999 to 2003 was used to create developmental and seasonal growth curves for the juvenile and adult marten, respectively. Marten organ weights were obtained at pelting by dissecting 19 males and 13 females in January 2003-04. At 7 days of age the body weight of the male kits was 61.7± 2.1 g and the female kits 55.1±1.7 g ($P=0.019$), while in December the juvenile males weighed 924.4±17.5 g and the females 633.9±8.1 g ($P<0.001$). The body weights of the juvenile female marten 631.2±7.9 g were significantly different in January to those of the mature female marten 667.6±11.8g ($P=0.013$), and the weights of the juvenile males 909.3±16.2 g differed significantly from those of adult males in January 1057.2±29.7 g ($P=0.001$). The marten exhibit pronounced seasonal fluctuation in their body condition throughout the year with both males and females being the heaviest in April, males being the smallest in August and the females being the smallest in July. A comparison of adult male and female marten showed a significant sex difference in body weight, body length, liver, heart, pancreas, stomach (empty), intestine (full and empty), kidneys and adrenal gland weights ($P<0.05$). The results of this study will serve as a valuable baseline data for the characterization of growth and seasonal changes in body condition of juvenile and adult American marten.

Fur properties

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The influence of pelting time on pelt characteristics in blue fox (Alopex lagopus)

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Blue fox pelt characteristics were studied in relation to three pelting days (October 20, December 2 and 14) in order to find the optimal pelting time. The study included 717 young blue fox males originating from five farms and from three pelting dates on each farm. On dried raw skins samples were taken from the hip for leather thickness and weight measurements. The dried raw skins were graded for skin auction and auction data was collected. The data was analysed by using Friedman's non-parametric test and analysis of variance taking into account litter and farm effects. Fur quality showed no statistically significant difference between the three different pelting dates (P=0.33) although the share of the best fur quality (Saga Royal) increased from the first to the last pelting date (6%, 8%, and 12%). Likewise the share of skins with low and sparse under wool (flat) diminished significantly towards later pelting (16%, 13%, and 7%, p<0,01). A larger amount of woolly skins with short and weak guard hair appeared when pelting date was later (p<0,01). The clarity of the fur colour, bluish instead of brownish shade, was highest in the earliest and lowest in the latest pelting group (the share of best class pelts: 45%, 32%, and 31%). The difference between the two first groups was significant (p< 0,001). The leather became significantly (p< 0,001) thinner and lighter until mid-December indicating the maturation of the skin and the fur. The results confirm that the fur volume increases still in December. Finally the economic balance between the positive price effect of fur volume and the negative effects of increasing woolliness and deteriorating colour clarity will define the optimum pelting time.

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Population genetics and registration of fox pelts in warehouses.(khlebnikov's travel notebooks revisited in terms of the hardy-weinberg law by borodin)

O.V. Trapezov

What did the population genetic law disclose? It provided answers to puzzling questions: 1) Are the differences in natural viability between black, red, and cross foxes, that is to say, are foxes subject to selection for this character (color phase) in natural populations?; 2) Did the higher market price of black and cross fur make hunting for foxes carrying the B gene preferable? (In fact, a black fox was three times more expensive than a red one at that time). 3) How honest were of the Russian American Company employees involved in pelt production in 1842? What if they biased their data to conceal theft of the exceptionally expensive pelts? To provide an answer, Russian geneticist Borodin referred to the mathematical law of the variability in coat color in the wild population of fur bearing animals. In population genetics, the law is known as

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Hair density and morphology of medulla in Mustelidae

Keiji Kondo, Yoshitake Ninomiya, Hideo Ichikawa, Masaru Kato, Shigeharu Fukunaga and Asako Kondo Hosaka

Insulation of pelage depends on its volume, that is, its density and length. Therefore, fur breeders have been interested in hair density, as it is an important factor to determine the quality of fur. Hair density is also important for mammals to adapt to their habitat. This study was carried out to measure hair density and to observe morphology of medulla in Japanese mustelids.

The furskins used in measuring hair density and observing medulla were collected from the following mammals; sable, ermine, least weasel, Japanese weasel, mink, river otter and sea otter The number of hair per one hair bundle (H) was

measured using SEM. Also, the number of hair bundle(HB) per a unit area (2.5 mm×2.5 mm) was measured by observing a surface of fur skin after cutting the hair using a stereo microscope. After these measurements, hair density (number of hair/cm2, HD) was calculated from the following formula; HD＝H×HB/cm2.
Observation of medulla was made on specimens cut with a new razor blade along the axis of fiber. Observations were made with a JSM-T220 SEM operated at 15 Kv.
The hair density was high in order in sea otter (approximately 150,000), river otter (approximately 60,000), mink (approximately 30,000), ermine (approximately 18,000), sable (approximately 15,000), Japanese weasel (approximately 13,000), least weasel (approximately 6,000). The morphology of medulla observed by SEM varied more than expected. In Mustelidae, it was suggested that the observation of medulla by SEM may identify its species. Pelage is important for mammals to adapt themselves to their environment. Even in Japanese mustelids, each species inhabits under various environments. This study suggested the possibility of clarifying whether hair density and morphology of medulla depend on taxonomy or habitat by examining the furskins from individuals inhibiting in different environments.

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Variation in parameters of raccoon dog hair coat with different degrees of fur matting

M.Piórkowska, A.Zoń

One of the major factors adversely affecting the quality and value of long-haired pelts is fur matting. Matting is an undesirable fault that occurs both in animals and on skins. Because good hair coat quality of the skins produced largely determines the profitability of breeding, the present study was aimed to analyse the incidence of this fault in raccoon dogs and to determine the relationship between hair matting and other properties of skin and hair coat.
The studies on a population of raccoon dogs, conducted from 2001 to 2003, included monthly monitoring of hair coat to determine the degree of fur felting/matting. From weaning to conformation testing, young raccoon dogs were tested organoleptically over their entire bodies, especially in the middle and sacral part of the back, in tail base and on sides of the pelvic girdle.
At fur maturity of the hair coat, the animals were killed to take 18 random samples of skins with different matting degrees (group I - skins without matting, II – skins with matted hair coat, III – heavily matted skins over a large area). Skins were measured for physical parameters and hair coats for density, thickness and length of hair as well as SGM (springiness, density, resilience).
First cases of matted hair and chewed areas were found in late July, i.e. at the time when winter hair begins to develop. Percentage of animals with damaged hair coat increased as the winter coat developed.
The present study revealed that skins with heaviest matting had the lowest weight and area and the thickest layer of skin tissue, while their hair coat was characterized by poorer heat-insulating properties of the skin (SGM measurement) and thinnest guard hair.

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