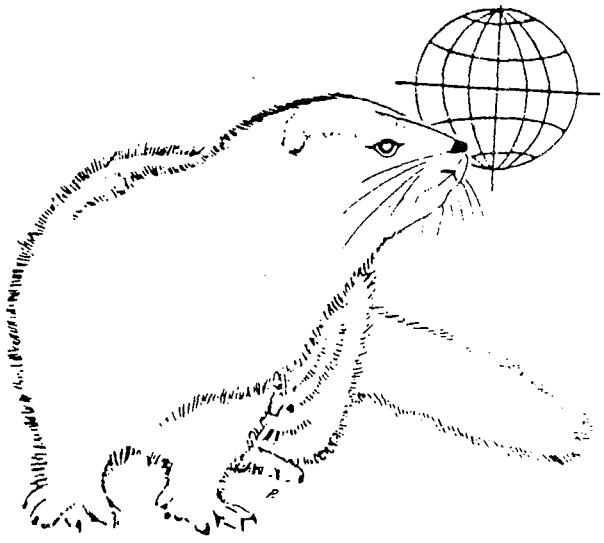

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Titles of other publications - not abstracted

Clinical analysis. *Birthe Damgaard. 720. Report from the National Institute of Animal Science, Denmark, pp 43-47, 1993. 24 refs. In ENGL. Code 3-14-M-F.*

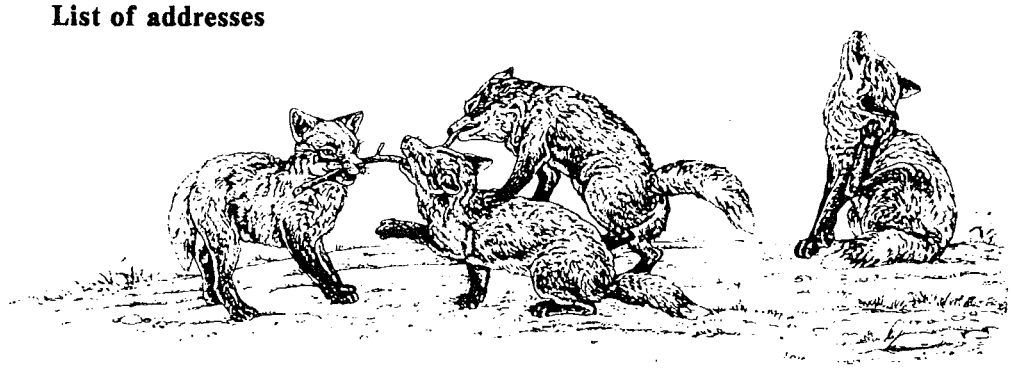
Morphology, Morphometry and Histology in Hair and Skin. *Palle V. Rasmussen. 720. Report from the National Institute of Animal Science, Denmark, pp 59-65, 1993. 20 refs. In ENGL. Code 2-14-M-F-O.*

Stress and Behavioural Biology. *Steffen W. Hansen. 720. Report from the National Institute of Animal Science, Denmark, pp 73-79, 1993. 43 refs. In ENGL. Code 11-10-14-M-F-O.*

Research in Housing Conditions and Welfare of Farmed Foxes. *Vivi Pedersen. 720. Report from the National Institute of Animal Science, Denmark, pp 80-85, 1993. 24 refs. In ENGL. Code 10-11-12-14-F.*

4. Genetics

8. **Congresses, symposiums, scientific meetings etc.**



Notes

SCIENTIFUR
Vol. 19, No. 1, 1995

When I sit here in my office in Norway and look at the very beautiful snowscape, the blue sky, a temperature of minus 10°C, with all trees covered in very white snow, I realize that my part of the world is as beautiful as can be. Automatically I imagine how wonderful it would be to step out into this great nature wearing a beautiful fur coat.

It is therefore depressing to read all the new year comments from the presidents of the various Fur Breeders Organizations. They are all dissatisfied with the mink skin prices and worrying about the fox skin prices. It is hard to have to realize that both 1994 and 1995 must be added to the years where mink skin prices did not even cover production costs, and despite the very nice "fur coat weather" the optimism is very limited.

On this background it is also very difficult to strike an exciting, promising, and optimistic note in the first issue of the 19th volume of SCIENTIFUR. The fact, however, that SCIENTIFUR can now - thanks to the support of individuals and organizations - look back upon 18 successful years, of which some gave very low skin prices, too, should give rise to a lot of optimism for the future, and just as the presidents mentioned all believe in a future for the fur animal production, we in SCIENTIFUR and IFASA believe in a future for SCIENTIFUR and the international scientific cooperation within fur animal production. This cooperation is the only way to reduce the necessary investments in research etc., as it should guarantee close to 100% utilization of the present international knowledge on research in fur animals.

The annual IFASA board meeting was held at the main office of the Dutch Fur Breeders Association in Nederasselt, The Netherlands, on November 11, 1994. We would like to express our thanks to the Dutch Fur Breeders Association and to Wim Verhagen for their great hospitality and for the information we received about the activities in The Netherlands.

The accounts and budgets of IFASA and SCIENTIFUR were approved, and the problems in connection with payment of subscriptions and membership fees were discussed. It was also discussed to combine the personal IFASA membership with a subscription to SCIENTIFUR, but this will only be decided after further investigations. It was concluded that subscription price and membership fee will be the same in 1995 as in 1994 and that we should make it possible to pay with the most common credit cards or by bank transfer.

The board agreed upon a proposal for a network communication within IFASA as published in SCIENTIFUR Vol. 18, No. 4, November 1994. Based on a report from Stanislaw Jarosz of the framework regarding the arrangement of the 6th international scientific congress in Poland 1996, the board made some decisions regarding the economy and formalities of the congress. It was also decided that the working groups of IFASA will hold group meetings during the congress in Poland in 1996.

The next board meeting will be held in Poland in week 22, 1995. If any members have suggestions or questions to the board, they should be given to one of the board members in due time.

We are facing increased costs and time for ordering and receiving copies of scientific reports on fur animals for publication in SCIENTIFUR. Therefore we could save a lot of money, if authors of scientific or technical reports would automatically send a copy to the editor of SCIENTIFUR.

Therefore: Please send a copy of your scientific or technical report or review, preferably including an abstract or summary in English, as soon as possible to SCIENTIFUR. Thank you very much for your cooperation. Simply include us in your mailing list, or in the mailing list of your institution or your department.

If you have not already received your 1995 invoice for membership fee of IFASA and/or SCIENTIFUR subscription, this will reach you soon. Please be so kind as to pay as soon as possible to save us the extra costs, and please note that payment by cheque in any currency will have to be added the equivalent of NOK 70.-. As already mentioned, it is now possible to pay with your international credit card. A help for you and reduced costs for us = a good solution.

We regret very much that pages 207 and 208 were missing in SCIENTIFUR Vol. 18, No. 3. These pages are included in this issue.

In this issue we start the previously announced publication of reviewed reports regarding results of the very comprehensive research on domestication of fur animals performed over many years by our colleagues at the Institute of Cytology and Genetics, Novosibirsk, Russia.

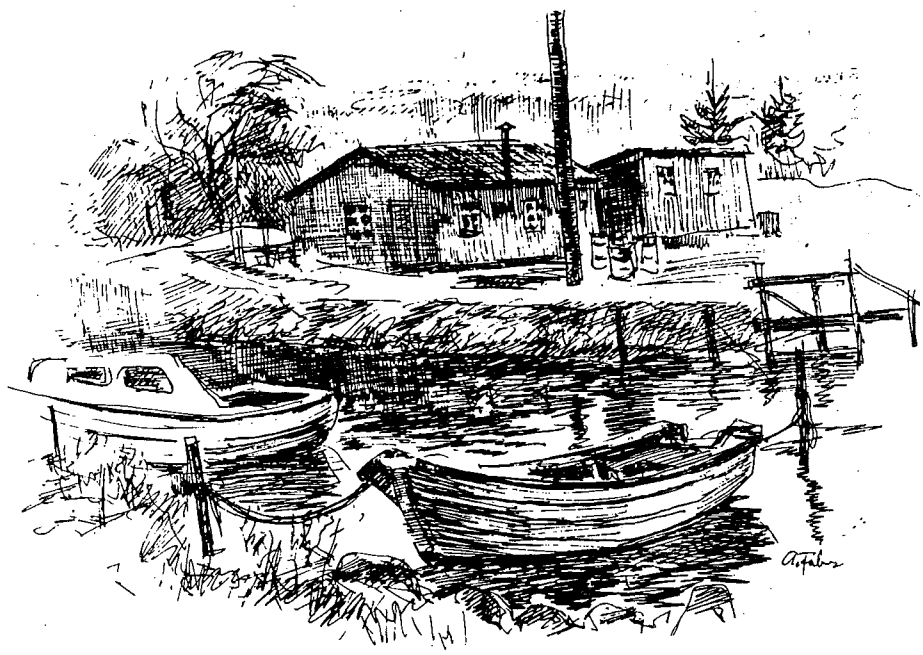
SCIENTIFUR intends to publish the series of reports in a booklet under the heading: Evolutionary-genetic and genetic-physiological aspects of fur animal domestication.

In this issue you will also find several original reports as well as abstracts from the reports given at the Scandinavian scientific meeting held in Denmark in September 1994. Furthermore, it is mentioned where the proceedings containing the full length reports can be ordered.

In summary, also this issue of SCIENTIFUR provides you with a lot of scientific and technical information regarding fur animal production. Please tell your colleagues and encourage them to become members of our family.

With the best regards and hopes

Gunnar Jørgensen
Your editor



Original Review

Experimental domestication of fur animals: A multidisciplinary study

L.N. Trut, L.V. Osadchuk (Eds.)

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

Preface

This book is concerned with the many-faceted problem of the domestication of animals. The relevant literature, to our knowledge, is scant. We present here the results of our experimental approach to the problem and some of the generalizations based on the results.

We owe credit to Prof. D.K. Belyaev, the late director of this Institute, for his original concept of the decisive role of behaviour in the morphological and physiological changes of domestic animals. We are also indebted to him for starting long-term experiments with domestication of silver foxes. The experiments were started at the beginning of the sixties at the laboratory of Evolutionary Genetics of which he was then head. Later on, experimental domestication included mink, another fur animal. The idea was to select animals for specific behaviour traits promoting their adaptation to conditions of captivity. By this time, fox and mink had already passed through a period of natural selection for capacity to adapt to new social surroundings, and we intended to accelerate the process by deliberate artificial selection for tameness.

The fox was chosen for experimental domestication because it is taxonomically closely related to the dog, which is regarded as the pinnacle of evolutionary transformations achieved by domestication. The ecological plasticity of the fox varies in a wide range. The mink is, by far, not as ecologically flexible as the fox managing to thrive in diverse niches. This has suggested that mink have simpler regulatory correlated mechanisms stabilizing development than foxes

Therefore, comparisons of the direct and indirect effects of selection for domestication in these two different species of fur animals appeared of interest.

The book deals with a range of topics within a multidisciplinary study of domestication of silver fox and mink. The behaviour of fur animals of unique experimental populations is described.

The role of critical developmental periods, maternal effects and genotype x environmental interaction in formation of domestic behaviour are considered. The various correlated responses of long-term selection for behaviour are also examined. The newly arisen changes in coat colour

are among those of particular interest. The results of phenogenetic analysis of these *de novo* colour variations are presented. A number of articles consider neurohormonal and hormonal mechanisms of fur animal domestication. Particular emphasis is on the adrenocortical and reproductive functions. This is consequential because the former is the key in adaptation and the latter is an integral parameter of fitness.

The writing and publishing of this collection of papers could be carried out thanks to the efforts of many, and the editors gratefully acknowledge their assistance. Gratitude is expressed to Prof. G. Jørgensen for his invitation to publish the book in Scientifur. Encouragement of Prof. V.K. Shumny has also been of great value. The editors express gratitude to the translator of the Institute, Mrs. A. Fadeeva for reading the entire manuscript. We are grateful to Mr. V. Prasolov for photographic assistance. In presenting this work, we acknowledge technical assistance of all colleagues.

This book will be hopefully of interest to those studying the various aspects of the domestication problem. The book is also intended for scientists who are professionally involved in ethology, physiology, genetics and evolution.

Novosibirsk September 1994
Ludmila N. Trut
Ludmila V. Osadchuk

This work was supported by grant N 93-04-6936 from Russian Fund of Fundamental Researches and grant N RBDOOO International Science Foundation.

Original Review

Domestication of the fox: Roots and effects

L.N. Trut

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Domestication in scientific terms

The term "domestication" is rarely associated with a large-scale experiment with scientific implications. Indeed, man has long domesticated animals to satisfy his own needs without afterthoughts about the biological consequences of domestication. However, there remains much to be learned about the evolutionary-genetic and other biological effects of domestication (*Herre, 1959; Belyaev, 1969*).

The history of domestication of animals dates to about 15 thousand years ago. Not far back on an evolutionary scale, perhaps (*Belyaev, Khvostova, 1974*). The enourmous divergence of domestic animals from their wild counterparts and also from each other keeps surprising from the time of Darwin's observations (*Darwin, 1842*). Not less remarkable are the similarities between the phenotypical-behavioural, physiological and morphological novelties acquired by animals very distant taxonomically in the course of domestication.

Loss of breeding seasonality by almost all domestic animals is an illustrative case, while the majority of animals of natural populations of temperate zones give offspring once a year and in a particular time of it (*Bronson, 1988*). Surely, genetic mechanisms, such as artificial selection, genetic drift due to inbreeding, and weakening of natural selection have contributed much to fixation, selection of various forms of variability hidden as recessive mutations in the wild phenotype of each and every natural population (*Belyaev, 1969; Price, 1984*). However, not all the evolutionary consequences of domestication can be reduced to the above mentioned genetic events. In fact, loss of breeding seasonality by almost all domestic animals is hard to understand in terms of Vavilov's homologous series of mutational variability (*Vavilov, 1922*). Also, it is not easy to understand this loss as the result of direct selection only. There is no variation in the number of sexual cycles in a year in animals with a strictly seasonal breeding pattern, whereas heretability of variation in pairing dates within the limits of the breeding season is extremely low (*Belyaev, Trut, 1983*). It is unlikely that certain physiological and morphological novelties appearing in animals under domestication might have been due to partial release from the pressure of natural selection. There is good evidence that many changes have arisen at the very early steps of domestication long before animals were consciously selected (*Herre, 1959*), when natural selection still had the major role (*Kislovsky, 1965; Price, 1984*). It should be emphasized that, having placed animals in captivity, man shifted the vector of natural selection. The drastic change in environment due to con-

finement in captivity could be coped with only by some animals with specific behavioural traits. Hence, natural selection reorientated its vector for social adaptation of animals under domestication.

It is known that the behavioural responses of the whole organism is controlled by, so to say, a biochemical code, i.e., a balance between the various neurotransmitters and hormones. It is also a fact that hormones and neurotransmitters are involved in the regulation of genetic activity (*Pokrovskay, 1983; Boshko, 1984; Funder, 1993*). Consequently, there is quite probably a relation between neurohormonal control of behaviour and the functional state of genetic systems, and selection for specific behavioural traits can interfere with specific changes in genetic regulation. If this is true, the question is: "Can changes in behaviour, morphological and physiological traits of domestic animals be the result of the same genetic changes produced by a selection vector acting on behaviour?" The pressure of such selection is very strong at the early steps of domestication. There is, however, no evidence to support this view on the past evolutionary scenario of domestication. What if the scenario, so to say, were turned back to an early time point when animals were first introduced in the novel conditions of captivity and to attempt to follow, starting from this point, the patterns of changes appearing in behaviour, morphology and physiology?

The domestic fox in its making

Thus, the silver fox was chosen as the first model of domestication. True, the silver fox has been farm-bred for commercial purposes from the beginning of this century. However, the fox has retained its standard species-specific phenotype, strictly seasonal reproduction pattern, dominance of fearful-aggressive responses to humans characteristic of its wild counterpart. This conclusion was based on our observations on large farm-bred populations of silver foxes. The aim was to establish a population of foxes showing no genetically determined attitude of fear and aggression towards humans, and to further develop a population of foxes behaviourally resembling dogs. This was to be achieved through systematic selection for capacity to be domesticated. Variations in the behavioural responses to man of a farm-bred population are shown in fig. 1.

Figure 1. Different responses of foxes from a farm-bred population to man. Three foxes of a farm-bred population unselected for behaviour show different responses to man standing before the cage. **Top**, the fox is strongly aggressive, snarling and ready to attack the man. **Middle**, this fox shows a weak aggressive response only when the man attempts to touch it. **Bottom**, this fox is fearful, crouching back in order not to be seen by the man. We took advantage of these variations in responses to humans, when starting our experiments with selection of foxes for behaviour.

When we started our experiments, all the farm-bred foxes showed aggressive (or actively defensive) responses to humans. However, the degree to which the responses were manifested was variable. Analysis of the phenotypic variance for the expression of aggressiveness in farm-bred foxes established an additive genetic component not exceeding 0.35 (*Trut, 1980a; 1980b*). Fear and aggresiveness were weakly manifested by about 10% of the foxes, and these were taken as initial material.

More than 40,000 pups were tested for amenability to domestication from 1961. Selection was strict, i.e., each year we took only 4-5% of offspring to be used as parents of the next generation. The presently established population has passed through more than 30 generations of strict selection. The total number of females is 600 and that of males is 250, and they are producing annually about 3,000 offspring. The methods for testing of tameability, a trait underlying domestic behaviour, breeding conditions and the course of selection have been described elsewhere (*Trut, 1980a; 1980b*). It should be noted that behavioral responses usual for the dog, not the fox, started to manifest themselves in our experimental animals. Such foxes dog-like followed their master, licking and begging for favours (fig. 2).

It is of importance that such individuals were obtained as a result of genetic selection, i.e., selection for the domesticated elite outstanding in tameness for successive generations. Surely, the behavioural phenotype of tame animals is the composite of various physiological parameters, and, as expected, the correlated responses to selection were manifold. One such change was a tendency of the reproductive function to release from seasonality. In Siberian areas, the mating season of foxes starts, as a rule, in the third week of January and lasts to the end of March. All the females are monoestral, pairing only once within these time limits. However, selection for behaviour has produced some destabilization of this seasonal pattern.

The limits of the breeding season widened and some females showed extraseasonality of sexual activity. Moreover, some of them mated twice a year.

These observations were made during the selection step between 1970-1980, and the number of such females in our experimental population was small. However, the fact to be emphasized is that mating outside the season has never, to our knowledge, been previously observed in foxes under conditions of natural photoperiod. Other changes brought about by selection for behaviour concerned the major parameters determining litter size: the mean ovulation rate was greater by unity in the population of domesticated foxes.

The results of detailed analysis of the effects of domestication on the reproductive function of foxes have been reported (*Belyaev, Trut, 1983*).

How to explain this unexpected association between modified behaviour and altered reproduction function? What physiological and biochemical mechanisms may underlie the association? It is known that seasonal rhythmicity of breeding in most mammals of moderate latitudes is cued by changes in the length of day light (*Bronson, 1988*). Photoperiodic conditions are sensed by definite neurohormonal substrates, the pineal gland being assigned here an important role (*Reiter, 1975*). Our special experiments have demonstrated that these substrates respond more weak to photoperiodicity in domestic than wild foxes (*Trut, 1984; Kolesnikova et al., 1988*). As a consequence, seasonal biological functions have become less dependent on photoperiodic conditions (*Belyaev, Trut, 1983; Trut, 1984*).

Phenotypic novelties in the population of domestic foxes

When, in ancient times, man started to domesticate animals, for whatever purposes, he was thoughtless about the scientific implications of his efforts. It became apparent with time that domestication is a large-scale biological experiment with various, hard to predict, consequences (*Herre, 1959; Belyaev, 1969; Belyaev, Trut, 1982*).

Morphological novelties having arisen in the population of the domesticated foxes were among those consequences we could not readily explain. Fig. 3 presents domesticated foxes with morphological novelties.

Figure 2. Behaviour of foxes of a population selected for domestication. Docile foxes, like the one in the left top corner, very rarely occur in farm bred populations (from - %). As a result of selection for elimination of aggression and fear, the occurrence frequencies of such individuals considerably increased in the very first generations under selection (from - %) The dog-like behaviour of the other foxes in this figure is noteworthy. It is the result of selection of tame behaviour for about twenty-five generations.

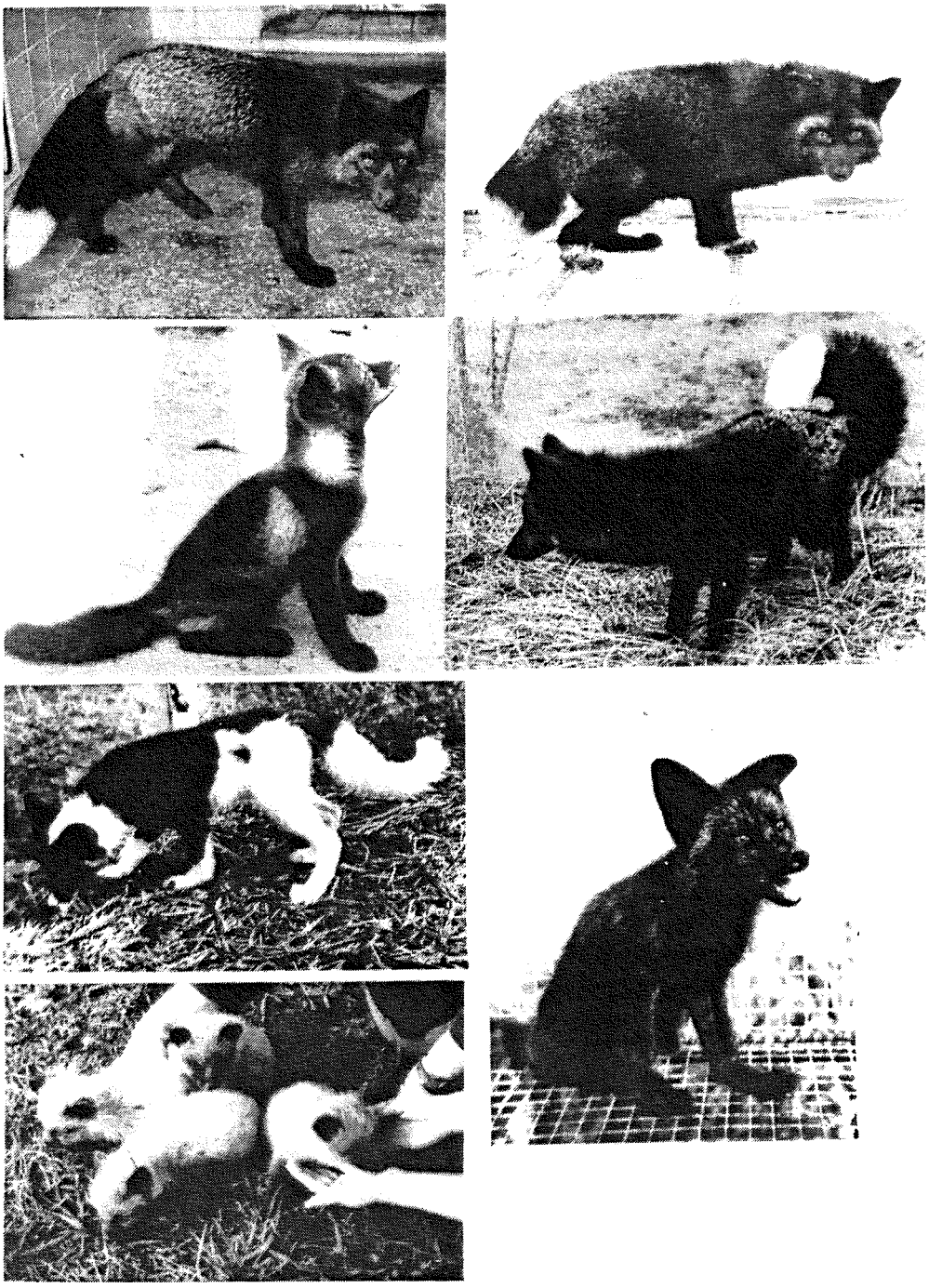

Figure 3. Some of the phenotypic novelties having arisen in the experimental fox population in the course of domestication. **Top, left.** The phenotype is standard silver black. **Below** are examples of coat color novelties. Brown mottling behind the ears, on the neck, and flanks is determined by a single recessive autosomal allele, most probably at the e locous (symbol e_p, see Belyaev and Trut, 1986). The next white flanked fox is a homozygote for the semidominant autosomal S gene (Belyaev et al., 1981). **Bottom**, the coat color of the pups is bluish instead of black; fur acquires standard colour after molt of the juvenile coat (the genetics of this coat colour is, as yet, not quite clear). This is a morphological deviant with a shorter tail and all the feet shorter than normal except the left hind. The tail of the fox in the middle is poised upward like in dogs of some good breeds. **Bottom**, the left ear of the friendly pup droops down like in the dog. Note that all the illustrated morphological features are novelties for the fox as a species. They are, however, usual for the majority of domestic animals, notably the dog.

The time course of changes in frequencies and genetic determination of some of the novelties have been previously described (*Belyaev et al., 1981; Belyaev, Trut, 1986).*

The morphological novelties are not characteristic of the fox as a species, much rather of the dog and many other domestic animals. The occurrence frequency of the *de novo* morphological changes was quite high (10^{-2}-10^{-3}). Some novelties of this type occur in farm-bred fox populations, with a frequency of more than an order of magnitude lower than in the experimental population (*Trut, 1980; Belyaev et al., 1981; Trut, 1988*). Stochastic homozygotization of recessive mutations cannot be responsible for all the morphological and physiological changes arisen in the experimental domesticated population of foxes. In fact, the values of the inbreeding coefficients of the populations, allowing an estimate of the probability of identical origin of alleles (*Falconer, 1981*), do not exceed 0.02-0.07 for both the control and experimental fox populations. The semidominant inheritance pattern of some of the novelties is noteworthy (*Belyaev et al., 1981*). It is also of importance that a physiological novelty, such as loss of seasonality of the reproductive function, can be hardly explained by stochastic fixation of previous random mutations. Analysis of pedigrees demonstrated the appearance of the same morphological novelties in unrelated domestic foxes (*Trut, 1980; Belyaev et al., 1981*). An individual can show more than one morphological novelty. Different *de novo* morphological changes can arise within a litter produced by standard parents, or parents with a particular novelty can give offspring with some other, quite surprising, novelty (*Trut, 1980*).
With these observations in mind, the novelties in the domestic fox population could be hardly accounted for by an increase in the rate of spontaneous mutational events (*Trut, 1980; Belyaev et al., 1981; Trut, 1988*). This prompted the idea that morphophysiological transformations are effected by selection vectorized for behaviour, i.e., they are specific correlated responses to selection not readily explicable in terms of traditional quantitative genetics. This is supported by the following considerations.

It is known that selection for any quantitative character produces correlated changes in other characters (*Falconer, 1981*). The genetic elements controlling a character under selection, among others, compose coadapted genetic systems created by natural selection. Any increase in the mean values of a selected trait is achieved by some loss of coadaptation of the system. For this reason, selection for a quantitative character reduces reproductive capacity and frequently gives rise to deviants from the standard phenotype. The correlated responses to selection of a population are hard to predict because they depend on its original genetic structure. Each selection experiment with respect to the correlated responses is most probably unique and hardly reproducible. However, it is also known that the same species had repeatedly undergone domestication at different localities and at different time periods (*Herre, 1959; Zeuner, 1963, Belyaev, Khostova, 1974*). It follows that there have been differences in the genetic structure in each original population undergoing historical domestication. In spite of this, animals of the same species and those of various taxonomically distant species, even orders, have given common correlated responses, when under domestication. Some of the correlated responses which have taken place during the historical course of domestication, have been reproduced in the present model experiment with domestication of silver foxes (*Belyaev, 1979; Belyaev, Trut, 1982*).

Thus, the experimental domestication of foxes has promoted the appearance of variability in a short time. Of importance is that there is a parallelism between the variability experimentally reproduced in foxes and the one observed in animals man has domesticated long ago. Discussions of the mechanisms of this variability are beyond the scope of this paper. It should be noted that our data on domestication indicate that one of these sources of variability might have been activation of inactive genetic material (*Belyaev, 1979; Belyaev et al., 1981*).

Domestic foxes: evolutionary implications

How can the experiments with fox domestication contribute to an understanding of the evolutionary role of behaviour? Belyaev has considered this in his concept of destabilizing selection (*Belyaev, 1979*). Briefly stated, it is as follows:

1. *The evolutionary consequences of selection are dependent on its vector.* When applied to physiological and behavioural traits, which are closely correlated with neurohormonal parameters of regulatory systems, selection destabilizes development as a whole (*Belyaev, 1979; Naumenko, Belyaev, 1980*).

2. *Selection can uncover sources of variability.* Selection vectorized for behaviour can create new sources of variability previously phenotypically unexpressed. A phenotypically unexpressed gene can become one such source. By destabilizing the neurohormonal parameters of development, selection can switch silent genes on, and the genes can become phenotypically manifest (*Belyaev et al., 1981*).

3. *Selection can cause parallelism in variability.* It is generally believed that parallelism of variability is due to homologous mutations of homologous genes (*Vavilov, 1922*).

Belyaev's concept of destabilizing selection provides a broader basis for viewing parallelism of variability: unidirectionally acting on the same behavioural traits, selection produces the same correlated changes in neurohormonal parameters, and these changes can underlie the recurrent appearance of new traits in animals of different taxonomic groups. This is a common observation under domestication.

Thus, according to Belyaev, the creative role of selection is regarded as more versatile. Its capacities to give rise to new variability and to determine its homologous pattern are recognized.

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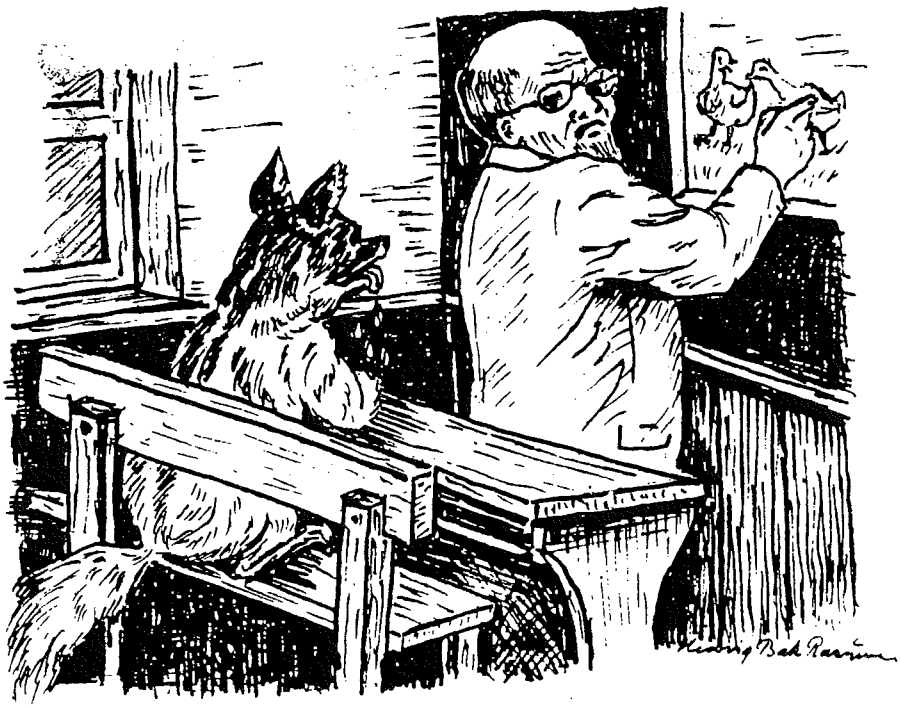

Original Report

The "glove test" as a tool in the study of the agonistic behaviour of arctic foxes kept in pavilions

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Abstract

The authors found that it was not convenient to measure the agonistic behaviour of arctic foxes utilizing the method for silver fox. The method designated for the arctic foxes kept in pavilions was developed. Nearly 100 individuals were tested using an old glove placed on a measuring stick. The four types of fox reactions were recorded. Comparing this method with the others it turned out that the behaviour differentiation was more clear in this case.

Introduction

In the latter years a large number of behavioural investigations have been carried out on fur bearing animals. Various tests have been used to this end (*Braastad, 1992*). The previous study by the present authors aimed at finding the correlation between agonistic behaviour and the reproductive capacity of the silver fox (*Vulpes vulpes*) (*Kaleta, 1991*). The developed methods of the agonistic behaviour study such as flight distance measurement turned out to be useful both in the case of adult and young silver foxes. The authors also tried to measure the flight distance in the arctic fox (*Alopex lagopus) (Frindt, Kaleta, 1993*). However, they came across some difficulties, particularly in the case of foxes kept in pavilions. The measuring procedure used under these conditions was rather in-convenient and most of the foxes performed similarly. Therefore, there was a need to develop a more suitable method.

Material and method

The observations were carried out on the state farm Brominy in January, 1994. All available arctic foxes were tested once: 64 males kept in pavilions and 30 males (18 from pavilions and 12 from free standing cages). All individuals were kept singly. The old glove drawn on the measuring stick (40 cm long) was placed near the wire always in the same way. Subsequently, the fox reaction was observed for 10 sec. and in the case of foxes approaching the object this time was also measured.

The reactions were described taking into account whether or not the foxes approached the object. If not, the type of motor activity or inhibition were recorded.

Table 1. The frequency of occurrence of various reaction types found in arctic fox

Reaction type	Males		Females			
			Pavilions		Free-standing cages	
	No.	%	No.	%	No.	%
Approach	17	27	6	33	5	42
Flight/withdrawal	18	28	3	17	4	33
Sitting/lying near object	7	11	-	-	-	-
Sitting/lying in the corner	11	17	8	44	3	25
Variable	11	17	1	6	-	-
Total	64	100	18	100	12	100

Results and discussion

The test fairly well differentiated the reactions of animals. The four main types of arctic fox reaction were recorded: approach, withdrawal/-flight, sitting/lying near the object without reaction and sitting/lying in the far corner of cage. The fifth group was comprised of foxes whose behaviour did not satisfy the above-mentioned criteria perhaps because of the short period of single observations. These individuals were described as "variable".

In foxes approaching the object the final sequence of reaction was always sniffing. In individuals which fled or withdrew short circling was sometimes observed, however, without approach. The foxes observed in the far corner of the cage usually showed motor inhibition. As regards the other forms of agonistic behaviour, during the short time of single observations only the cut-off acts and vocalization were occasionally observed. The frequency of occurrence of reactions is shown in table 1.

Because of the relatively small number of investigated females it is difficult to compare males and females. However, there is lack of the sitting/lying near the object without reaction in female behavioural repertoire. In males this kind of reaction seems to be a form of compulsive adaptation to the particular keeping system - the pavilion with a narrow aisle. Similar reactions were found in "pavilion" silver foxes (*Kaleta, 1991*). Arctic fox males lying or sitting in the corner in response to a stressful situation also showed a frequently typical form of motor inhibition which resembled "freezing" in silver foxes (*Kaleta, 1991*). As regards distribution of approaches in the male group, a great number of foxes responded to stimulus in 7-8 sec. (6 individuals) and in 3-4 sec. (4 individuals).

Conclusion

1. The "glove test" designated for arctic foxes turned out to be suitable for further experiments.

2. For the better assessment of an animal reaction the time of observation should be longer than 10 sec.

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The effect of cage environment and ad libitum feeding on the circadian rhythm, behaviour and feed intake of farm mink

Steffen W. Hansen, Bente Krogh Hansen, Peer Berg

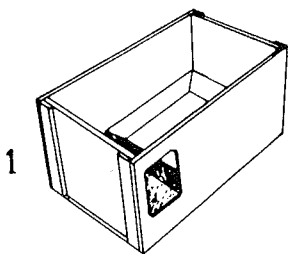
The effect of cage size and nest box environment on circadian rhythm and on stereotyped and non-stereotyped activities was measured for 66 farmed female mink fed ad libitum. The behaviour of the animals was recorded over 24 h on video on the months of September and October. Weight and feed consumption were measured for the 66 females and the 66 male mink placed with the females. The experiment included three cage sizes (0.10, 0.27 and 1.10 m^2) and cages with and without nest boxes. In the cages with nest boxes the use of wire netting cylinders and shelves was evaluated.

Farm mink, fed ad libitum, had their primary ativity period from 04:00 to 10:00 h. There was no food anticipatory activity, but the actual feeding at noon caused an interruption of the animals' resting period. Mink in cages without nest boxes performed more stereotyped behaviour than mink with nest boxes.

There was no effect of cage size on the measured behavioural elements. Mink were passive for more than 70% of the day and night and preferred to rest together. Apart from resting in the nest box, mink preferred to rest on shelves above floor level. Lacking the possibility of using a nest box and performance of stereotyped behaviour increase the feed intake of farm mink.

A large variation between animals, having a significant effect on all the measured behavioural elements, indicates different coping patterns and/or stress sensitivity.

Acta Agric. Scand., Sect. A, Animal Sci., 44: 120-127, 1994. 3 tables, 3 figs., 26 refs. Authors' summary.



Reproduction in silver-fox vixens in breeding boxes with and without an entrance tunnel

Bjarne O. Braastad

On nine farms in a joint fur-farm area, reproduction was studied in 834 silver-fox vixens (*Vulpes vulpes* L.), half of which were primiparous. Two different breeding boxes with a narrow entrance tunnel and two versions of a traditional box were used. The vixens had access to the box after insemination. No effect of box type was found on two farms with a high reproduction. In the remaining seven farms, vixens in tunnel boxes more often bore offspring and had a lower cub mortality 0-3 weeks postpartum than vixens in traditional boxes. The effects were most pronounced for primiparous vixens. It is concluded that breeding boxes with an entrance tunnel may improve the reproduction and the welfare of both vixens and their offspring.

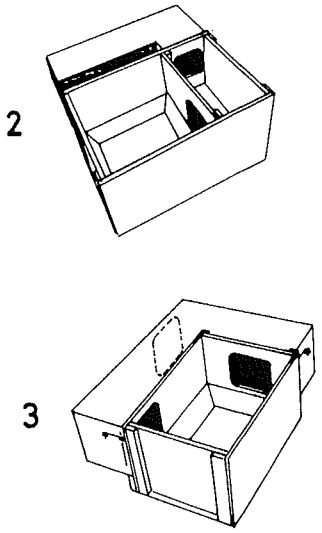


Fig. 1. The types of breeding boxes used in this experiment (1) Boxes 1A and 1B, control boxes; (2) Box 2, with an entrance tunnel; (3) Box 3, with two exits into a tunnel system.

Acta Agric. Scand., Sect. A, Animal Sci., 44: 38-42, 1994. 4 tables, 1 fig., 14 refs. Author's summary.

Biochemical investigations in relation to fur development and fur quality in mink

Søren Michaelsen

Biochemical studies of hair and skin of mink are discussed with a view to relating normal values for composition and individual variations to pelt quality. Effects of feeding and other factors are reviewed.

720. Report from the National Institute of Animal Science, Denmark, pp. 66-72, 1993. 1 fig., 1 photo, 15 refs. CAB-abstract.

Production systems and management

Steen Møller

Some studies carried out by the National Institute of Animal Sciences, Denmark on the effects of housing mink in 2-row or multi-row sheds and of housing male and female mink separately or in groups on reproduction, and the effects of watering and feeding systems on growth of mink are summarized.

720. Report from the National Institute of Animal Science, Denmark, pp. 86-94, 1993. 2 tables, 2 photos, 17 refs. CAB-abstract.

The colonization and function of lactic acid bacteria in the gastrointestinal tract

Karl Pedersen

This Ph.D. thesis "The colonization and function of lactic acid bacteria in the gastrointestinal tract" appears as the result of a series of projects carried out at the Department of Veterinary Microbiology in the period between February 1987 and November 1989.

The thesis comprises 5 chapters. Chapters 1 and 2 give a review of the microecology of the gastrointestinal tract, particularly concerning the lactic acid bacteria, whereas the last three chapters describe three series of experiments carried out during the Ph.D. study.

Chapter 1 gives a short introduction to the microbial ecology of the gastrointestinal tract. The different compartments of the GI tract and the conditions they can offer the microflora are briefly described, and an array of factors supposed or known to be of importance to the composition and size of the microflora is discussed.

Chapter 2 especially concerns lactic acid bacteria. Initially the probiotic concept is presented followed by a characterization of the group of microorganisms known as the lactic acid bacteria (LAB). Next, the adhesion and colonization of LAB in the GI tract together with the functions exerted by LAB by their presence here is reviewed.

Chapter 3 describes an experiment where a series of lactic acid bacterial strains were given to piglets immediately after birth. The purpose of the study was - with a view to selecting optimal strains to include in a probiotic product for pigs - to investigate whether there were any significant differences between different strains in their capacity to colonize and persist in the GI tract. The results showed considerable differences between strains, both with respect to their ability to adhere to stratified squamous epithelium in vitro and their capacity to colonize the digestive tract in vivo. None of the strains seemed able to colonize permanently, but while some strains had almost disappeared after 2-4 days others were able to maintain high populations still after about two weeks. There was no unequivocal relation between the ability to adhere to isolated squamous epithelial cells in vitro and the duration of the colonization in vivo. Indeed, the best colonizing strain in vivo was also good at adhering in vitro, but so was the poorest colonizer, and the second best colonizer in vivo was negative in the in vitro adhesion test. The colonization of the stratified squamous epithelium in the oesophagus and pars oesophagea was followed with scanning electron microscopy.

Chapter 4 describes an experiment where strains of lactic acid bacteria were given to sows in a period around farrowing. The purpose of this experiment was to examine, whether these strains colonized the digestive tract of the sows to an extent that could ensure a massive contamination of the environment and thereby a rapid establishment within the digestive tract of the newborn piglets. This would enable the administration of probiotic strains to piglets without using individual dosing. The results showed that the lactobacillus test strains constituted only a very small fraction of the total lactobacillus

flora, while Enterococcus faecium constituted up to more than half the total flora of streptococci/enterococci. In all cases the fractions test strains constituted of the total counts of lactobacilli and streptococci/enterococci, respectively, both in the piglets and the environment was diminutive, rarely exceeding a few percent. The test strains disappeared from the environment within 4-40 days after the last administration. An Enterococcus faecium strain could be detected for the longest period after the last administration, while a Lactobacillus acidophilus strain was the first to disappear.

Chapter 5 describes an experiment where an Enterococcus faecium (Streptococcus faecium) was given to mink. The purpose was to determine whether mink possess any autochtonous intestinal flora or if the flora only consists of bacteria ingested with the feed and passively transported through the intestine. Furthermore, to examine whether probiotic strains can be expected to survive and multiply in this animal species, in which the intestinal passage time is as short as 3-4 hours. The results suggested that mink possess no autochtonous intestinal flora, even though certain bacterial strains are able to colonize for a period. Thus, the flora in the intestinal tract was not merely found to be reflecting the composition and size of the flora in the feed. Enterococcus faecium was found to survive and to a certain degree multiply in the digestive tract of the mink, but the strain disappeared within a few days after the last administration had taken place. By scanning electron microscopy bacteria adhering to the epithelium was never observed, neither to secreting nor stratified squamous epithelium.

Ph.D.-thesis, Inst. for Veterinary Microbiology, Royal Vet.- and Agric. Univ., Copenhagen 1990. 29 tables, 49 figs., 232 refs. 152 pp. In DANH, Su. ENGL. Author's summary.

Studies on aetiology and pathogenesis of fur damages in the chinchilla

Susanne Eidmann

Because of some inconsistency in the literature, this study was carried out to characterize the symptoms of fur chewing in the chinchilla. In 39 fur chewers of different ages, both males and females, the clinical features of the fur damage was recorded in detail. In comparison with 19 healthy chinchillas, being the control group, the skin was examined histologically, and mycological and microbiological investigations were conducted as well. The adrenals, thyroid, liver, spleen, and kidneys were included in the histological examination. Besides determining the quality and quantity of the bacterial flora in the upper gut and caecum, the feces were examined for parasitic infestations. In addition, the haematological indices as well as several indices of clinical blood chemistry were recorded.

Results:
The condition "fur chewing" showed considerably morphological variations and gradual differences in its expression. From the clinical point of view there seemed to be no sense in subdividing the condition further.
Histologically, the skin markedly revealed the features typical for species with a dense hair coat, and there was only little evidence of pathological changes.
Neither macroscopic nor light microscopic evaluation of the two endocrine organs studied presented symptoms of a primary endocrine dysregulation. In only one animal of the fur chewers, but in one control animal as well, the adrenals showed features consistent with progressive transformation. In the thyroid gland several degrees of activation could be demonstrated morphologically. The level of activation of this gland could be connected with the size of the chewed area over the body. This finding suggests that the thyroid had been activated due to the insulation loss following removal of the hair. Conclusive estimations of the role of the endocrine glands in the pathophysiology of fur chewing are yet impossible. This aspect needs further examination including specific endocrinological and morphometric indices.

Evaluation of the data obtained from the study of the intestinal bacterial flora did not reveal qualitative changes, but the total bacterial count/g in the caecum was very low. Some values of the haematological indices ranged fairly low, and the values of the enzyme determination suggested liver affection which was confirmed by light microscopic examination of liver sections.

Summarizing all findings in this study, any infectious nature of the condition is excluded, but it is indicated that all animals had suffered from

some kind of malnutrition. Since the histo-pathological findings showed a slightly but constantly higher degree in the fur chewers, those animals might have chewed their fur for dietary requirements. It is very likely, however, that many food factors are involved in this status of malnutrition, so it should be seen qualitatively and not quantitatively. In addition to the important primary factor of the diet composition itself, more consideration should be given to the intestinal parasite Giardia which was found in fairly high numbers in both groups, and which might be responsible for a secondary lack of nutrients.

The initial cause of fur chewing could not be pointed out. However, taking into account the statements of breeders the data suggest a major role of non-specific stressors, and behavioural disturbances are possible as well.

Scientific studies dealing with chinchillas are very limited because these animals are relatively unimportant as laboratory animals and pets, respectively. Even in their field of main importance, i.e. in commercial breeding, adequate diet composition and adequate keeping conditions are discussed controversely. Further investigations should be carried out.

Thesis. Aus dem Institut für Pathologie der Tierärztlichen Hochschule Hannover und dem Institut für Kleintierzucht der Bundesforschungsanstalt für Landwirtschaft Braunschweig-Völkenrode, Germany. 34 tables, 9 figs., 202 refs. 163 pp. In GERM, Su. ENGL. Author's summary.

Evaluation of plasma cortisol and corticosterone responses to synthetic adrenocorticotropic hormone administration in ferrets

Karen L. Rosenthal, Mark E. Peterson, Kathy E. Quesenberry, Clinton D. Lothrop

Plasma cortisol and corticosterone responses of 8 clinically normal adult ferrets to synthetic ACTH (cosyntropin) were evaluated. Cosyntropin was administered IV at 4 dosages (0.5, 1.0, 5.0, and 10 µg/kg of body weight) at 2- to 4-week intervals, with blood samples collected 60 and 120 minutes after injection. After completion of the studies, an additional ACTH stimulation test was performed by administering cosyntropin (1.0 µg/kg) IM. The baseline plasma cortisol concentrations from all studies ranged from 25.9 to 235 nmol/L (mean ± SEM = 73.8 ± 7.0 nmol/L), and plasma corticosterone values ranged from 1.7 to 47 nmol/L (mean ± SEM = 8.3 ± 1.1 nmol/L). After IV administration of cosyntropin, plasma concentrations of cortisol and corticosterone increased significantly ($P \leq 0.05$) and reached peak values at 60 minutes; however, there were no significant differences between plasma cortisol or corticosterone responses to the 4 dosages of cosyntropin. Intramuscular administration of 1.0 µg of cosyntropin/kg induced increases in plasma cortisol and corticosterone concentrations that were similar to the responses induced by IV administration of cosyntropin. The mean molar ratio of cortisol to corticosterone, calculated from the resting plasma concentrations, was approximately 9:1, whereas the ACTH-stimulated cortisol to corticosterone ratio was approximately 4:1. Results of this study indicated that administration of cosyntropin to clinically normal ferrets, at dosages ranging from 0.5 to 10 µg/kg, increased plasma concentrations of cortisol and corticosterone. Although cosyntropin stimulates the adrenocortical secretion of cortisol and corticosterone, cortisol appears to be the predominate circulating glucocorticoid in ferrets.

Am J Vet Res, Vol. 54, No. 1, pp 29-31, 1993. 2 tables, 8 refs. Authors' summary.

A hair defect

V.I. Eremeeva, N.V. Barkova, G.A. Kuznetsov

Fur quality and the incidence of fur defects in mink are discussed, particularly with reference to a belly fur defect. Data are tabulated from investigations carried out in 1988-89 on pelt traits and body weight. In 1988 and 1989, the percentage of large standard dark mink at pelting (more than or equal to 2.7 kg body weight) was 14.7 and 32.3 resp., the percentage of medium-sized mink (2.0-2.6 kg) 11.4 and 21.2, av. guard hair density (scored 1-5) 4.4 and 0.5, and the percentage of pelts with the belly fur should be culled, and their parents and sibs should be excluded from the breeding population.

Krolikovodstvo i Zverovodstvo, No. 6, pp 9, 1990. 1 table. In RUSS. CAB-abstract.

Anisotropy of physical-characteristic functions of fur leather

E. Mäntysalo, M. Marjoniemi, E. Kemppinen

According to recent investigations carried out in the LFTF the leather of fur has properties which must be considered anisotropic in nature contrary to those considered true random variables. Leather properties are functions of orientation angle and position coordinates of samples. Results are given for the leather of male and female blue fox (*Alopex lagopus*) and scanblack mink (*Mustela vison*) in the cases of breaking and elongation experiments. Four sample groups of fox leather (46 foxes) and one sample group of mink leather (21 mink) of different backgrounds as random subsets from the production of the year 1988 were investigated. All leathers were aluminum-tanned.

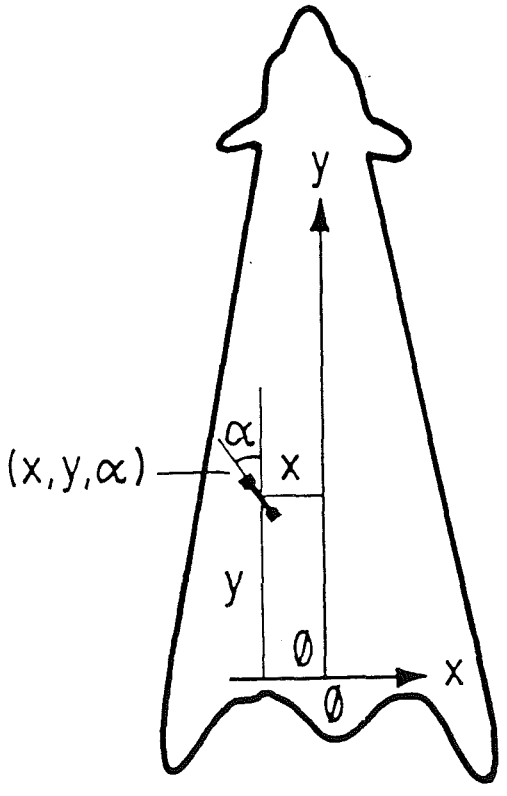


Fig. 1. Co-ordinate system (x,y,α) set on leather

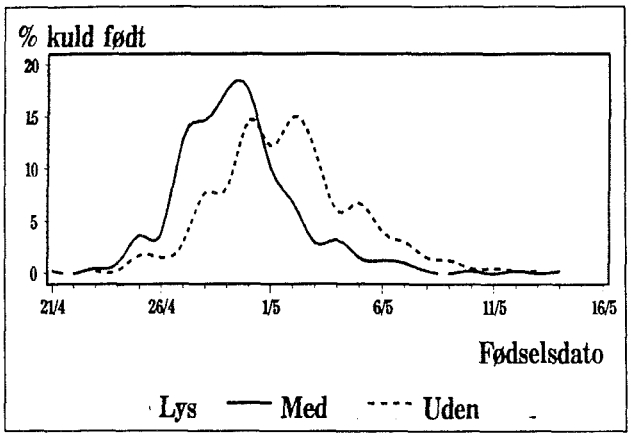
JALCA, Vol. 86, 4, p. 133-139, 1991. 1 table, 15 figs., 10 refs. Authors' abstract.

Lighting programmes reduce the gestation period in mink

Janne Hansen

For 439 mink females exposed to artificial light for 4 h daily, resulting in a day length of 14 h from 15 Mar. to 15 Apr., litter size averaged 5.69 and the number of kits born per mated female 5.29 vs. 5.52 and 5.05 respectively for 439 untreated controls, and the percentage of females failing to give birth to a litter was 7.1 vs. 8.4. At a 2nd farm, the introduction of extra light from 16 Mar. to 11 Apr. had no significant effect on litter size, but resulted in a marked increase in the percentage of litters born before 2 May (87.7 vs. 50.9-62.9).

Figur 1. Fødselsforløb for tæver med og uden lys - farm 1.



Dansk Pelsdyravl, 57, 2, pp 40-41, 1994. 2 tables, 3 figs. In DANH. CAB-abstract.

A comparison of the number of breeding females on 1 June 1993 and in 1992

Anonymous

On 1 June 1993, in Sweden, there were 170,155 mink breeding females at 171 farms vs. 236,690 females at 222 farms in 1992. There were 751 silver fox, 2618 blue fox and 232 polecat breeding females in 1993 vs. 1538, 3378 and 525, respectively, in 1992.

Vara Pälsdjur, 64, 4, pp 97, 1993. 1 table. In SWED. CAB-abstract.

Fur animal statistics in 1993

Anonymous

Of 4423 silver fox, 10,944 blue fox, 1726 cross-bred fox and 7105 mink females recorded in Norway in 1993, 11.7, 12.7, 13.3 and 8.6%, respectively, failed to give birth to a litter. Litter size at birth averaged 4.6, 8.5, 8.1 and 6.4, respectively, and litter size at 3 wk averaged 4.4, 7.4, 6.5 and 5.9 per litter and 3.4, 5.5, 4.6 and 5.2 per mated female. For inseminated silver and blue fox females, litter size at 3 weeks per mated female averaged 3.1 and 4.8, respectively vs. 3.6 and 6.0 for naturally mated females.

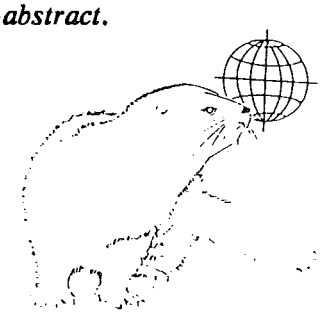
Norsk Pelsdyrblad 67, 11, pp 23-25, 1993. In NORG, 8 tables. CAB-abstract.

Breeding results in 1988-1993

Anonymous

In 1993, in Denmark, the reproductive performance of 1,349,895 mink and fox females, representing 88% of the total population of the 2 species, was recorded. Of mated mink females, 7.9% failed to give birth to a litter, and the number of kits born and weaned per mated female averaged 5.65 and 5.21, respectively. For blue and silver fox females, the percentage of mated females failing to produce a litter was 16.8 and 16.1, respectively, and litter size averaged 4.86 and 3.97. Data are tabulated by colour type, farm size and district, and results are compared with those in the previous 5 years.

Dansk Pelsdyrblad 56, 10, pp 348-349, 1993. In DANH, 10 tables. CAB-abstract.



Original Report

A new brown silver fox mutant (the Trintrud fox)

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Introduction

Throughout the ages, several different brown colour types and mutations of the silver fox have been described. Other brown types can have appeared, also without being reported, because it was regarded as very unfortunate to have brown silver foxes on the farm. It must, however, be born in mind that the original Alaska silver fox often had some brown hairs, and in the first Canadian pedigree rules it was accepted to find brown hairs in the grandparent generation of Alaskan silver foxes, opposite to the standard silver fox where brown hairs were not accepted. From Norway we also know that earlier the requirements were very strict regarding brown hairs, f.inst. in connection with the official approvement of the silver foxes (the arrow-marking).

Today at least two different brown mutants of silver fox are known, more likely three (see *Nes et al., 1987* for further description). Common for the brown foxes is a uniform brown colour and that ears and legs are brown and not black as in red and silver foxes. The amount of silver in the guard hairs, and the intensity of the colour may vary within types, based on polygenes (quantitative inheritance). The mutants are all a result of recessive genes, meaning that they must be homozygotes for the gene, i.e. both parents must have this gene (either as a carrier or as a homozygote). The new phenotypes also require the presence of the silver fox genes. This can especially be seen in the cross fox types (AaBB or AaBb), where the brown colour will only be visible in the dark/silver colour areas, not in the red areas.

Burgundy (gg) also called cinnamon or Fromm brown has a clear reddish-brown colour and has brown or yellow-brown eyes. Colicott is more brownish and has blue eyes. Colicott has not yet been thoroughly examined with regard to heridity, but it differs from burgundy. For colicott the gene symbol oo will be used in this article. The Polish pastel fox appeared in Poznan in Poland in 1972. The colour varies from light to dark brown with a lot of silver in the guard hairs. The eyes vary from green to yellowish. Even though colicott and Polish pastel may resemble each other in appearance, cross examinations have proved that they result from mutations in two different loci (*Einarsson & Nes, 1987*). For the Polish pastel fox the gene symbol ll is being used here. Please note that the gene symbols used for colicott (oo) and Polish pastel (ll) are not official.

Even other brown colour types of silver fox have been mentioned (*Nes et al., 1987*). The Swedish pastel fox, which is described as chocolate-coloured, appeared in Dalarna and a male was shown at an exhibition in 1946. The Norwegian pastel fox appeared at the farm of D. Jahren in Ullensaker in 1952 and was later described as a dark brown fox with silver. At the Oslo Fur Auctions similar colour types have been seen several times. Similar segregations were also recorded at T. Dalaker in 1982 and at J. Hellevik in 1984. The genetic relations of these types to the above mentioned brown mutants have not been clarified. In addition to the types mentioned, various brown combination types have been produced such as Bolerts brown, Golden Glory and amber as well as platinum pastel in combination with a dominant gene.

In 1986 a brown silver fox type appeared at Torfinn Trintrud in Ål, Hallingdal. This type resembles the pastel foxes, and the difference from the silver fox is easy to see (*Einarsson & Skrede, 1989*, fig. 16). The genotype was examined by the late prof. N. Nes, but unfortunately it has not been possible to procure the necessary documentation for the final conclusion. It was therefore necessary for us to perform some additional crossings to clarify the relations to the three brown silver fox mutants.

Hypothesis

It was, however, obvious that crossings between the Trintrud fox and silver foxes only produced silver fox coloured offspring, meaning that the Trintrud fox is a recessive type in relation to the silver fox. The hypothesis therefore was that the Trintrud fox is a recessive brown mutant based on a mutation in other loci than burgundy, colicott and Polish pastel. This was examined by crossing Trintrud vixens with the three male types mentioned, as shown in table 1.

Animal material

It was agreed to transfer Trintrud vixens to the fox farm of the Norwegian Agricultural University, where they were inseminated with thawed frozen semen from the three brown fox mutants mentioned. It was not possible to get cubs from all three colour combinations in 1993, and therefore the experiment continued in 1994.

At the end of 1992, 12 vixens were obtained from T. Trintrud (1-5 years old). In 1993 one vixen was killed before insemination, one was not found to be in heat, and 10 were inseminated. The vixens were cared for according to usual farm routine. Number of vixens and their litters are presented in table 2.

Table 1. Parent genotypes and possible genotypes in offspring.

Genotype Father	Genotype Mother	Alternative genotype offspring	
		Brown	Silver coloured
gg TT (burgundy)	GG tt (Trintrud)	gt*	Gg Tt
oo TT (colicott)	OO tt - " -	ot*	Oo Tt
ll TT (Polish pastel)	LL tt - " -	lt*	Ll Tt

g = burgundy, o = colicott, l = Polish pastel and t = Trintrud
* = alternative, where t is identical to one of the other three genes, e.g. gt* = gg.

"Somehow I was hoping genetic engineering would take a different turn.

Table 2. Animal material used for crossing experiments in 1993 and 1994, all vixens are Trintrud foxes.

Male type	No. of vixens inseminated		Litters born*)		Litters weaned	
	1993	1994	1993	1994	1993	1994
Burgundy	4	6	0	3	0	2
Colicott	3		2		2	
Polish pastel	3		1		1	

*) = recorded at 1st counting, not comprising vixens which had been pregnant but had had no cubs.

Table 3. Number of cubs after the different crossing combinations

Crossing	Cubs at birth	Cubs at weaning	Colour type of cubs
Burgundy x Trintrud	6 + 4 + 1	6 + 4 + 0	Silver fox colour
Colicott x Trintrud	4 + 3	3 + 0	Silver fox colour
Polish pastel x Trintrud	5	5	Silver fox colour

Results

In table 3, cubs after the different crossing combinations are shown.

The colour type of the cubs was evaluated when the cubs were very young, at the age of 4-6 weeks, and from then until pelting. All cubs were pelted. The colour was silver, but it was a somewhat duller colour than the normal silver fox, and especially the underfur was of a more greyish colour. This is, however, quite natural as these foxes are heterozygotes in two loci (double carriers), e.g. AAbbGgTt (genotype in standard silver fox).

Conclusion

Crossing experiments between the Trintrud fox and burgundy, colicott and Polish pastel, respectively, have shown that the gene for the brown colour in the Trintrud fox is the result of mutation in another locus than the three brown mutants mentioned before. These crossing experiments - together with previous crossings between silver fox and Trintrud foxes - show that the gene for the brown Trintrud fox is recessive. It is suggested that the new brown mutant is called the Trintrud fox with the gene symbol tt. (This is later approved by the Committee for Breeding of the Scandinavian Association of Agricultural Scientists, Division for Fur Animals).

Acknowledgements

We are grateful to T. Trintrud for placing animal material and all other information at our disposal for clarification of heridity conditions. The late prof. Norodd Nes is remembered for his comprehensive work with colour genetics of fur animals, also comprising illustration of the heridity of the Trintrud fox.

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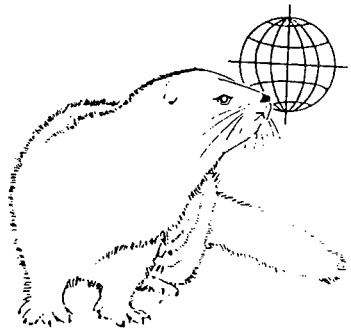

Variation between and within populations of mink. 1. Weight and skin length

Peer Berg

Genetic and non-genetic sources of variation were estimated within and between populations in a progeny testing scheme with approximately 200 paternal progeny groups of mink. Animals from several populations were housed at a central test station and corresponding full-sibs were kept at the farm of origin. Body weight was recorded in the production period, and the length of the dried skins was measured after pelting.

Significant environmental and genetic population differences were found accounting for 20-30% of the total variation. Environmental and genetic differences were on average up to 1.9 and 1.6 phenotypic standard deviations, indicating a potential for improved breeding schemes. Most heritability estimates varied between 0.2 and 0.4, lower than earlier estimates within populations. Maternal effects accounted for 10-40% of the variation in most cases. There was a large difference between sexes, and males and females were found to react differently to environmental effects. Furthermore, an interaction between the genetic level and sex was found.

Acta Agric. Scand., Sect. A, Animal Sci., 43: 151-157, 1993. 5 tables, 22 refs. Author's summary.

Variation between and within populations of mink. II. Skin and fur characteristics

Peer Berg

Genetic and environmental sources of variation in skin and fur characteristics were estimated within and between populations in a two year mink progeny testing scheme with approximately 200 paternal progeny groups. Animals from several populations were housed at a central test station, and corresponding full-sibs were kept at the farm of origin. Data were analysed with an animal model to estimate heritabilities, common litter effects and fixed effects due to population and environment. Genetic variation within and between populations was found, together with significant environmental effects, indicating potential improvements in the breeding scheme. An interaction of sex with population and environment was considered and found significant for traits with a large sex dimorphism. Common litter effects were unimportant for traits measured, except for length and weight of skin. Discrete, subjectively measured traits are analysed with a linear model and a threshold model.

Acta Agric. Scand., Sect. A, Animal Sci. 43: 158-164, 1993. 7 tables, 20 refs. Author's summary.

Breeding and genetics of mink

Peer Berg

In this review, consideration is given to genetic parameters for economic traits in mink, estimation of breeding values, breeding strategies and prospects for mink breeding.

720. Report from the National Institute of Animal Science, Denmark, pp 21-29, 1993. 1 table, 3 photos, 66 refs. CAB-abstract.

Litter size and growth of mink - possibilities for improved performance

Bente Krogh Hansen

This review considers factors influencing preweaning and postweaning growth, and mature body weight, and the relationships between skin size and preweaning and postweaning growth.

720. Report from the National Institute of Animal Science, Denmark, pp 30-37, 1993. 4 figs, 1 photo, 33 refs. CAB-abstract.

Cytogenetics and molecular biology in fur animal research

Outi Lohi

A brief discussion of research at the National Institute of Animal Science, Denmark on cytogenetics, blood groups and biochemical polymorphisms, mainly in foxes.

720. Report from the National Institute of Animal Science, Denmark, pp 38-42, 1993. 2 photos, 17 refs. CAB-abstract.

Analyses of serotonin in the blood of domesticated silver foxes (*Vulpes vulpes*) as a major marker of domesticated behaviour

L.L. Vasileva, K.V. Syechnikov

The inheritance of serotonin level was studied on 104 foxes in 4 families from a population selected for tameness. The distribution of levels was consistent with the existence of a major gene controlling the trait. Foxes with a high value for an index of domestication had a significantly higher serotonin level than foxes with a low value for the index. The results suggest that selection for tameness is accompanied by selection against heterozygotes for the major gene.

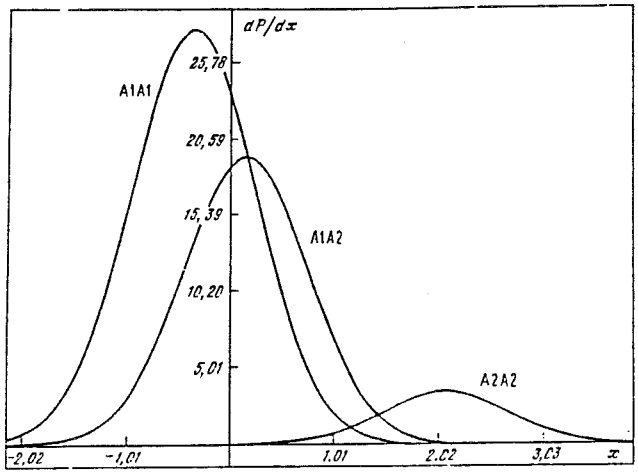

Fig. 3. Distribution of genotypes A1A1, A1A2 and A2A2 of the major gene in the total distribution of peripheral blood serotonin level according to the most probable hypothesis (H4). The abscissa axis - serotonin level in units of standard deviation, the ordinata axis - density of probability of the character distribution for respective genotypes.

Genetika (Moskva) 29, 3, pp 498-507, 1993. 1 table, 3 figs., 20 refs. CAB-abstract.

Principal component analysis of craniological traits of silver foxes (*Vulpes vulpes Dems.*) and changes arising from domestication

L.N. Trut, F.Ya. Dzerzhinskii, V.S. Nikolskii

A principal component analysis was carried out on the correlation matrix for 9 cranial measurements on 236 foxes (118 males and 118 females) from a population selected for tameness and 187 foxes (92 males and 95 females) from an unselected, control population. The 1st principal component accounted for approx. 50% of total variation, and was interpreted as a measure of skull size. It clearly discriminated between the 2 sexes, but not the 2 populations. The 2nd component reflected the allometric relationship between skull length and width, the 3rd and 4th components reflected skull width, and the 5th component brain size. The 2nd-5th components accounted for 12.0-15.8, 8.2-10.1, 6.9-9.4 and 5.5-6.1% resp. of total variation in the 4 sex-within-population groups, but none of them clearly separated the domesticated from the control foxes.

Рис. 1. Щенки в возрасте 1,5 мес (слева — норма, справа — с нек торым расширением лицевого черепа)

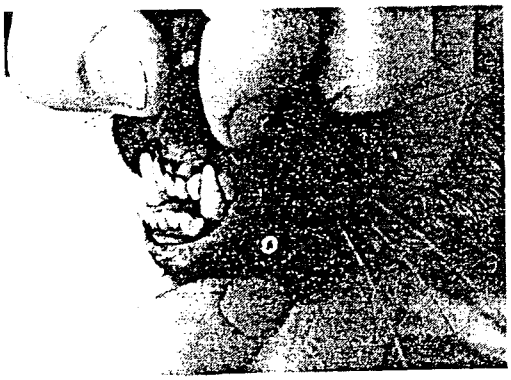

Рис. 2. Выступающая вперед нижняя челюсть («перекус»)

Genetika (Moskva) 27, 8, pp 1440-1450, 1991. 3 tables, 6 figs., 17 refs. In RUSS, Su. ENGL. CAB-abstract.

Original Report

Preliminary study of the sexual cycle of the South-American nutria (Myocastor coypus) by the method of exfoliative colpocytology

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Summary

Vaginal samples (3 weekly during 70 days) were obtained from 18 adult nutria females of the Silver, Greenland and Cognac varieties, bred in corral or in cage. Nine females were reared in corral, 4 without male and 5 with a male and sampling was made over 70 days. Four different cellular types were observed in vaginal smears: squamous, intermediate, and parabasal cells and polymorphonuclear leukocytes. Correlation of smears with ovarian histology established that vaginal samples with more than 50% squamous cells indicate that the female is in the period of estrus. The average duration of the estral cycle was of 28.9±12.6 days. In 20% of the cycles observed the duration was 28 days; the others ranged from 12 to 49 days, among animals as well as among cycles of the same animal. Estrus had a variable duration, between 2 and 5 days. A tendency to keep conditions of greater reproductive activity was noticed in animals reared in corrals compared to those reared in cages (1.7 and 1.1 estrus/"corral" and "cage female", respectively). As for the different breeds observed, the Silver variety females were more active. Forty per cent of the females with male had estrus in the period observed, whereas 100% had it in the group without male. In conclusion, a great variability in the duration of the cycles and in the estrus, among animals as well as in the same individual, was observed. Corral breeding (lower density?) seems to facilitate sexual behaviour and the presence of the male would depress this behaviour in the first days of contact.

Introduction

The nutria (*Myocastor coypus*) belongs to the order *Rodentia*, suborder *Caviomorpha*, Family *Capromydae*; it is an autochthonous South-American species, with a continental distribution that covers the Pampa region and the Argentine littoral, Paraguay, Uruguay and south Brazil.

The knowledge about the reproduction of the nutria shows that it is a species which keeps in reproductive condition throughout the year and which reaches sexual maturity towards 6 months of age, when the body weight is between 3 and 4 kilograms.

The gestation period lasts from 130 to 134 days, with a post-partum estrus in the following 12 to

72 hours after the birth of the litter. The size of the average litter is of 4 to 6 cubs, having embryonal reabsorption in about 10% of the cubs in gestation. These data have been recorded from post-mortem studies (*Willner, Chapman & Pursley, 1979; Chapman, Lanning, Willner & Pursley, 1980*), from observations of behaviour in its natural habitat (*Warkentin, 1968*), from the study of related ecological features (*Brown, 1975; Ehrlich, 1966; Doncaster & Micol, 1989*) or through descriptions of breeders of nutrias in captivity (*Kraetge, 1937; Szuman & Srzydlewski, 1979*).

One important and unsolved problem about the production of this species in captivity concerns the ignorance of many aspects of the reproductive function which would facilitate the directed reproduction (AI, estrus synchronization, etc.). This would not only improve the efficiency of the programs of genetic advancement but also the synchronization of births, so that the animals reach the adequate size for slaughter in coincidence with the moment when the best quality of furs occurs (winter)

This study was done through the technique of exfoliative colpocytology, in series, in order to characterize the estral cycle of the South-American nutria and to deepen the knowledge of the physiology of reproduction and its subsequent use in the method of breeding. This technique is a reliable method and one of the simplest to determine the estral cycle and its different stages (*Derivaux, 1976; Cole, 1959; Stenson, 1988; Jarosz & Dukelow, 1980*) and it has been analyzed with greater attention in rodents (*Dempsey, Myers, Young & Jenninson, 1934*).

Materials and methods

Animals and experimental groups
Twenty-seven female nutrias (*Myocastor coypus*) of the varieties Silver, Cognac and Greenland, were used for this work. Animals belonged to "Las Charitas", breeding place of Bs.As. state (37° S. and 59° W.), Argentina.

All were adult females, according to their age, which was between 6 and 8 months (*Calvo & Ranea Arias, 1989*) and to their weight, that in all animals was between 3.5 and 4.5 kg (*Willner et al., 1979*).

A group of 9 females (4 Silver and 5 Greenland) was kept in cages (cage females) made of wire fabric, 2m/1m/0.40m in size and placed 0.50m above the floor under a shed. Density was 4.5 animals per m^2.

A second group of 9 females (4 Silver and 5 Cognac) was kept in a 4m/2m/0.80m covered corral (corral females), which included an open space of 2m/1m/1m, accessible through a rectangular passage of 0.30m/0.40m. Density was 1.1 animals per m^2.

A third group of 9 females (Silver) was divided into two corrals with the dimensions already described. Five of the 9 females were placed in a corral where an adult male of the same variety and proved fertility had been introduced 5 days before. Density was 0.75 animals per m^2. In the other corral, the 4 females had no male. Density in this corral was 0.5 animals per m^2.

Feed, the same in all cases, was a balanced mixture of maize and sunflower grains, bran, minerals and vitamins, with a minimum protein content of 18 to 20% (*Di Marco & Ranea Arias, 1990*). Feed and water were administered "ad libitum".

Vaginal samples
Colpocytological samples were taken between the 19th July 1990 and the 27th September 1990 (seventy days). Samples were taken with a periodicity of 3 in a week with intervals of 48 and 72 hours, which gives a total quantity of 32 samples per female.

Colpocytological samples were taken introducing into the vagina a glass pipette of blunt edges filled with a physiological solution. After the discharge of the liquid, the physiological solution that had washed down desquamation cells in suspension was recovered. The sample thus obtained was placed onto a slide, dried at room temperature and after fixing for 5 minutes with ethanol, stained by the method of Shorr (1941). Briefly, the cells on the slides were stained with Harriss's hematoxylin and then with Shorr's stain, rinsed in distilled water, dehydrated in an alcohol series, cleared in xylene and protected with Permount and a coverslip. Slides were observed by light microscopy at x 450 magnification.

Each sample was taken by duplicate and in each one the number and type of cells present in 10 fields, randomly chosen, were counted.

Compocytological samples obstained from different regions of the vagina did not show notable differences in the cellular proportions observed. Therefore, the depth of the vagina was standardized in approximately 10 cm to take all the samples.

The colpocytological terminology used was taken from works which describe colpocytology in other species (*Derivaux, 1976; cole, 1959; Stenso, 1988; Jarosz et al., 1980, Dempsey et al., 1934*).

Ovaries

At the end of the serial sampling, 9 females chosen at random were sacrificed by a stroke at the occipital zone and the genital tract and ovaries were recovered (*Hillemann, Gaynor & Stanley, 1958*).

The ovaries from each female were weighed together. Histological cuts of the vagina and ovaries were made and then stained with hematoxylin and eosin. Preparations were observed by light microscopy at x 50, 100 and 450 magnification.

Results

1) Validation of the method of exfoliative colpocytology as an indicator of the state of the female's sexual cycle

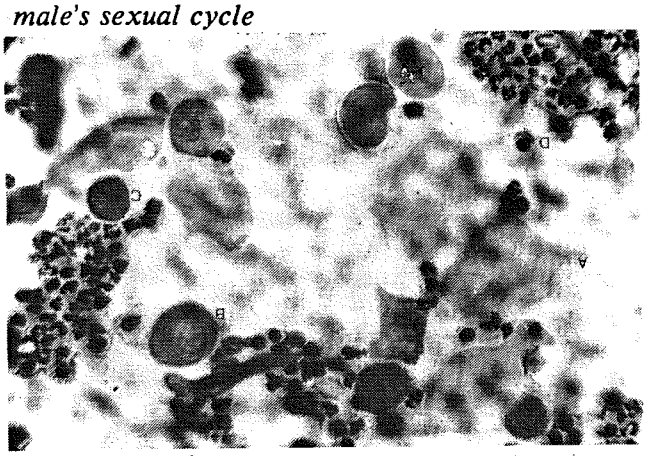

Fig. 1. Vaginal smear. A: squamous cell; B: intermediate cell; C: parabasal cell, D: polymorphonuclear leukocyte. Magnification x 500.

Exfoliative colpocytology observed in samples taken immediately before the sacrifice, allowed us to establish the presence of 4 well-defined cellular types (plate 1, fig. 1).

Type A or squamous cells: large, strongly acidophile, polyhedrical cells, with a diameter of approximately 40 μm, most without nucleus or when present, it is small and pyknotic with highly condensed chromatin. Their presence in the smears varied between 0 and 100% (plate 1, fig. 2).

Fig. 2. Vaginal smear. A: squamous cell. Magnification x 500.

Type B or intermediate cells: medium size cells, pale-acidophile stained, with a diameter of approximately 30 μm, with a large nucleus that shows chromatin arranged in a very lax way. Their presence in the preparations varied between 0 and 15%.

Type C or parabasal cells: small cells, with a diameter of approximately 17 μm, with a very prominent nucleus surrounded by a thin strip of cytoplasm. Their presence in the preparations varied between 0 and 20%.

Type D or polymorphonuclear leukocytes: they are present in most of the preparations and are only completely absent when types A cells are about 100%.

When the smears of exfoliative colpocytology were related to ovarian and genital tract microscopy, a significant correlation between samples with a majority of squamous cells (Type A) and ovaries which have conspicuous graafian follicles, was found.

In those cases which showed other proportions of the 4 cellular types mentioned, a great varia-

bility in the ovarian structures, microscopically observed, was noticed, and it was not possible to correlate a determined physiological state with a fixed proportion of the cells that appear in the exfoliative colpocytology.

Examples of that above-mentioned can be observed in females 1, 5 and 6 from table 5.

Considering these results, it can be taken as valid that a sample of exfoliative colpocytology with a majority of squamous cells (greater than or equal to 50%) is indicative of the proximity of estrus, that is of the ovulatory period.

2) Analysis of the data obtained from all the animals observed

Estrus: Throughout the study 1.3 estrus/female were observed with 7 females without estrus, 9 had it only once, 8 twice, 2 three times and 1 four times (table 1).

Table 1. Estrus per female and its frequency considering all the females during the study (70 days)

Estrus per female	Frequency (%)
0	7 (26)
1	9 (33)
2	8 (30)
3	2 (7)
4	1 (4)

Mean frequency 1.3

Cycles: defining a complete cycle as the period between two estrus, there were 11 females with complete cycle and a total of 15 cycles were observed. Eight females (73%) had 1 complete cycle, two (18%) had 2 cycles and only one animal (9%) had 3 consecutive cycles.

The average duration of the cycles was of 28.9±12.6 days, but only 3 were of 28 days (20%) and the rest with great heterogeneity (between 12 and 49 days). This variability in the duration of the cycles was not only observed among animals but also in the same animal since in those which had more than one cycle, the ranks also were between 12 and 49 days (table 2).

The duration of estrus: A "long estrus" is that in which 2 consecutive samples (period from 2 to 3 days) showed a percentage of squamous cells greater than or equal to 50%. Five estrus (14%) with that characteristic were observed.

In the analysis of the samples which precede those of the estrus and which could be examined, there were preparations in which the percentage of squamous cells increased significantly, but without exceeding 50%. In half of the cases (7 occasions), this peak of squamous cells was recorded between 3 and 7 days before the estrus and, in 37.5% of the samples (5 occasions), the same behaviour was showed between 12 and 21 days. An increase of squamous cells before the increase of the estrus was not observed in 14.3% of the preparations analyzed.

Table 2. Number and duration of estral cycles observed per animal

Number of estral cycles per animal					
1		2		3	
n	duration	n	duration	n	duration
8	30±10.8	4	25.7±16.5	3	21.7±6

Total cycles	Average duration±sd
15	28.9±12.6

n: number of animals which have 1, 2 or 3 estrus

Table 3. Estrus per female and its frequency, considering females reared in corral or cage

	Corral	Cage
Estrus per female	Frequency (%)	Frequency (%)
0	2 (22)	2 (22)
1	2 (22)	4 (44)
2	3 (33)	3 (33)
3	1 (11)	-
4	1 (11)	-
Mean frequency	1.7	1.1

In the samples taken after the estrus and which could be examined, it was possible to observe that in 37.5% of the cases (6 estrus) the percentages of squamous cells immediately fell to values lower than 10%, in 50% of the cases (8 estrus) the squamous cells remained as more than 10% more than 2 to 5 days after the estrus, whereas in 12.5% of the females (2) this period extended from 7 to 12 days.

3) Effect of the two breeding methods used
Estrus: considering the females studied in groups divided according to the breeding practice (cage or corral) during the period of study, the results recorded were as follows: in corral, 1.7 estrus/animal and in cage, 1.1 estrus/animal (table 3). Among the "corral females" one "long estrus" was recorded, whereas among the "cage females" there were 4.

Cycles: the average duration of 8 and 3 cycles observed in "corral" and "cage females" was respectively 27.1±13.5 and 31.7±6.4 days.

4) Effect of the varieties studied
As the Greenland and Cognac females were reared with different systems, they cannot be compared. For that reason both will be compared with the Silver variety, which was present in both systems.

Estrus: All the Silver females had at least 1 estrus in the 2 breeding systems although in corral 2.2 estrus/female were observed and in cage 1.2. The other two varieties had a lower level of activity than the Silver. The Greenland (corral) had 1.2 estrus/female and the Cognac (cage) 1 estrus/female.

There were no "long estrus" in the Cognac and only one was observed in a Silver female in corral. In cage, 3 Greenland females and only one Silver had "long estrus".

Cycles: The average duration of the cycles in the Greenland females was of 33.5±7.8. The cycle of the Silver female was of 28 days.

The average duration of the cycle in the Cognac females was of 21.7±6 days, whereas in the Silver females the average was of 30.4±6.3 days.

5) Effect of the presence of the male on the sexual activity
Analyzing the females with or without the presence of the male over a period of 70 days, it was observed that 100% were in estrus among those without a male and only 40% in those which had a male (table 4). The first estrus in this group was observed 24 days after the introduction of the male.

The average duration of the cycles in the females reared without a male was of 28.3±11.6 days. There was no complete cycle in those having a male.

The group of females without a male had 2 "long estrus", whereas the females with male did not have such an estrus. Within the females reared in absence of a male, high levels of squamous cells were observed throughout the sampling. On the contrary, low levels of that cellular type were recorded during the first 24 days of observation in those females which had a male.

This is understandable if we consider that all situations of stress go against a normal reproductive behaviour. An important factor could be the density of the different breeding systems. The greater space available per animal in the corrals would result in greater sexual activity in the females.

Concerning the observation of the different breeds, it is notable that all the Silver females, reared in cages as well as in corrals, had estrus and cycled, whereas within the Cognac and Greenland varieties there were higher percentages of females which did not have estrus or had it only once.

As for the effect observed due to the presence of the male, it is inverse to that observed in other farm species such as the ovine (*Schinckel, 1954; Watson & Radford, 1960*), the caprine (*Shelton, 1960*) or the bovine (*Albertio, Schiermann, Carou & Mestre, 1987*). We can explain the high percentage of females which do not cycle, as well as the period of "lethargy" or delay in the sexual manifestation of those which do it, as the result of an alteration in the conditions. The lower availability of food, monopolized by the male and, above all, the hostilities observed among the animals have probably caused the sexual depression observed. This negative effect of the presence of the male on the cycle of the female was observed in repeated opportunities during the formation of the families (*Ruarte, Personal Communication*). This result would indicate that the fertilization of females in newly constituted families does not take place before 25 days after their formation. Mazzadra and collaborators (*Personal Communication*) have observed in 70% of the females a delay of approximately 30 days in the date of the delivery with respect to the remaining 30%, this datum indicating that the last were fertilized by the male at the moment of the formation of the families.

It was not possible to register regularity in the levels of the different cellular types throughout the total cycle to be able to establish the relative durations of the periods of proestrus, metestrous and diestrus. The period of estrus varied between 2 and 5 days, judging by the number of consecutive samples which show a percentage of squamous cells higher than or equal to 50%. This datum coincides with the observations of receptivity in the female evaluated by Warkentin (1968) in analysis of behaviour. A pre-peak of squamous cells that never exceeded 50% was constantly observed in the days preceding that in which the maximum value of this cellular type is reached. We explain such an observation as an increase in the level of estrogens prior to that causing ovulation, equal to that showed by other species (*Humphrey, Kaltenbach, Koritnik & Niswender, 1983; Pope, 1982*).

The data obtained by the histological observation (corpus luteum in females without male) differ from Brown (1975) who asserts that the nutria has ovulation induced by coitus and coincide with Willner et al (1979) and Gluchowski (1954) who relate that ovulation is spontaneous.

A great variability in the measures and weights of the ovaries is observed, a conclusion shared by Hillemann and others in their work on anatomy of the reproductive system of the species (*Hillemann et al., 1958*).

In conclusion to the observations of this work we must point out: the great variability in the duration of estral cycles and of estrus; the efficiency of serial colpocytology to determine the moment of estrus; the greater reproductive activity of "corral females" (lower density?) and the possible temporary effect of the male as a restraint of the ovarian function.

According to this, future studies must include a greater number of animals or of cycles studied and other types of studies (endocrinology) to allow for a better explanation of the reproductive physiology of the species.

Acknowledgements

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Postnatal development in mink kits

Anne-Helene Tauson

The relative growth rate of mink kits during the 42 day lactation period was evaluated. Postnatal development, including chemical composition of the body, relative weights of liver and digestive tracts, liver glycogen, plasma glucose and cortisol, was studied from birth until 5-6 days of age. A maximum relative growth rate of 23%/d was recorded between 1 and 2 days of age. The average over 42 days was 9%/d. Body fat content increased from 1.4% at birth to 4.4% at 5 days of age. Stillborn kits tended to have a lower fat content than live born. Nutrient and energy retention data indicated a ten-fold increase in fat, a doubled protein content, and a three-fold increase in energy retained from birth until 5 days of age. The liver and digestive tract made up 3.5 anad 5.6% of body weight at birth, respectively, a ratio that increased to 5% (liver) and 6.5% (digestive tract) from 3 and 2 days of age. Liver glycogen tended to be lower in dead than in live kits and tended to increase from 1 to 2 and 3 days of age. Plasma glucose increased significantly from 4.5 mmol/l at birth to about 7.5 mmol/l from 3 days of age. Plasma cortisol decreased from 20 nmol/l to about 5 nmol/l from 1 to 2 days of age.

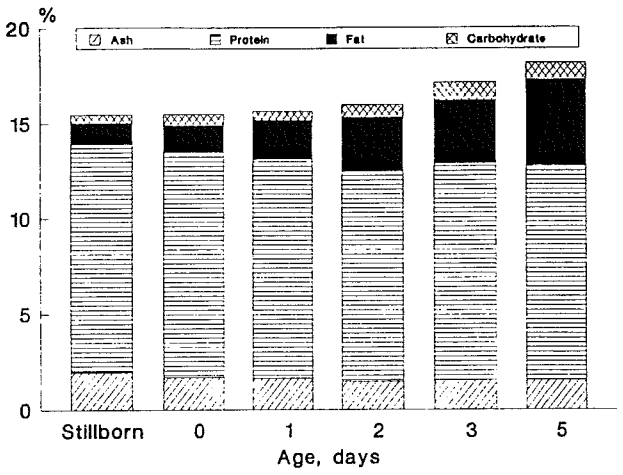


Fig. 2. Chemical composition in per cent of stillborn and live mink kits from birth until 5 days of age (LS means; the ranges of SE of LS means were 0.26-0.36 for dry matter, 0.07-0.10 for ash, 0.23-0.34 for crude protein, 0.11-0.17 for fat and 0.11-0.23 for carbohydrate).

Acta Agric. Scand., Sect. A, Animal Sci., 44: 177-184, 1994. 4 tables, 3 figs., 35 refs. Author's summary.

Effect of flushing on embryos in early developmental stages in mink (*Mustela vison*)

Anne-Helene Tauson, Hans Gustafsson

Nutritional flushing of mink females by ad lib. feeding from March 3 or 5, following a two week period of restricted feeding, was evaluated with respect to effects on the number and early development of the eggs shed in females mated once on March 7, 10, 14, 17, 20, and 24. Plasma oestradiol-17ß was recorded at mating and at killing 3 or 4 days after mating. The average number of eggs recovered increased for females mated from March 7 to 17, after which time it declined. The number of early embryos was not significantly affected by flushing, but the early development of the eggs was enhanced, documented by a significantly higher percentage of eggs having reached the four-cell stage or more at killing. The effect was most pronounced for females mated early in the breeding season, and then levelled off.

Acta Agric. Scand., Sect. A, Animal Sci., 44, 43-49, 1994. 3 tables, 1 fig., 32 refs. Authors' summary.

Estimation of body fat in arctic foxes

L.V. Tolstenko, V.S. Snytko, I.M. Mironova

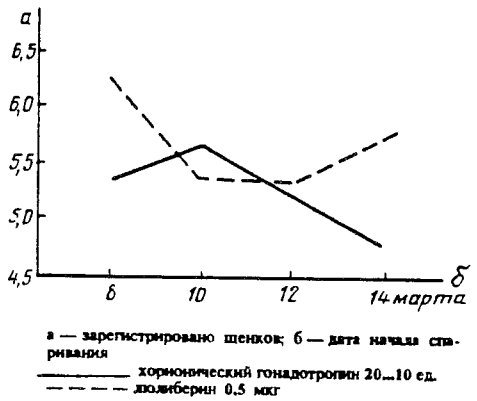
Body fat was assessed in 1100 female arctic foxes (*Alopex lagopus*) during November, January and February and on the 20th day of pregnancy using the index of fatness (ratio of body weight in g to length in cm) and thickness of the fat fold in the groin. Effectiveness of the indices was estimated from analysis of reproduction data in females having or not having the desired degree of fatness throughout the study period. The results showed a close correlation between the 2 methods. The fat-fold method required only 10 to 15 s/fox to perform assessment of a whole population in 1 to 2 days.

Krolikovodstvo i Zverovodstvo, No. 4, p. 7, 1992. In RUSS. 1 table. CAB-abstract.

Luteinising hormone releasing hormone and prostaglandins in a new method of mating mink

V.G. Vernatskii

Female mink were injected with LHRH (Surfagon) or chorionic gonadotropin on 1 or 3 March, and were mated 78 hours later. For mink treated on 1 or 3 March, whelping rate was higher by 3.4 and 5.1% resp. for LHRH than for chorionic gonadotropin treatment. In a 2nd experiment, whelping rate after injection of 0.5 and 0.25 microgram LHRH was 92.8 and 83.5% resp. vs. 88.6% for treatment with a PGF2alpha analogue or chlorionic gonadotropin on 9 March and mated once on 16 or 17 March had whelping rates of 96.7 and 96.3% resp., and litter sizes at birth of 7.0 and 6.7.



Krolikovodstvo i Zverovodstov, No. 6, p. 8-9, 1990. In RUSS. 3 tables, 1 fig. CAB-abstract.

Not just an inclination. A possible relationship between willingness to mate and fertility

Janne Hansen

880 mink females were scored for willingness to mate. For females exposed to a male on 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 occasions before accepting mating, litter size averaged 5.63, 5.76, 5.56, 5.52, 4.93, 5.67, 6.01, 6.25, 5.16 and 4.45, respectively, and the percentage of females failing to give birth to a litter was 6.8, 6.5, 7.7, 14.3, 17.6, 7.7, 13.3, 27.3, 14.3 and 0. There were no significant differences between young and adult females in the incidence of unsuccessful mating attemps. The estimated h^2 of willingness to mate for females at the farm was 0.45 when adjusted for line differences.

Dansk Pelsdyravl, 57, 1, pp 18, 1994. 2 figs. In DANH. CAB-abstract.

Possible causes of infertility in mink males

Ulla Lund Nielsen, Niels Therkildsen

10 mink males, which had sired no progeny in 1991 after each mating at least 5 females, were mated again in March 1992 before being sacrificed. Examination of semen samples from the infertile males showed no spermatozoa in samples from 4 males and poor semen quality in samples from 6 males, and several males had small testes. No chromosome abnormalities were detected in any of the males. It was concluded that the infertile males were "out of season", resulting in sexual inactivity, but the reason for this could not be explained.

Bitestikel og testikel fra en steril han (til venstre) og en frugtbar han - testiklen er tydeligt indskrumpet hos den sterile han, medens bitestiklen har normal størrelse

Dansk Pelsdyravl, 56, 11, pp474-475, 1993. 1 photo. In DANH. CAB-abstract.

Vitamin B_{12} supplementation to mink (*Mustela vison*) in the prevention of feed-induced iron deficiency anaemia. I. Effect on growth performance and fur quality characteristics

Anne-Helene Tauson, Maria Neil

Vitamin B_{12} supplementation in the prevention of feed-induced iron deficiency anaemia was evaluated with six treatment groups of mink kits, comprising a control group and five groups fed an anaemiogenic diet either unsupplemented, supplemented with vitamin B_{12} orally, or by intramuscular injection, with iron therapy by ferrous fumarate and cysteine, and iron therapy plus vitamin B_{12} orally. Unsupplemented animals showed symptoms of anaemia including poor growth performance, achromotrichia and poor fur quality. Oral vitamin B_{12} supplementation, but not injections, had some effect in preventing anaemia, indicating an influence on intestinal iron absorption. Iron therapy completely prevented the occurrence of anaemia, and simultaneous addition of vitamin B_{12} had no further positive effect.

Acta Agric. Scand., Sect. A, Animal Sci. 43, 116-122, 1993. 4 tables, 24 refs. Authors summary.

Vitamin B_{12} supplementation to mink (*Mustela vison*) in the prevention of feed-induced iron deficiency anaemia. II. Effect on haematological parameters and mineral content of the liver

Anne-Helene Tauson, Maria Neil

An effect of oral vitamin B_{12} administration on growth performance and fur quality characteristics in mink kits fed an anaemiogenic diet has earlier been found. The present data confirmed that kits fed the unsupplemented anaemiogenic diet developed anaemic with low haemoglobin, haematocrit and erythrocyte counts, microcytosis, anisocytosis, and low iron and cobalt contents in the liver. Oral vitamin B_{12} supplementation, but not injections, partly restored iron status, documented by haemoglobin and haematocrit values not being significantly different from the control group, and increased liver cobalt content. Iron therapy alone or combined with vitamin B_{12} resulted in normal iron status. A mechanism for the effect of vitamin B_{12} in preventing anaemia is suggested.

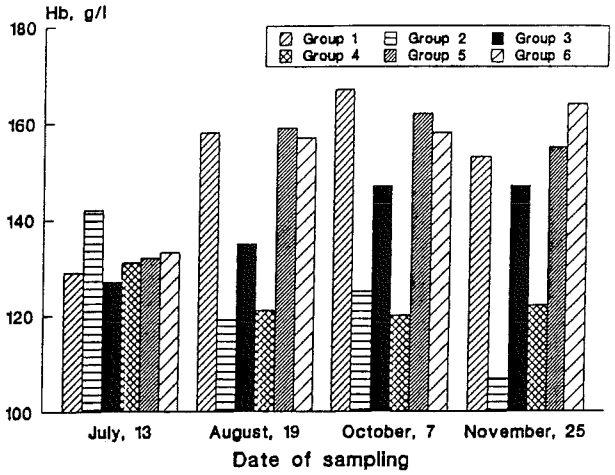


Fig. 1. Average haemoglobin values in male and female kits

Acta Agric. Scand., Sect. A, Animal Sci. 43: 123-128, 1993. 3 tables, 1 fig., 32 refs. Authors' summary.

Feedstuff evaluation, nutrition, and nutritional physiology

Christian F. Børsting, N. Glem-Hansen

Progress in fur animal nutrition conducted at the Department for Research in Fur Animals, National Institute of Animal Science, Denmark over the last 35 years is reviewed. Sections include feedstuff evaluation, protein and amino acids, fat and fatty acids, carbohydrates, vitamins and minerals, metabolic studies and perspectives for the future.

720. Report from the National Institute of Animal Science, Denmark, pp 48-58, 1993. 2 tables, 1 fig., 56 refs. CAB-abstract.

Ionoll and bischofite in diets

N.N. Loenko, N.A. Balakirev

The effect of supplements of the antioxidants ionol and bischofite on growth, size and pelt quality was studied in 2 experiments with Arctic foxes (*Alopex lagopus*). In the first, 3 groups of 28 to 29 male and female foxes were given, from July until November, diets based on horse meat, cattle offal and fish equal in energy with protein 8.5 and fats 4.4 g/100 kcal metabolizable energy

(ME) (group 1) or protein 7.6 and fats 5.2 g/100 kcal ME (groups 2 and 3). Diets in groups 2 and 3 were supplemented with ionol 25 mg/100 kcal for 71 days or bischofite 80 mg/100 kcal for 88 days, respectively. There were differences in body weight between the groups from 4 months old. Gain and body length were greater and size, colour and quality of pelts were better in the experimental groups. Length and thickness of fur were not significantly different among groups. In the 2nd experiment, 3 groups of 40 male silver foxes were given diets similar to that in group 2 in the first experiment without supplements or with ionol 25 mg/100 kcal for 72 days or bischofite 80 mg/100 kcal for 94 days from July (groups 1 to 3). During October and November all groups were given a stock mixed diet. Mean liveweight at 5 months old was 150 to 200 g greater in the experimental groups. Body length tended to be greater. There were significant differences in width and area of pelt between groups 1 and 2 and 3 and 2. Pelt quality rating was 101, 104 and 98% in the 3 groups, respectively.

Krolikovodstvo i Zverovodstvo, no. 4, p. 6, 1992. In RUSS. 1 table. CAB-abstract.

A knowledge of amino acids can reduce expenditure on feeds

Christian F. Børsting

In this brief report of a meeting held at the state experimental station for furbrearing animals, the significance of recent work on the levels of specific amino acids in feeds was discussed, and normal values proposed. In the general discussion which followed, the specific requirements for mink in relation to the content of amino acids in feeding plans were debated.

Dansk Pelsdyravl, 57, 1, pp 15, 1994. In DANH. CAB-abstract.

Amino acids in mink feeds

Niels Therkildsen

Understanding the amino acid requirements of growing mink will enable producers to choose feeds with lower amino acids content and hence lower cost.

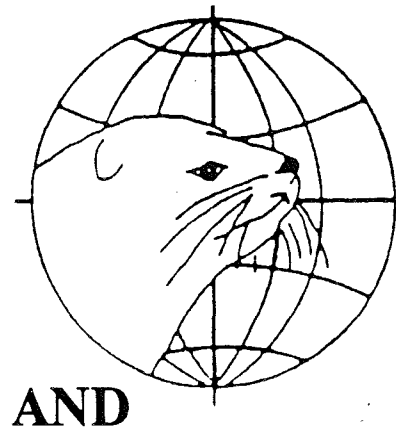
Dansk Pelsdyravl, 56, 7, pp 255, 1993. In DANH. CAB-abstract.

Regulation of the breeding condition of mink by autumn and winter feeding

Paavo Niemelä, Hannu Korhonen

In 1990-91, mink were fed a standard diet from 20 Sep., and were housed in a single-sex group with 72 females per pen (group 11) or in a mixed-sex group, comprising 72 males and 72 females (group 13), or were fed a restricted diet and were housed as above (groups 21 and 23, respectively). For females in the 4 groups, body weight loss from 18 Oct. to 5 Mar. was 6.5, 9.8, 12.6 and 14.3% respectively, the percentage of females remated was 52.3, 51.4, 46.4 and 54.4. Of 65, 70, 69 and 68 females mated, 46, 48, 51 and 57 respectively produced a litter, and the number of kits born per mated female averaged 3.4, 3.6, 3.6 and 4.1. The differences between the groups were not significant, and it is suggested that feed restriction should be carried out with regard to the body condition of individual females.

Finsk Pälstidskrift, 23, 8-9, pp 178-182, 1993. 3 tables, 3 figs., 7 refs. In SWED. CAb-abstract.



INTERNATIONAL SCIENCE - INFORMATION AND COOPERATION IN FUR ANIMAL PRODUCTION

Original Report

Salmonella bacilli on nutria farms

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Summary

The presence of Salmonella bacilli on nutria farms with water systems was examined. Samples of vegetable feed, faeces, soil, water and sewage were analyzed. Four serotypes of Salmonella - S.typhimurium, S.enteritidis, S.dublin and S. agona were found in the analysed samples. Solely in the samples of inflowing water no Salmonella bacilli were found. The presence of Salmonella in farm sewage is particulary dangerous from the point of view of environment protection.

Introduction

The contamination of the environment with Salmonella bacilli is related to their dispersal by infected animals or those having salmonellosis. The bacteria enter the soil, the sewage water and subsequently the fields and natural water reservoirs. A great accumulation of Salmonella more and more frequently causes infections in animals who get their feed from sewage - fertilized fields (refs. 2, 4, 5, 6, 7).

The problem of salmonellosis in nutria has not been sufficiently discussed in the available literature. Only Szaflarski et al. (1951) described the epizoology of salmonellosis in nutria having been given feed which had been secondarily infected by rodents. At present, nutria are often given feed coming from fields fertilized with liquid manure, which is a potential source of Salmonella.

The objective of the present research was to investigate whether or not nutria farms with water systems using natural water flow are dangerous to both water and soil.

Materials and methods

The research was carried out on the farm "R" in Southwestern Poland. The farm is situated in a forest and contains about 1500 Standard nutria. It has been in operation for about 20 years.
The nutria were fed in the traditional way with vegetable feed (grass, clover, lucerne, maize leaves) with an addition of steamed grain as protein feed.

Sanitary conditions on the farm may be described as satisfactory. Chemical disinfection was regularly carried out as general prophylaxis.

The following terminology was employed in the research: - water - inflow, coming to the farm and gravitationally flowing through the channels to the pools, - sewage - outflow - drained off to the cesspool from the pools, - farm waste - faeces, urine, food residue washed away into the pools during cage cleaning - crucial to the characteristics of the sewage.

Samples of feed, faeces, soil, water and sewage were used as research material. Analysed samples were taken twice, in the spring at air temperatures of 5-7°C and in the autumn at 10-17°C.

Samples of the feed were collected before it was given to the animals and each of them consisted of many individual samples. The total number of feed samples was 25.

Faeces samples were collected from the cages. Thirty collective faeces samples were tested bacteriologically.

Thirty samples (15 in each season) of inflowing and outflowing (sewage) water were taken respectively. Sixty soil samples were collected in the center of the farm (I) as well as 75m (II) and 100m (III) outside the farm acconding to pedological principles, physiographical conditions of the farm location and directions of water flow.

Table 1. Results of feed, soil and water analysis for Salmonella bacilli

Material		Number of samples tested		Number of positive samples		Salmonella strains isolated			
						Spring		Autumn	
		Spring	Autumn	Spring	Autumn	Name	Number	Name	Number
Feed		15	10	5	5	typhimurium enteriditis dublin	3 1 1	typhimurium agona dublin	3 1 1
Faeces		15	15	15	10	enteritidis dublin agona	7 5 3	dublin enteritidis	5 5
Water in flow		15	15	0	0				
Water outflow sewage		15	15	3	5	typhimurium dublin	2 1	typhimurium	5
Soil	I	10	10	8	8	dublin typhimurium	5 3	typhimurium agona	3 5
	II	10	10	6	5	typhimurium dublin	3 3	dublin agona	3 2
	III	10	10	5	4	agona enteritidis	2 3	typhimurium enteritidis	3 1

Bacteriological tests were carried out according to general norms and regulations (ref. 3). Diagnostic tests were used as well as 10% lactose culture medium and Api 20E microtubes manufactured by bio-Merieux.

Preliminary serological classification was carried out by means of a latex agglutination reaction using a Latex Salmonella set produced by Biomex. Serotype was determined by agglutination on the glass. Serums coming from the National Salmonella Center were used according to the Kauffmann - White scheme.

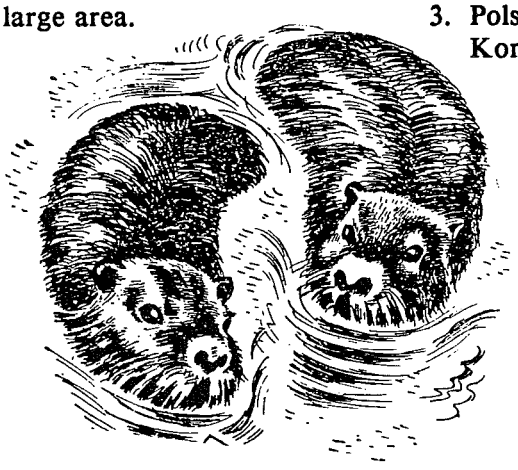
Results and discussion

Table 1 shows the data obtained from bacteriological tests of feed, faeces, water, sewage and soil for Salmonella bacilli.

The presence of four serotypes was determined i.e. S.typhimurium, enteritidis, dublin and agona. S.typhimurium being most numerous seems characteristic as that bacillus, together with S.enteritidis which is adapted to both humans and many species of animals and those types regarded by many authors (refs. 1, 7) as responsible for the epidemic situation of salmonelloses.

The presence of S.dublin, most common in cattle, may suggest the following chain of infection: vegetable feed coming from fields fertilized with liquid cattle manure - organism of nutria. The fact that bacilli were found in vegetable feed samples is an indication that every non-processed feed, both vegetable and animal, may be contaminated with Salmonella.

The presence of S.typhimuria may also suggest rodents as part of the infection chain. Salmonella becilli being found in faeces and farm sewage definitely prove nutria to carry and disperse those bacteria, whose presence in the water is especially dangerous as in this way they can be spread over a very large area.



This fact is pointed out by many authors (refs. 2,5), who claim that even the process of sewage purification does not eliminate the bacteria and, consequently, the chain of infection becomes a circle.

Soil samples, including those collected relatively far from the center of the farm, also contained Salmonella which is also very dangerous for the environment as the bacilli may survive in the soil even as long as 300-400 days.

The research carried out previously concentrated on carnivorous fur animals being carriers for Salmonella because of their feeding conditions.

However, the results obtained from the present research suggest that herbivorous fur animals may also pose a threat to the environment being Salmonella carriers.

Conclusions

1. Salmonella were found in feed, faeces, sewage and soil samples collected on a nutria farm.
2. The presence of Salmonella in farm sewage is particulary dangerous for the environment.
3. The effective size of protective zones for nutria farms as well as working out ways and means of preventing bacteriological contamination of the environment require further research.

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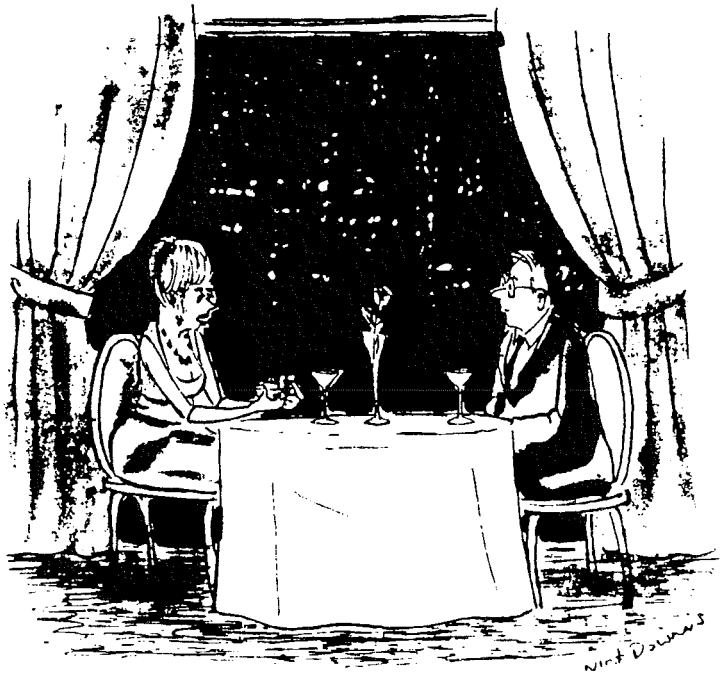

"It may be indistinguishable from a diamond chemically, Harry, but to me, charcoal is charcoal."

Original Report

Induction of deoxyribonuclease activity in mink serum after administration of DNA: A correlation with resistance to the Aleutian disease virus

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Summary

Deoxyribonuclease (DNase) activity in serum from mink of standard (AA/Aa) genotype, resistant to the Aleutian disease virus (ADV), considerably and persistently increased after i.p. injection of alien heterogenous DNA, and an increase in its activity was also observed in white random bred and Black mice known as resistant to viral infection.

In mink of Sapphire (aa) genotype, susceptible to infection with the ADV, DNase activity sharply decreased after the injection of heterogenous DNA. DNase activity remained lower than the basal for 72 h after DNA administration; concomitantly, the level of RNase activity remained in the normal range in mink of both genotypes. Decrease in DNase activity occurred also in AKR and CBA mice known as susceptible to viral infection which was in contrast with the observations made for virus resistant Black and white random bred mice.

It appears plausible that the capacity of standard mink to respond to heterogenous DNA by increase in the serum DNase activity provides their resistance to DNA-containing ADV; the incapacity to respond to injected alien DNA by induction of DNase activity renders Sapphire mink sensitive to ADV. Similar dependence between capacity to respond to DNA administration by a change in serum DNase activity and resistance to viral diseases are found in different strains of mice.

Introduction

In a serie of previous studies it has been demonstrated that deoxyribonuclease (DNase) inhibits DNA synthesis of a number of DNA-containing viruses, suppresses their reproduction and that it also possesses a therapeutic effect in diseases caused by DNA-containing viruses (refs. 1-6).

These data suggested that the proper DNase activity in serum and tissues of animals can also be also a means of antiviral defense like, for instance, nuclease activity induced in cells by interferon (ref. 7). This was shown in several studies with respect to RNA-containing viruses and RNase activity (refs. 8-9).

More recently, we demonstrated this relation between DNase activity in serum and resistance to the DNA-containing virus of aleutian disease

in mink (ref. 10). Standard mink, resistant to the ADV, when infected with the virus, show a considerable increase in DNase activity in serum, whereas Sapphire mink, sensitive to the ADV, when infected with the ADV, do not exhibit an increase and even show a decrease in DNase activity. These observations support the idea that high DNase activity in serum of infected animals has a defensive antiviral effect with respect to DNA-containing viruses.

The data obtained raised the following questions. 1) If viral DNA is an inducer of DNase activity in the serum of animals infected with a virus, can nonviral alien DNA, also act as an inducer? 2) Is the response to administered heterogeneous DNA by induction of DNase a genetically determined trait shown by certain animal strains or species? 3) Are populations heterogeneous for this trait? If so it may be possible to enhance this trait in animals through selection and breeding.

Materials and methods

In this study, we used 12-14 month old mink of two coat colours: standard (brown) and Sapphire and 5-6 month old AKR, CBA, Black, as well as white random bred mice. Experimental groups of animals received DNA isolated from cattle spleen (Plant of Chemical Reagents, Olaine, Latvia). DNA was dissolved in saline to get the concentration of DNA 2 mg/ml; the dose of DNA administered intraperitoneally (i.p.) was 5 mg/100 g body weight. Control groups of animals received saline.

In mink killed for commercial purposes, 5 ml of blood was collected 3, 18, 24, 48 and 72 hrs after injection of heterogeneous DNA or saline. 25-30 animals were taken at each time point. In experiments with mice, blood was collected 3, 6, 8, 12 and 24 hrs after injection of heterogeneous DNA, 24 mice were taken at each time point. Serum was stored at -20°C. DNA isolated from cattle spleen served as a substrate to determine the activity of neutral (pH 7.2) or acid DNase (pH 4.5); tRNA from E.coli (Plant of Chemical reagents, Olaine, Latvia) was used to measure the activity of neutral RNase (pH 7.2). Measurements of the activities of DNase and RNase, expressed in optical units (OU) per ml of serum, were based on increase in absorption at 260 nm of the acid-soluble fraction obtained after enzyme hydrolysis of high molecular weight DNA or tRNA at 37°C for 30 min (ref. 11). Student's t-test was used in treatment of the data for significance. The enzyme activity was expressed in optical units per ml of serum.

Results and discussion

In standard mink, which are resistant to the ADV, a sharp rise in the activity of neutral DNase occurs as early as 3 hrs after administration of heterogeneous DNA (fig. 1, table 1).

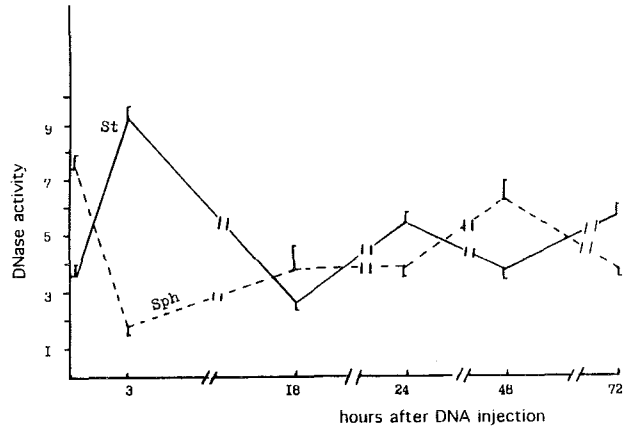

Fig. 1. DNase activities (pH 7.2) of blood serum in standard and Sapphire mink after injection of heterogeneous DNA. Continuous line - standard mink (st); discontinuous - Sapphire mink (Sph).

Thereafter, its activity decreases, and reaches the basal level by 18 hrs. displaying marked variations (fig. 1). In Sapphire mink, which are susceptible to ADV, the activity of neutral DNase not only does not increase, but even sharply decreases by 3 hrs after injection of DNA (fig. 1, table 1). and it does not reach the basal level in 3 days (72 hrs), showing variations during this time span (fig. 1). Changes in the activity of acid DNase reproduce the pattern observed for neutral DNase (fig. 2).

Table 1 Variations in DNase activity in blood serum of standard and Sapphire mink in 3 hours after administration of alien DNA

DNase activity (in OU/ml blood serum)			
Standard mink		Sapphire mink	
Before DNA injection	3 hrs after DNA injection	Before DNA injection	3 hrs after DNA injection
2.80	6.95	2.85	1.57
2.95	6.90	2.90	1.57
3.15	7.17	3.30	1.75
3.50	7.70	3.15	1.75
3.85	7.80	3.85	1.76
3.50	7.90	3.85	1.90
3.15	7.60	3.60	1.95
3.15	8.75	5.60	1.20
3.15	8.75	6.65	1.75
3.60	8.22	7.70	1.80
3.70	8.70	7.70	1.27
3.80	9.95	7.87	1.37
3.85	9.95	7.50	1.77
3.70	9.80	8.40	2.27
3.50	9.85	8.70	2.95
3.25	10.50	8.50	3.15
3.07	10.10	8.70	4.20
3.20	10.20	9.50	4.55
3.70	10.70	10.15	5.25
3.25	10.85	10.70	6.65
4.50	11.55	10.70	6.90
5.60	11.10	12.20	6.90
5.60	11.10	12.20	6.90

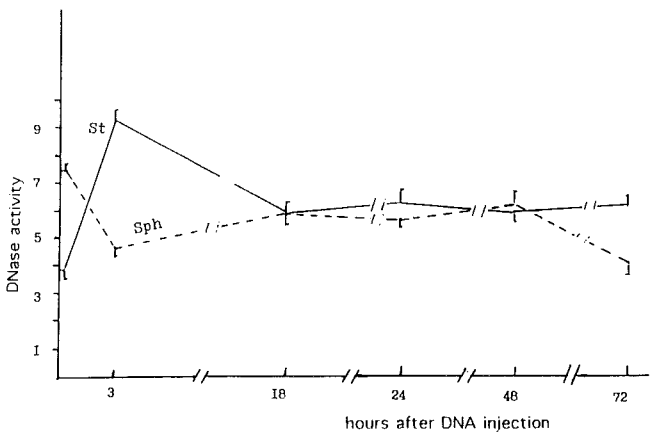

Fig. 2. DNase activities (pH 4.5) of blood serum in standard and Sapphire mink after injection of heterogeneous DNA. Continuous line - standard mink (St); discontinuous - Sapphire mink (Sph).

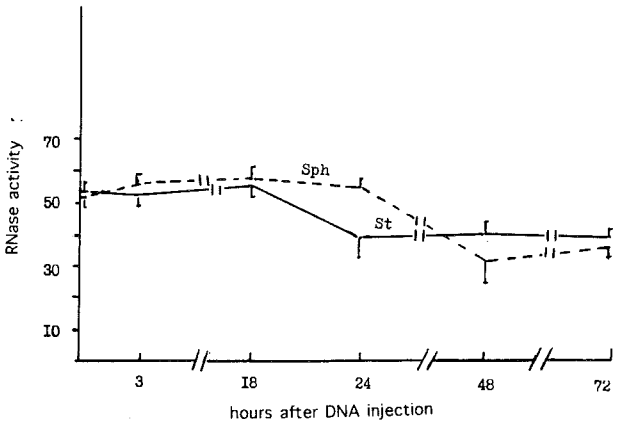

Fig. 3. RNase activities (pH 7.2) of blood serum in standard and Sapphire mink after injection of heterogeneous DNA. Continuous line - standard mink (St); discontinuous - Sapphire mink (Sph).

The increase in DNase activity in serum from standard mink and its sharp increase in Sapphire mink in response to heterogeneous DNA is presumably a substrate-specific reaction (for instance, the activity of RNase in mink of both genotypes, as shown in fig. 3, remained unaltered).

The changes in the acid DNase activity in serum from mink, which genetically differ in susceptibility to the ADV, conform with the pattern of changes in the activity of neutral DNase in these strains, when infected with the ADV as previously shown. The obtained data suggest that DNase activity induced by infection with the ADV or heterogeneous DNA is a genetically determined trait. Sapphire mink were developed through selection of mutants for coat colour making them more valuable commercially, however, this selection sharply decreased the resistance of animals of this genotype to the ADV and thereby their viability.

In both strains, when infected with the ADV, a sharp increase in the level of specific antiviral antibodies is observed (refs. 12-13). In all probability, the mechanism of induction of DNase activity is a factor providing relative resistance of standard mink to Aleutian disease. Precisely, the incapacity to respond to the ADV by induction of DNase activity may be because of higher sensitivity of Sapphire mink to the ADV.

Suppressed induction of DNase activity in Sapphire mink in response to infection with the ADV, more that that, a sharp decrease in the basal level of DNase activity, after injection of heterogeneous DNA, is possibly due to impairment of the mechanism of substrate induction. This appears so because induction of DNase activity seems to be an expected response to alien DNA (refs. 14-15).

Clinical observations have revealed that in the serum of patients with viral deseases caused by RNA-genomic viruses (viral meningitis, meningoencephalitis, epidemic parotitis, among others), nuclease activity increases, and, in the case of considerable decrease, the prognosis and course of the disease are benign and vice versa (refs. 8, 9).

It appeared of importance to elucidate whether animals of other species may respond to administered DNA by an increase in DNase activity and, if they do, whether animals of different genotypes vary in intensity of the response.

For this purpose, DNA was administered to 6 month old random bred mice, Black, AKR and CBA. As shown in fig. 4, only random bred and Black mice respond to administered DNA by a marked increase in DNase activity, like standard mink to the administered heterogeneous DNA. In AKR and CBA mice, in contrast, the response to alien DNA is the same as in Sapphire mink: DNase activity in serum sharply falls. Random bred and Black mice are distinguished by their higher resistance to disease caused by the small pox virus compared to AKR and CBA mice. It was reasonable to assume that induction of DNase activity may be one of the rapidly acting factors of humoral antiviral defence.

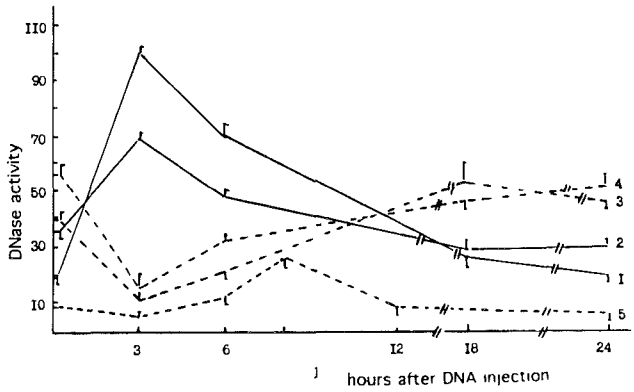

Fig. 4. DNase activites in white random bred (curve 1), Black (curve 2), AKR (curve 3 - 2 months old, curve 5 - 6 months old), CBA (curve 4) mice after injection of DNA.

The experiments we performed with mink revealed that animals within the groups of standard and Sapphire mink vary in DNase response to parenterally administered DNA (table 1).

These individual differences for this trait suggest that through selection of animals responding to administered DNA by a rise in DNase activity a substrain of mink (or other animals) resistant to viral diseases can be developed.

The present studies have demonstrated for the first time a distinctive response of animals of different genotypes to alien DNA. The data quite convincingly demonstrate a correlation

between the level of DNase activity in response to administered heterogeneous DNA and resistance of mink of two different genotypes to ADV, and also strain-specific differences in this trait in mice. Thus, we obtained support for the idea that the DNase activity in the animal organism itself can be a mean of antiviral defense. Furthermore, based on our previous and present studies, it appears likely that a preparation of heterogeneous DNA can be used as a test for evaluating the level of nuclease defense, as one of the links of humoral biological defense of the organism in man and animal. Further studies are needed to clarify this promising issue.

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"...and *this* is for those drug-resistant microbes."

Evaluation indices of the coprological test for some helminthoses in the fox *(Vulpes vulpes)*

G. Poglayen, M. Martini, V. Guberti, G. Battelli

Faecal samples and guts from 103 red foxes (*Vulpes vulpes*), shot in the province of Forli (Italy), were examined for intestinal helminths. The discordance between the coprological results and those from necropsy gave a significant value ($P<0.05$) only for tapeworms. Concordance was observed for *Toxocara canis*, *Trichuris vulpis* and hookworms (*Uncinaria stenocephala*). Sensitivity values of the coprological test were: 0.915 for *T. canis*, 0.667 for *T. vulpis*, 0.867 for hookworms and 0.108 for tapeworms.

Parassitologia 30 (Suppl. 1), pp 146-147, 1988. In ITAL, Su. ENGL. 2 tables. Authors' abstract.

Helminth parasitism in martens (*Martes americana*) and ermines (*Mustela erminea*) from Washington, with comments on the distribution of *Trichinella spiralis*

Eric P. Hoberg, Keith B. Aubry, J. David Brittel

Helminths are reported for the first time from ermines (*Mustela erminea*) and martens (*Martes americana*) in Washington (USA). Among 22 adult ermines, 41% were infected by one or more of five species (*Taenia mustelae, Alaria mustelae, Molineus patens, M. mustelae* and *Trichinella spiralis*). Among 78 adult martens from three geographic localities, the prevalence was 83%. Nine species were identified (*Mesocestoides* sp., *T. Mustelae* and *T. Martis americana, Euryhelmis squamula, M. Patens, Baylisascaris devosi, Physaloptera* sp., *Soboliphyme baturini* and *T. spiralis*). *Trichinella spiralis* occurred with a maximum prevalence of 50% in martens but only occurred in 9% of ermines. Compression and digestion techniques provided a similar estimate of prevalence of *T. spiralis*, yet neither was entirely accurate in identifying all infected hosts. The species richness of the helminth community of martens in Washington was greater than that reported from other regions of North America.

Journal of Wildlife Diseases, 26 (4), pp 447-452, 1990. 2 tables, 29 refs. Authors' abstract.

***Campylobacter spp.* in blue foxes (*Alopex lagopus*) in the Olsztyn province**

Jan Siemionek, Jan Uradzinski, Zbigniew Anusz

The paper presents the first studies in Poland on the presence of *Campylobacter spp.* which were found in the faeces of 9 out of 108 animals examined (8.3%). *Campylobacter spp.* were present in 8.2% of the foxes on a state farm and in 8.5% of the foxes on private farms. Animals from 2 private farms had no *Campylobacter spp.*.

The isolated strains were sensitive to nalidixic acid and cloxacycline (75% strains), nitrofurantion 50% and streptomycin, doxycycline, gentamycin, erythomycin (25%). They were resistant to penicillin, oxytetracycline, chloramphenicol, colistine and sulphonamide.

Acta Academiae Agriculturae ac Technicae Olstenensis, Veterinaria, No. 20, pp 47-53, 1992. 2 tables, 38 refs. Authors' summary.

Nosematosis - a current disease in Norwegian fur farms

A. Solli, G. Sanson, J.A. Fougner

An outbreak of the disease (Encephalitozoon cuniculi infection), probably transmitted by rats that had access to feed, was reported in blue foxes in Osterland. The clinical signs resembled those associated with other diseases (reduced weight gain, holding the head to one side, circling and paralysis). Differential diagnosis and control measures are discussed.

Norsk Pelsdyravl, 68, 1, pp 10-11, 1994. 1 fig. In NORG. CAB-abstract.

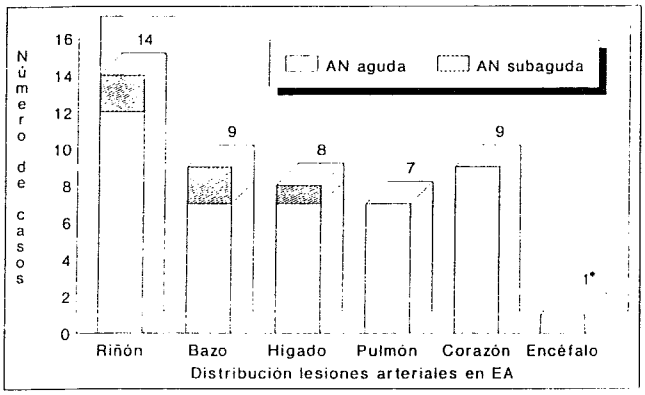
Necrotising arteritis and concomitant lesions in progressive Aleutian disease of mink (*Mustela vison*)

S. Vidal, M.I. Quiroga, M. Lopez, R.F. Antonio, J.M. Nieto

Progressive aleutian disease of mink is an immunocomplex disease caused by parvovirus and characterized by lesions for deposit of immuno

complexes. 101 mink, Wild and Standard varieties, diagnosed as progressive aleutian disease, were histopathologically and ultrastructurally studied according the routine methods. 14 animals presented necrotizing arteritis principally in small vessels of the kidney, spleen, liver, lung, meningens and brain, 12 cases were identified as acute and 2 as subacute necrotizing arteritis. The present paper describes the morfology of the arteritis and the correlation with other simultaneous lesions - caused by deposit of immunocomplexes or not - in progressive aleutian disease.

TABLA I



* solo se ha estudiado un caso EA: enfermedad aleutiana AN: arteritis necrotizante

Medicina Veterinaria 10, No. 2, pp 103-107, 1993. 5 figs., 2 tables, 15 refs. In SPAN, Su. ENGL. Authors' summary.

Test list 14. Results of CIEP tests in 1992-93.

T. Mejerland

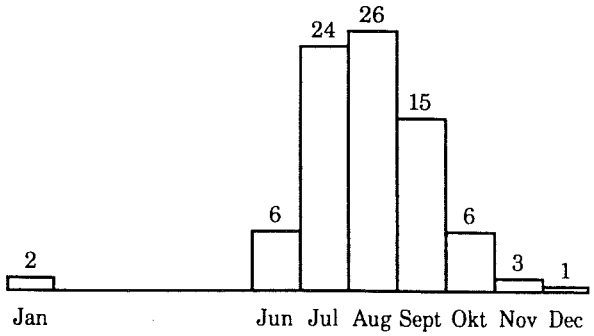
The tests carried out in 1993 covered about half of the breeding female mink in Sweden; 5.7% were positive reactors to Aleutian disease.

Vara Pälsdjur, 64, 6, pp 140-142, 1993. 2 tables, 1 fig. In SWED, CAB-abstract.

Diseases of furbearing animals 1993

Mogens Hansen

Investigations on a wild pine marten and foxes with distemper are described; the disease was diagnosed in 2 mink farms during the year. There were 83 cases of plasmacytosis; on 25 farms on which Aleutian disease had been diagnosed there were about 30% of positive reactors, anad the disease appeared again in about 1% of plasmacytosis-free farms where it had been necessary to replace stock. An infectious respiratory disease (haemorrhage pneumonia) of mink occurred in 7 outbreaks, but only 2 of the farms had significant mortality (13-16%); 3 Pseudomonas aeruginose serotypes were involved (B, C and G). Clostridium was thought to be responsible for the death witin 1 week of 60% of the animals on one farm. The disease is limited to farms that prepare their own feeds, it was emphasized that vaccination should be carried out on such farms. Toxin-producing staphylococci were present in throat swabs from 600 mink on 18 farms, with incidences of 4-44%. bacteriological examination of PM material from a further 411 mink indicated that 9% were positive. The possibility of scab being transmitted from wild to farmed foxes is mentioned.



Tabel 1. Månedlige udbrud af virus enteritis i 1993.

Table 1. Månedlige udbrud af virus enteritis i 1993.

Dansk Pelsdyravl, 57, 1, pp 8-10, 1994. 3 tables. In DANH. CAB-abstract.

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NJF UTREDNINGAR - RAPPORTER

The relationship between stereotypic behaviour and physiological state in mink

Anders Lund, Leif Lau Jeppesen

Stereotypies in mink is an animal welfare problem in the sense that they concern animal protection groups and the public opinion. The may also represent a problem for the animal, although it is, at this point, still not determined whether all aspects of stereotypies are negative.

Work done on mink and other animals suggests that high stereotyping animals are physiologically "calm", e.g. low in cortisol, whereas the opposite is the case for low stereotyping animals. It should be kept in mind, however, that other factors, such as a relatively higher metabolic rate, could explain the low cortisol levels in very active/stereotyping animals.

Although it is possible to breed a low stereotypy line of mink, it seems undesirable to breed mink which look calm, but suffer from high physiological stress levels.

In order to investigate whether the converse relationship between stereotypic activity and physiological state also exists in mink, the following experiment has been set up:

A tiny radio transmitter, that monitors heart rate and body temperature, has been transplanted into six mink selected as high stereotyping and six mink selected as low stereotyping. Sampling of base levels of urine cortisol, heart rate and body temperature, as well as video monitoring has begun.

During the summer the response of the two groups of mink will be monitored under different induced stress situation. Preliminary results will be presented at the meeting.

NJF Utredninger - Report no. 98, 1994. In DANH, 3 pp, 2 refs. Authors' summary.

Development of the response of mink to human contact and the possibility of selecting for temperament in mink

Steffen W. Hansen

The response of mink kits to human contact has been examined over 6 years in the growth period from July to November. The influence of genetic and environmental factors on the development in time of explorative, fearful and aggressive behaviour is discussed.

The examinations indicate the possibility of promoting various temperaments in mink through behavioural selection.

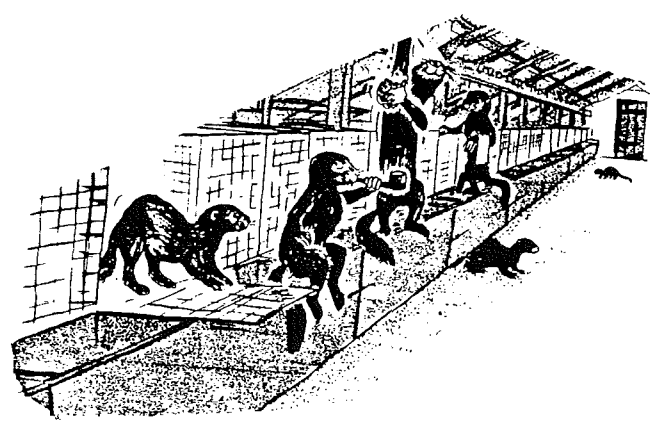
NJF Utredninger no. 98, 1994. In DANH, 8 pp, 2 figs, 12 refs. Author's summary.

Stress during pregnancy. Influence of prenatal environment on growth and behaviour of silver fox cubs (*Vulpes*)

Morten Bakken

Many studies have shown that environmental effects can affect mammalian reproduction, both in relation to number of offspring raised and in relation to sex ratio in the litters. Perhaps almost as important in relation to farmed animals, it is also demonstrated that the environmental effects during pregnancy and delivery need not be restricted to the effects on the mother but also affects cub behaviour ontogeny and later reproduction.

This paper presents results on sex ratio in litters, and growth and behaviour differences between cubs from two groups of multiparous farmed silver fox vixens treated in two different ways in relation to human contact: group 1 (G1, N=14) got a titbit two times a week during pregnancy, while group 2 (G2, N=14) got the same amount of human contact without any titbit.



Earlier experiments indicate that the silver foxes fear of humans is reduced with use of titbits. Number and sex of cubs were recorded during the first hours after delivery. The cubs were weighed at delivery, at thirty days of age and at weaning (49 days old). Behaviour tests were done when the cubs were 30 days of age with the same methods as presented in Bakken (1992).

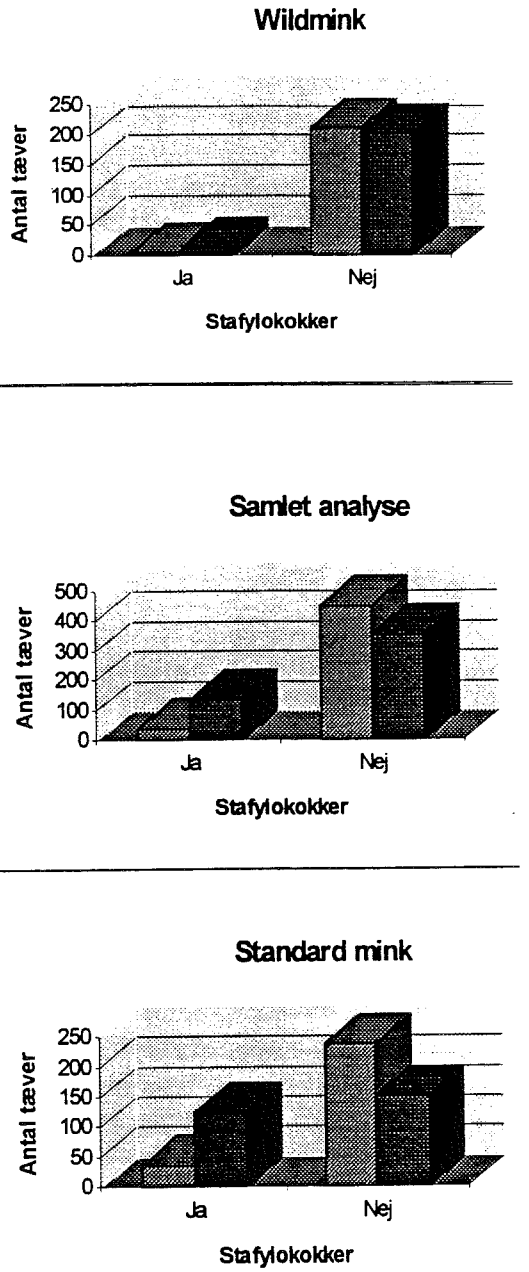
There were no differences between the two groups of vixens (G1, G2) in relation to number of cubs born (4.9±0.3 versus 4.8±0.5, NS) or number of cubs at weaning (4.1±0.4 versus 3.8±0.4, NS), but the G1 had a significantly higher proportion of male cubs in their litter both at delivery (64% versus 51%, $p<0.05$) and at weaning (68& versus 56%) than G2. At delivery there were no significant weight differences between the cubs from the two groups or between the male and female cubs. But at weaning the female cubs from G2 were lighter than the male cubs from both groups (+<0.05) and the female cubs from G1 ($p<0.05$). At weaning there were no significant weight differences between the female cubs from G1 and their brothers or the male cubs from G2. At thirty days of age the female cubs from G1 were more active ($p<0.05$) and less fearful ($p<0.05$) than the female cubs from G2. Corresponding differences were not found between the male cubs.

These results indicate that reduced fear of humans or reduced human stress during pregnancy affects both the silver fox vixens parental investment in male and female cubs and, perhaps most importantly, the female cubs growth and behaviour ontogeny. Seen in relation to earlier findings that active female cubs at thirty days of age wean more cubs during their first parity and are less often infanticidal than inactive cubs, this result indicates that environmental effects during pregnancy don't only affect the farmed silver fox vixens own reproduction but also their female cubs during their first parity.

NJF Utredninger no. 98, 1994. In NORG, 8 pp, 2 tables, 26 refs. Author's abstract.

Staphylococcus intermedius and neonatal mortality in mink

P. Henriksen, H.H. Dietz, M. Madsen, J. Clausen



Perinatal mortality in mink is often caused by bacterial septicaemia due to Staphylococcus intermedius. The pathogenesis is not known, but the mother animals tonsillar microflora might act as reservoir for the staphylococcus species.

In this study tonsillar swabs were obtained from 12 mink farms with 300 samples from each farm: 150 black females and 150 wild type females (totally 3600 tonsillar swabs). The samples were taken in Mid-April from pregnant females. The samples were microbiologically examined for the presence of S.intermedius. The kit mortality in litters from the 300 examined females were noted.

The black females revealed S.intermedius in the tonsils 4 to 5 times more frequently than in the wild type females. The study revealed a statistically significant correlation between a positive S.intermedius tonsillar culture from females and corresponding kit mortality.

The correlation was significant both for black mink females and for wild type females.

NJF Utredninger no. 98, 1994. In DANH, 8 pp, 4 tables, 1 fig., 26 refs. Authors' abstract.

Developing water protection for fur farms in Finland

Arto Latvala

Kokkola Water and Environment District has worked with the devleopment of water protection for fur fams from the beginning of nineteen eighties.

The question of water protection on fur farms at Ostrobothnia has all the time been actual because it is the main fur production area in Finland. That also means that improvements on fur farms has been made from the beginning of nineteen eighties for some amount and increasingly during the last years.

In 1991 a new reseach began. The meaning of it is to develop and test methods for the decreasing of nutrient loads from fur farms and to measure the loads as well.

It has been measured and calculated that to water courses runs 13 g phosphorus and 85 g nitrogen per one produced mink skin and 18 g phosphorus and 200 g nitrol per one produced fox skin. There are, however, great differences between farms depending on the conditions and soil art in the farm.

It has been noticed, that it is possible to decrease phosphorus from the leaching water from fur farms by filtration and chemical treatment. The reductions of phosphorus in experiments have been: 85-95% by chemical treatment; 10-80% by filtration.

The big difference in filter efficiencies are caused by the fact that the phosphorus absorption capacity of the filter material will diminish during filtration. That is why the reduction of phosphorus is decreasing. Therefore the filter material must be changed now and then.

For the decreasing of nitrogen load other methods should be used. The gathering of urine is important in ground water and other sensitive areas.

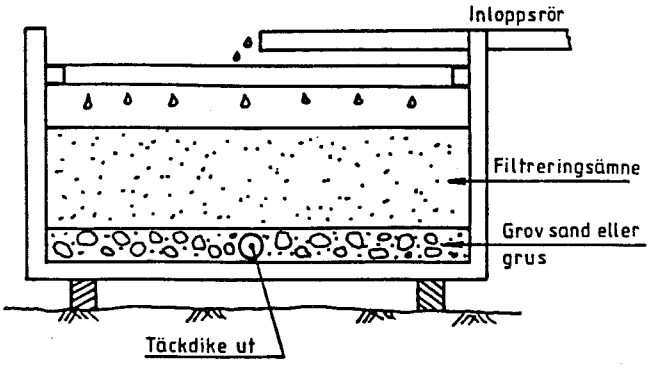


Fig. 3. Filtrering av avrinningsvatten

NJF Utredninger no. 98, 1994. In SWED, 9 pp, 3 figs., 3 refs. Author's summary.

Repeatability and heritability of some male and female fertility traits in foxes

Hilkka Kenttämies

Good fertility is economically important to fox breeders. Males and females are selected by a fertility index in order to ascertain good fertility results. Furthermore males used for artificial

insemination are supposed to have high semen quality. The purpose of the present study was to compare repeatability and heritability of some male and female fertility traits for purebred silver foxes and blue foxes. Male fertility was defined as conception rate and litter size due to the inseminating male.

In 1990-1993 a total of 1749 silver fox and 2907 blue fox females were inseminated and recorded in an AI project in the middle of Finland (Suomenselkä). A Sampo recording system was used. Apart from the station males some private males were used for the insemination. Genetic parameters were analyzed using the REML animal model. Analyses were done separately for one year old females and for all-aged females with repeated records.

In silver fox females, the estimates of heritability for litter size per whelped female tended to be fairly similar for one year old females (h^2 = 0.08) and for females with several observations (h^2 = 0.13). No additive genetic variance was found for litter size per inseminated young female whereas a moderate heritability of 0.15 appeared for females with repeated records. Low heritabilities for conception rate were found for both the female groups (h^2 = 0.05 vs. 0.08). A lower heritability for date of heat was found for young females (h^2 = 0.02) than for those with repeated records (h^2 = 0.10). Date of heat seemed, however, to be highly repeatable (r = 0.56) due to a high permanent environmental effect for females with several records.

Repeatabilities analyzed for inseminating males tended to be lower for young females than for females with repeated records. Great differences appeared for repeatabilities of conception rate between the female groups (r = 0.03 for young females vs. r = 0.29 for those with repeated records). Minor differences existed between repeatabilities for litter size per inseminated female (r = 0.04 vs. r = 0.12). However, litter size per whelped female did not seem to be affected by the inseminating male.

Results obtained for silver foxes were compared with those for *blue foxes*.

NJF Utredninger no. 98, 1994. In ENGL. Only abstract received. Author's abstract.

Effect of direct and maternal inbreeding on reproduction in mink

Peer Berg

Results from three years' utilization of alternating inbreeding (father-daughter matings) and outbreeding are presented. The design allows for distinction between direct (offspring) and maternal (mother) inbreeding on reproduction.

The average inbreeding obtained in the four combinations were 0(0), 0(0.22), 0.20(0), and 0.20(0.15) for offspring (mother). The corresponding litter sizes at birth were 6.33, 5.88, 5.95, and 5.13, respectively.

The degree of maternal inbreeding had a stronger effect on litter size at birth than at 3 weeks, whereas the effect of direct inbreeding on litter size increased from birth to 3 weeks of age.

Further, a small effect of direct inbreeding on the number of stillborn kits and early survival was observed. Maternal inbreeding did not affect the number of barren females. Further, a curvilinear effect of time of birth and duration of pregnancy on litter size was found.

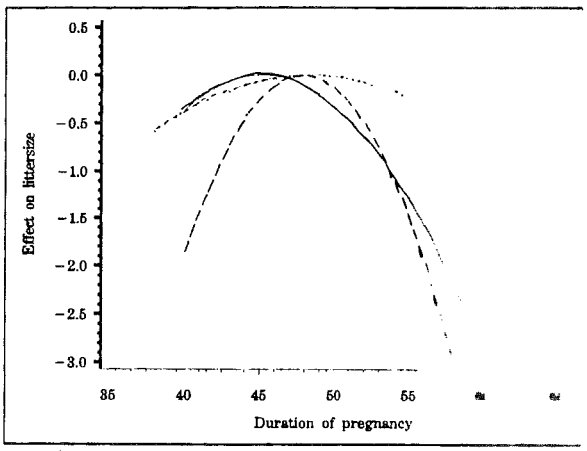


Fig. 2. Estimated effect of duration of pregnancy in days on littersize at birth. Curves for three years shown.

NJF Utredninger no. 98, 1994. In ENGL, 8 pp, 2 tables, 2 figs., 5 refs. Author's abstract.

Early growth of mink kits heritability and relations to skin characteristics

Bente Krogh Hansen

The investigation is based on the size of scanblack mink kits from 5 generations. The body weight and body length have been recorded individually at birth, at 2, 4 and 6 weeks of age and after weaning once a month from July until pelting. A slight difference between sexes exists both in weight and length already at birth and increases in 6 weeks on average to 40 g and 10 mm, respectively. A negative relationship is found between litter size and body weight of kits at birth and until 6 weeks but the effect decreases towards pelting. Medium high estimates for heritability (h^2 = 0.2 - 0.4) were found for both body weight and body length. From 2 weeks until pelting the body weight shows increasing positive correlation to skin size, but increasing negative correlation to skin quality. The advantage of using body length seems to be that there is not as strong a negative correlation to skin quality as with body weight.

NJF Utredninger no. 98, 1994. In DANH, 11 pp, 6 tables, 15 refs. Author's abstract.

Line breeding and line crossing in mink

Ulla Lund Nielsen

By attaching different weights to subindices when selecting breeding animals with the aid of DanMink, it was possible to create 2 lines which were quite divergent from each other with respect to pelt traits. However, it was not possible to achieve clear differences in reproductive traits in spite of the fact that in one of the lines, the kit's litter index was weighed with 60% compared to just 10% in the other line.

Crossing of the two lines, which were selected very divergently for 8 years, did not result in heterosis with regard to neither reproductive nor breeding traits.

Crossing of the two lines resulted in intermediate values in all pelt traits while reproduction was not improved (only F_1 were studied).

The cross results correspond to those which minimally could be expected when, for example, purchasing animals. If one's own animals have poor pelt traits it is possible to improve them by purchasing breeding animals from farms with good pelt traits.

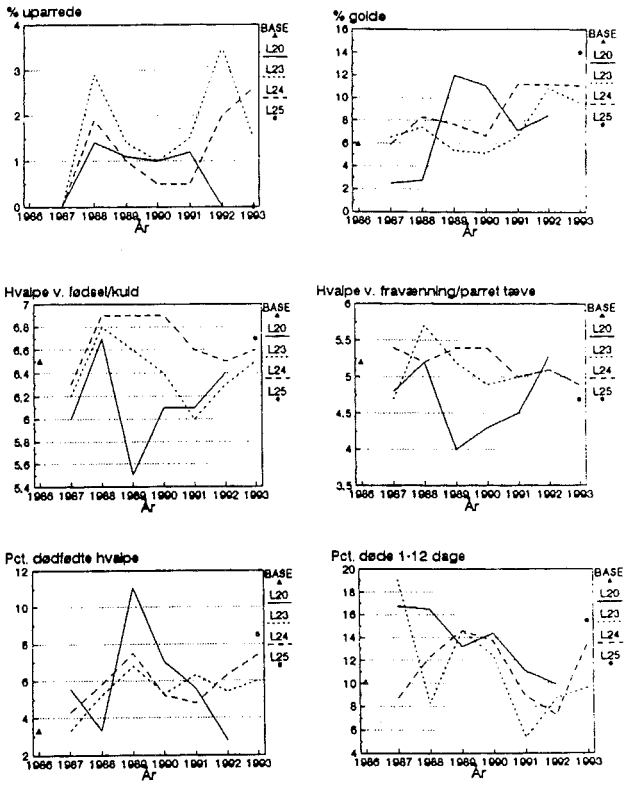


Fig. 1. Reproduction- and viability results

NJF Utredninger no. 98, 1994. In DANH, 11 pp, 2 tables, 3 figs., 4 refs. Author's abstract.

Selection experiment for and against pelt chip in mink

Ulla Lund Nielsen

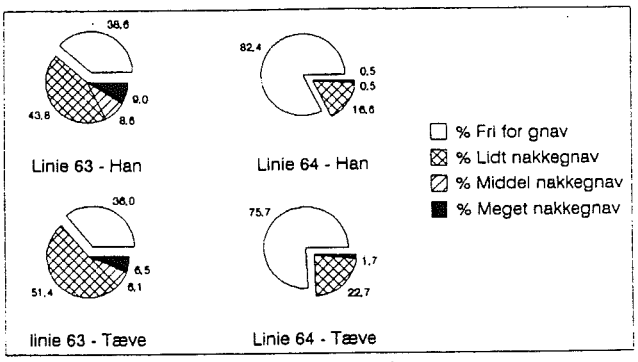


Fig. 3. Halegnav. Procentvis fordeling ved livdyrsortering 1993.

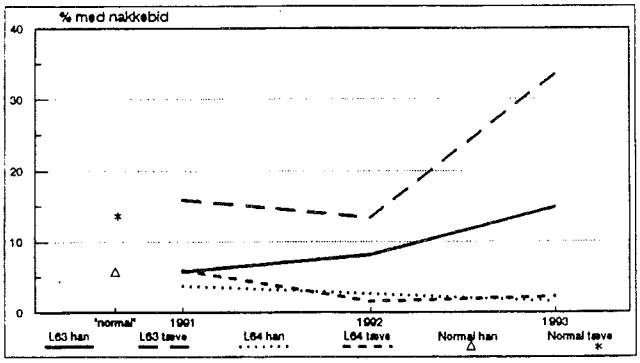


Fig. 4. Udvikling i nakkegnavfrekvenser.

Breeding animals in line 63 (following indexation) are, as far as possible, selected at live grading in November for having nibbled their cage partner in the neck. Line 64, correspondingly, are selected for having nibbled their cage partner in the neck as little as possible.

After four years of selection in lines 63 and 64, at live grading in 1993 the females had 32.2% and 2.3% neck chip, respectively, 52.3% and 5.6% body chip, respectively, and 64.0% and 24.4% tail chip, respectively. The differences in chip between the two lines was also observed in the males, but to a lesser degree.

Even though selection in the two lines has been directed for or against nibbling in the neck of the cage partner, it is worth observing that there are considerably more body chips in line 63 than in line 64, for both males and females.

The heritability of nibbling (which must be regarded as a categorical trait) has, by means of Proc Nested (SAS), been calculated to be approximately 0.3 and the trait can be considered to be moderately heritable. The phenotypical correlation between neck nibbling and body nibbling at live grading is 0.5-0.6.

An investigation of the phenotypical correlation between pelts and animals showed a significant correlation of 0.8 between the frequency of nibbling at live grading and at pelt grading.

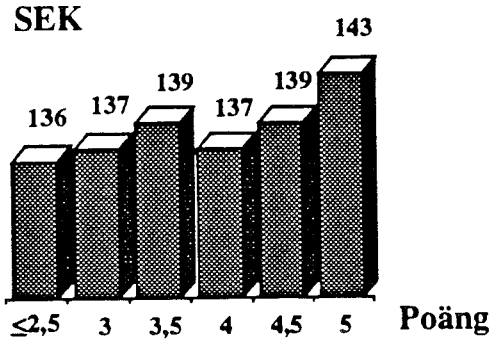
There are no significant phenotypical correlations between nibbling frequencies and pelt quality, colour, clarity, length and litter size.

While at the same time considering other production economic traits, one must, as far as possible, not select animals for breeding which can cause pelt chips in the neck of the cage partner.

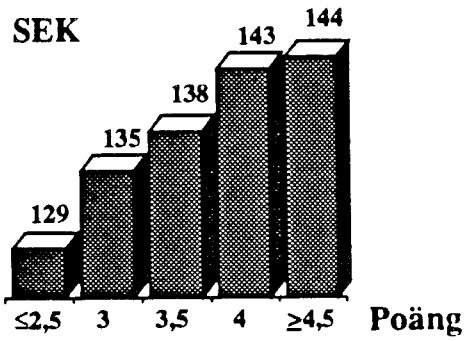
NJF Utredninger no. 98, 1994. In DANH, 8 pp, 1 table, 4 figs. Author's abstract.

Economic profit from improvement in litter size, body size and pelt quality in mink

Gabrielle Lagerkvist



Figur 6. Medelpris för hanskinn (LSM), klassificerade för helhetsintryck i november som levande djur (1986 - 1989).



Figur 7. Medelpris för hanskinn (LSM), klassificerade för helhetsintryck före ordinarie auktionssortering (1986 - 1989).

For most fur breeders, the main breeding goal would be to maximize the economic profit. The present report comprises analysis of the economic profit by improving litter size, body size/skin length and pelt quality by one unit. It is further studied if or how skin size and pelt quality are affected by the size of the litter where the kit was born. During the years 1985 - 1989, litter size, body weight, skin size, pelt quality, and sales price were recorded in 3000 male Standard mink. The recordings were performed during a selection experiment compri-

sing the traits litter size, body weight and pelt quality. Skins from kits originating from large litters tended to be more expensive than those from small litters. The loss in skin size with increasing litter size was negligible. Only animals/pelts from litters of ≥ 10 kits tended to be smaller and of poorer quality. The highest pelt prices were achieved for the lightest kits (<1700 g September weight, <2000 g pelting weight) and for the heaviest (>2500 g September weight, >2700 g pelting weight). An improved pelt quality of the small skins seemed to compensate well for the loss in skin size. The live animal grading of pelt quality gave no statistically significant differences in sales prices between classes. The difference between the highest score (5) and the lowest (≤ 2.5) was only 7 SEK. Corresponding difference was 15 SEK when skins were graded. The highest economic profit was achieved when the "number of units" (pelts) was increased. Cost/benefit calculations showed that the value of each extra kit was worth 70 SEK, at an average sales price of 150 SEK, and 170 SEK at sales price level 250 SEK.

NJF Utredninger no. 98, 1994. In SWED, 8 pp, 9 figs. 11 refs. Author's abstract.

Economic analyses of pelt quality (mink)

Ejner Børsting

In the planning of a breeding programme the economic value of different traits plays an important role. Pelt quality is a group of traits where special analyses are needed to obtain realistic economic weight factors. The traits are often correlated and "clean" estimates for the traits can only be obtained by adjusting each trait for influences from the others and that can only by done by complex statistical models.

The Breeding Committee in the Fur Animal Division of the Scandinavian Association of Agricultural Scientists (NJF) has conducted such analyses for a couple of years. The results have been published in the Scandinavian Fur Magazines and made available to the Advisory Service in a condensed form.

The paper shows the results of the analyses of mink pelts sold in Denmark and Finland in 1992/93. The colour types Scanblack, Scanbrown, Scanglow, and Pastel are analyzed. Only pelts free of defect codes are used and groups with a low number of lots are excluded. The results are shown graphically for Scanblack, Scanbrown and Scanglow.

Quality and size have about the same influences on pelt price in Denmark and Finland, but some differences are seen for clarity in the two countries.

The points used to range the breeding farms on the official Hitlists have low relation to the market's reaction to differences in the traits.

The value of pelt quality is highly overestimated in both Denmark and Finland.

NJF Utredninger no. 98, 1994. In DANH, 27 pp, 20 figs. Author's abstract.

New breeding plan in Norwegian fur breeding

Kai-Rune Johannessen, Einar J. Einarsson

The first Official Breeding Plan for the Norwegian fur breeding was presented in 1983. This plan was the first of its kind nationally as well as internationally, and has now been operating for 10 years. A major revision of the plan was started in 1991/92 and is now completed. To complete the plan the Department of Breeding and Genetics in the Norwegian Fur Breeders Association has been cooperating with external institutions like the Agricultural University of Norway and The Norwegian College of Veterinary Medicine. The revised plan covers three main subjects. The first is an evaluation of the effects of the plan the last 10 years, the next is a revision, and especially a precise definition of the breeding goals. Finally there are propositions for changes in the breeding activities. A major breeding activity in the present period is the Field Recording System (Pelsdyrkontrollen) as a basis for breeding on the farms as well as nationally. A main goal is to increase the number of participants in the system. Both the skin exhibitions and the live animal exhibitions will still be important breeding activities. A reorganisation of the breeding to a more pyramidal organisation is outlined.

NJF Utredninger no. 98, 1994. In NORG, 12 pp, 5 tables, 2 figs. Author's abstract.

A DanMink databank as support to a commercial breeding program - a tool for the mink farmer and the local adviser

Michael Sønderup

The extensive use of personal computers in Danish mink breeding has made it possible to develop a data bank system run by the local advisory service. The users of the DanMink system send a copy of their files to the local adviser twice a year. The adviser transfers the data to SAS data sets and runs a set of statistics on the data. A report is then issued and given to the farmer. It gives the farmer a survey of the breeding work and estimates of the latest genetic progress. The normal genetic parameters are also estimated. The adviser helps the farmer to use the report for improvements in his breeding programme and the adviser's own know how is enhanced by the system. New statistics are developed every year.

The breeding databank of Funen and South Jutland Fur Breeder Association has been run permanently since 1992. Today 51 farmers with a total of 70,000 mink females participate in the bank. The contents of the breeding reports are mentioned. Some of the summaries of the results from the participants in the databank are presented.

NJF Utredninger no. 98, 1994. In ENGL, 11 pp, 13 tables, 4 refs. Author's abstract.

Liverlipids and peroxisomal ß-oxidation in blue foxes and mink

Øystein Ahlstrøm, Anders Skrede

Previous investigations have shown that blue foxes and mink have different fat content and fatty acid compositions in the liver (*Rouvinen & Kiiskinen, 1989*). The species difference was particularly a considerably higher level of long-chain n3 fatty acids, typically fish oil in blue fox liver fat. This difference was proposed to be due to reduced peroxisomal ß-oxidation capacity in blue foxes. Our investigation focused on the liver lipids of the two species and the peroxisomal ß-oxidation activity.

Three levels of fish oil were used in diets for blue foxes and mink in the period from July/August to November. The fat:carbohydrate ratios on ME basis were 65:5, 55:15, 40:30, and the corresponding fat percentages on a dry matter basis were 35.5, 26.9, and 18.0, respectively. Fish oil accounted for 85, 80, and 65% of the dietary fat, respectively. The liver phospholipid (PL) content was 0.5-1% for both species, whereas the contents of total liver lipids were about 10% in mink and 5% in blue foxes. The fat content of the liver was only slightly influenced by the dietary fat level. The PL fraction was dominated by long-chain n3 fatty acids in both species. The n3:n6 ratio in PL decreased with decreasing dietary fat level and the ratio was highest for mink. However, blue foxes revealed higher n3 levels and n3:n6 ratios in total liver fat. This relation can be explained by the relatively higher contribution of PL to total liver fat in blue foxes than in mink.

Two diets were used in Experiment 2, one high fish oil diet (7.2%) and one low level (1.4%). The fat:carbohydrate ratio was 55:15 in both diets. The peroxisomal ß-oxidation activity in liver tissue from both species was determined at pelting. The peroxisomal ß-oxidation activity increased with increasing dietary fat level for both species. Blue foxes revealed higher activity than mink.

The results of this study show that there are distinct differences between blue foxes and mink in liver lipid content and composition. These differences appear not to be related to the peroxisomal ß-oxidation capacity of the species. The liver lipid analyses did not indicate any differences between the species in their ability to metabolize n3 fatty acids originating from fish oil.

NJF Utredninger no. 98, 1994. In NORG, 9 pp, 4 tables, 10 refs. Author's abstract.

Heat production measured in two lines of mink (*Mustela vison*) selected for high or low feed conversion

Jan Elnif, Niels Therkildsen

Objective

Mink have been domesticated for almost one hundred generations during which time the animals have mainly been selected for size, fur quality and fertility but little attention has been

drawn to differences in feed conversion and heat production. The aim of this study was to measure the heat production in two groups of mink selected for either high or low feed conversion.

Methods and materials

Two lines of mink of the scanglow colour type were selected for high and low feed conversion during three generations. Feed conversion measured as weight gain per gram ingested dry matter was registered for 4 weeks in the growth period in the month of July. 6 adult males with the best feed conversion from the high feed conversion strain and 6 males having the poorest feed conversion in the low feed conversion strain were selected for the study of heat production (HE). HE was measured by open-circuit indirect calorimetry over 24 hours, as well in ad libitum fed animals as in animals fasted for 24 hours before measurement. Blood samples were collected and analyzed for both free and total amount of thyroxin (FT_4 & TT_4) and triiodothyronine (FT_3 & TT_3).

Results

Parameter ± SD	High feed conversion	Low feed conversion
Fed:		
Heat production, kJ/kg$^{0.75}$	658[a] ± 76	814[a] ± 79
RQ	0.82[b] ± 0.04	0.80[a] ± 0.03
Fastened:		
Heat production, kJ/kg$^{0.75}$	534 ± 151	661 ± 155
RQ	0.76[b] ± 0.01	0.75[a] ± 0.01
Thyroidhormons:		
nmol/l TT4	21.1 ± 1.5	21.9 ± 3.4
nmol/l TT3	0.68 ± 0.08	0.60 ± 0.09
pmol/l FT4	10.9 ± 3.0	11.4 ± 4.9
pmol/l FT3	3.9 ± 0.4	3.7 ± 0.7

a) $p < 0.005$; b) $p < 0.01$; c) $p < 0.005$

Conclusion

Heat production (HE) in mink with low conversion was 24% higher than in mink with high feed conversion both for fed and fasted animals. There were no differences in thyroid hormone levels between the two groups and the difference in HE is discussed in relation to individual activity patterns.

NJF Utredninger no. 98, 1994. In DANH, 8 pp, 6 tables, 7 refs. Author's summary.

Restrictive feeding of pregnant mink females in the period just before birth

Steen Møller

In practice, mink females are subjected to varying feeding strategies in the gestation period. After mating, the females are often fed on or a little above the requirements for maintenance, but towards the time of birth the amount of feed is often reduced for heavy females in order to avoid complications in connection with birth. Females giving birth late will therefore often have been fed restrictively over a comparatively long period. The effect of restrictive feeding in this period is unknown. It is, however, known that the females need extra energy for the development of foetuses and mammary gland tissue.

Knowledge of the consequences of restrictive feeding in the latter part of the gestation period to the development of females and kits is therefore necessary.

An experiment was carried out where 52 first year pastel mink females were fed 20% below normal farm level from April 6 to birth. A control group comprised 50 young pastel females fed according to normal farm routine. Fifteen females from each group were weighed 7/1, 25/1, 3/2, 17/2, 1/3, 15/3, and 21/4 as part of the normal production control. The other females were weighed 17/2 and all females and kits were weighed at birth, and at 4 and 6 weeks of age.

Restrictive feeding had no effect on reproduction. The females gained less weight in the period with restrictive feeding but lost less weight during the nursing period, so that at weaning their weight was the same. Kit growth was a little lower in the latter part of the nursing period. No differences in the frequency of diseases in the nursing period were found.

NJF Utredninger no. 98, 1994. In DANH, 12 pp, 3 tables, 4 figs., 5 refs. Author's summary.

The nutritive value for mink of decorticated mill fractions of wheat exposed to different treatments

Christian Børsting, Knud E. Bach Knudsen,

The nutritive value of boiled and enzyme treated whole grain wheat and six mill fractions prepared by decortication was studied in digestibility trials with mink. The decortication process yielded fractions varying considerably in botanical and consequently in chemical composition. The whole kernels (WK) and the six mill fractions (F1-F6) were provided to mink either boiled or after treatment with cell wall degrading and proteolytic enzymes and mixed into diets to comprise 45-50 g dry matter (DM) per 100 g DM.

The amount of starch in the diets based on boiled fractions ranged from 8.5 g per 100 g DM in the diet prepared from the fraction enriched in pericarp/testa (F1) to 30 g per 100 g DM in the diet containing the endosperm enriched inner layer (F6). Total non-starch polysaccharides (NSP) run conversely constituting 21.3 g per 100 g DM in diet F1 versus 5.0 g per 100 g DM in diet F6. Enzyme treatment resulted in a significant depolymerization and solubilization of cell wall NSP and of starch.

The digestibility of energy was significantly higher (~3 %-units) in the diets with enzyme treated wheat fractions compared to diets with boiled products. This was mainly due to higher digestibility of the carbohydrates and to a lesser extent to higher protein digestibility. The digestibility of crude carbohydrates (calculated by difference) was consistently higher in enzyme treated fractions compared to boiled fractions, the differences varying from 13 %-units in F1 to 5 %-units in F6. Starch digestibility was ~90% for both boiled and enzyme treated fractions.

The higher digestibility of crude carbohydrates in enzyme treated fractions could be ascribed to depolymerization of NSP and to higher digestibility of the remaining NSP in enzyme treated fractions (28-35%) compared to boiled fractions (12-25%). A significant positive digestibility of NSP in both boiled and enzyme treated fractions combined with substantial amounts of short-chain fatty acids in faecal material suggest that microbial degration of cell wall NSP can occur in mink despite the high rate of passage and the relatively low microbial activity in the gastrointestinal tract.

NJF Utredninger no. 98, 1994. In ENGL, 13 pp, 4 tables, 16 refs. Author's abstract.

Effect of formic, propionic and benzoic acid in slaughter-house offal conservation

Ilpo Pölönen, Vesa Toivonen, Jaakko Mäkelä

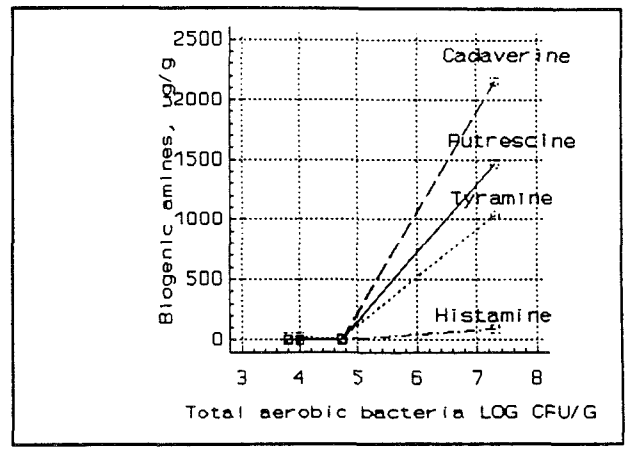


Fig. 3. Biogenic amine concentration plotted against total aerobic bacteria, µg/g of feed. Samples are from silages stored for 35 days (both temperatures, N=12)

Slaughterhouse offal from cattle was stored at +4°C and +2°C for five weeks in order to evaluate antimicrobial effects of formic (FA), propionic (PA) and benzoic (BA) acid. FA (0.6% w/w) was used as an acidulant in all the following treatments (w/w): 1) -, 2) PA 0.2%, 3) PA 0.1% + BA 0.1%, 4) BA 0.2% and 5) PA 0.3% + BA 0.1%. All treatments were done in triplicates in 1+-kg minisilos.

At +4°C all additive treatments preserved fairly well but only BA 0.2% and PA 0.3% + BA 0.1% were able to prevent both fungal and bacteriological deterioration of the offal for the whole five-week period. At room temperature most silos became organoleptically spoiled within 1-3 weeks, however, in silages with PA 0.3% + BA 0.1% only minor fungal growth was detected at the end of the experiment.

Generally, deterioration was predominated by yeasts that first initiated growth on the surface

of the silage and were then followed by aerobic bacteria which caused a massive deterioration of the whole silage in a few days, especially at room temperature. PA alone at the level of 0.2% had only a weak effect against yeasts.

Microbiological quality was a good indicator of the overall quality of the silages. Formation of biogenic amines could be seen only in silos where aerobic bacteria grew for several days and their number exceeded log 6 CFU/g. However, some changes in feed quality could also be seen in microbiologically stable silages. The portion of free fatty acids increased in all treatments in the beginning of the storage and later went up to 30% of the total fat. Also, total volatile nitrogen (TVN) tended to increase gradually.

By the concept of a preservation system where several treatments, such as acidification, preservatives and temperature are combined, microbiologically stable and low cost, cattle slaughter offal silage of fairly high pH can be produced. The use of silage can be increased without neutralizing the feed. Preservation takes place immediately and can be monitored by pH determination. With the combination of FA (0.6-1.0%, pH 4.1 or lower) and preservatives BA alone (0.2-0.3%) or BA (0.1%) together with PA (0.3%) a 3-week storage time is achieved at +20°C, but at +4°C can be significantly lengthened. Also, prevention of fungal growth on the surface (coverage, layer of crystalline BA), always contributes to the improvement of the stability of silage.

NJF Utredninger no. 98, 1994. In ENGL, 11 pp, 2 tables, 3 figs., 13 refs. Author's abstract.

Influence of oxidized fish oil in mink diets on nutrient digestibility, fatty acid accumulation, performance, and health

Christian Børsting, Ricarda M. Engberg,

In an experiment with 18 male adult pastel mink during 15 weeks, the influence of high amounts (55% of metabolizable energy) of fresh and oxidized fish oil (200 and 400 meq. 0_2/kg oil) on performance, health, and fatty acid accumulation in liver and inguinal fat was examined.

The quality of the experimental oils was followed during oxidation and storage (13 weeks, -80°C, exclusion of light and oxygen), and the apparent digestibilities of macronutrients, fatty acids, and α-tocopherol were determined during the fifth week of the experiment.

1. During storage the peroxide values of the respective oils were kept relatively stable, but a considerable loss of n-3 fatty acids was recorded especially in the heavily oxidized oil (400 meq. 0_2/kg oil).
2. Feed intake, growth, and performance in mink were negatively affected, in particular by the heavily rancid fish oil.
3. The apparent digestibility of total fatty acids decreased from 98% (fresh oil) over 94% (200 meq. 0_2/kg oil) to 78% (400 meq. 0_2/kg oil).
4. The apparent digestibility of α-tocopherol was in the range of 60% and was not influenced by the dietary fat quality.
5. The fatty acid composition of liver and inguinal fat clearly reflected the marine origin of the dietary fat source. The accumulation of long chain fatty acids (C20, C22) was extremely high in both liver (28-31% of total fatty acids) and inguinal fat (38-42%).
6. Generally, the severity of the pathological findings was closely related to the quality of oxidized fish oil and to the duration of the dietary treatment.
7. Elevated plasma enzyme activities of CK, ASAT and ALAT indicated degenerative processes in liver and skeletal muscle in the mink fed the oxidized oil.
8. Following the intake of oxidized fish oil, a decrease of plasma α-tocopherol concentration and an increase of plasma GSH-Px-activity was observed.
9. Irrespective of the dietary fish oil quality, all animals showed low haemoglobin concentrations (5.5-7.9 mmol/l) as well as a low liver iron content (<300 μg/g dry matter) at the end of experiment. These results imply the development of iron deficiency anaemia probably due to an impaired iron absorption.

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

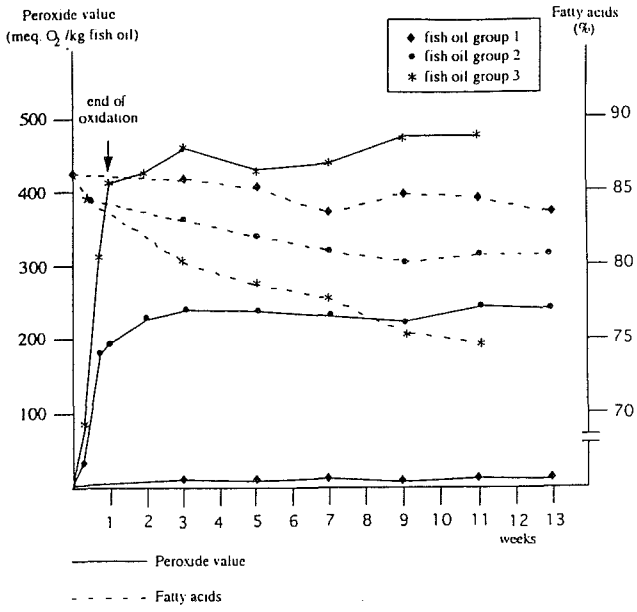


Fig. 1. Peroxide value (meq. 0_2/kg) and content of fatty acids (%) in fish oil during oxidation and storage

NJF Utredninger no. 98, 1994. In ENGL, 15 pp, 5 tables, 1 fig., 29 refs. Author's abstract.

Underfur hair growth in relation to weight gain in young mink, blue fox and silver fox

Maija Valtonen, Liisa Jalkanen, Leena Blomstedt

In young mink winter pelage, the period of underfur hairs in anagen lasts about 14-15 weeks. The anagen phase for an individual hair lasts about 6-7 weeks. In blue fox the underfur hairs of the summer pelage do not moult completely until growing winter underfur hairs appear. Thus there are growing underfur hairs during the whole growing period of the young blue foxes. The anagen phase for an individual hair has been estimated to last at least 8-9 weeks. In silver fox the period of winter fur hairs in the growing phase is about 5 months. Variations in underfur hair growth and body weight gain were monitored at two week intervals from weaning to pelting in order to determine whether there is a critical phase during the growing period of the winter pelage during which extra care of feed composition is needed to ensure a good pelt quality.

The growth of the winter pelage was very fast in mink after mid-October when the growth rate of underfur hairs measured 14 mm per two weeks. The average final underfur hair length was 15.3 mm. The fastest hair growth in mink occurred after the increase in body length had ceased and only fat deposition continued. In blue fox the underfur hairs grew gradually and body weight gain was even. The guard hair cover grew very fast from late September to mid-October. In silver fox the growth rate of underfur was fastest from mid-September mid-October. However, the main hair mass developed in October when the final body length obviously had been reached and the maturation of winter pelage was finished not earlier than in December. The periods of heavy hair growth in fur animals probably need extra attention in feeding. Besides protein composition the great importance of carbohydrates during hair growth should not be neglected.

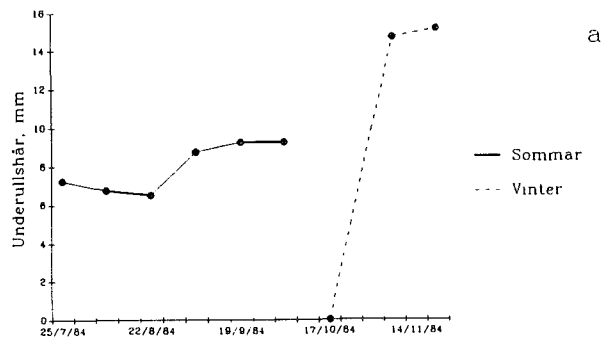


Bild 1a. Bottenullens medellängd i minkhanvalpars (n=4) sommar- och vinterpäls under uppväxtperioden.

NJF Utredninger no. 98, 1994. In SWED, 10 pp, 4 figs., 24 refs. Author's abstract.

Preferences of silver and blue foxes for farm cage and pen

Hannu Korhonen, Paavo Niemelä

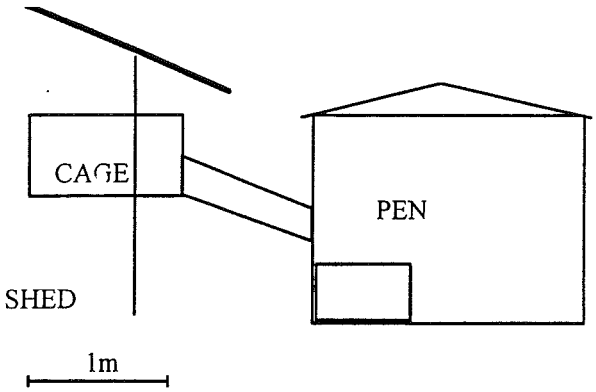


Figure 1. Schematic picture of the cage-pen housing combination from a lateral perspective. A net tunnel connects the shed cage to the ground pen. Inside the pen was also a wooden box on the roof of which the fox could access through the tunnel.

Interesting ethological studies in alternative housing conditions have recently arisen in response to the increasing demands of anti-fur campaigns for improved farming conditions, including environmental enrichment and ground contact. In the present study, preferences of male silver and blue foxes were assessed in a farm cage-pen housing system by means of an infrared detector and video camera. The ground floor pen was 2 m wide, 4 m long and 1.5 m high, and covered with a plastic roof. A wire-mesh tunnel of 1 m in length (diameter 30 cm) connected the shed cage (110 cm long x 107 cm wide x 60 cm high) to the pen. The devised testing system proved valid for the evaluation of the animals' preference for the two different housing conditions. Time spent for locomotion, sitting and standing was of the same order of magnitude in both sections in silver foxes. However, the cage floor was utilized significantly more ($p<0.001$) than the ground floor for sleeping. Feeding location did not significantly influence preference, although some tendency was evident. Time used for locomotion was about the same in the adult blue foxes in both test sections. However, juvenile blue foxes preferred the cage section significantly ($p<0.01$). In light of the observed preferences, cage flooring is not considered a poor surface for farm-raised silver and blue foxes.

NJF Utredninger no. 98, 1994. In ENGL, 16 pp, 3 tables, 2 figs., 18 refs. Author's abstract.

Effects of fasting and superficial hibernation on body condition and reproduction in the raccoon dog in farm conditions

Juha Asikainen, Seppo Pasanen, Hannu Korhonen

In nature, the raccoon dog (*Nyctereutes procyonoides*, Gray 1834) is known to spend the coldest part of the winter in superficial hibernal sleep under subarctic regions. However, in farm conditions the raccoon dogs are taken care of throughout the winter being giving food daily and kept mostly without nests. The main aim of the experiments carried out at the fur farm of Siikasalmi Research Station during 1992-1994 was to find more information on the fasting and hibernation process and its effects on body condition and reproduction in the raccoon dog.

The experiments consisted of two groups: (1) normal feeding groups (10 females, 8 males) with a daily energy supply of 1580 kJ/animal 1992-93, 700 kJ/animal (36 females, 10 males) 1993-94, and (2) fasting group without any food but having a nesting box with straw from Nov. 26th 1992 to Feb. 12th 1993 (19 females, 8 males) and from Dec. 2nd 1993 to Feb. 7th 1994 (34 females, 11 males). Water or ice was freely supplied to all animals and they were inspected daily and remained healthy during the course of the experiments. Blood samples were taken for the analyses of creatine kinase (CK) and gamma-glutamyltransferase (GGTP) activities in serum. Urea and ammonium (92-93), haemoglobin and glucose (93-94) levels were also determined. The animals were weighed during the experiments and the energy balances were measured. After the experimental period both groups were maintained under identical conditions through the subsequent breeding season.

At the beginning of the experiments the mean body masses of the raccoon dogs were the following (1992): Groups (1) - females 8.8 kg (9.6), males 10.0 kg (10.3) and group (2) - females 8.9 kg (9.5), males 9.8 kg (10.5). On February the body masses were: (1) - females 7.0 kg (8.2),

males 8.1 kg (8.8) and (2) - females 5.8 kg (6.9), males 6.5 kg (7.4). There were no statistical differences between groups (1) and (2) in enzyme activities which were normal also in the fasting animals. Thus, the animals were not starving in the fasting treatment. Urea, ammonium, haemoglobin and glucose levels of the blood remained also normal during the experiments in both groups. The breeding results were: mating success was 100% in group (1) and 84% in group (2) 1994 (1993 both groups 100%). The rate of pregnancy was 87% (68) and 85% (80), the mean litter size was 7.4 in both groups (5.7 and 6.3), and the mean whelping result/mated female 5.1 (1.8) and 6.3 (4.0) in the groups (1) and (2) respectively.

The present experiments indicate that in Finnish boreal regions the raccoon dog with good nutritional condition in late autumn does well in the coldest winter in farm conditions by fasting and superficial hibernal sleep. At the same time the breeding results were good in the fasting treatment (1994). There is a doubt that the females of the group (1) were too obese during the whelping time 1993. Therefore, more information is needed on the metabolism of the raccoon dog in farm conditions.

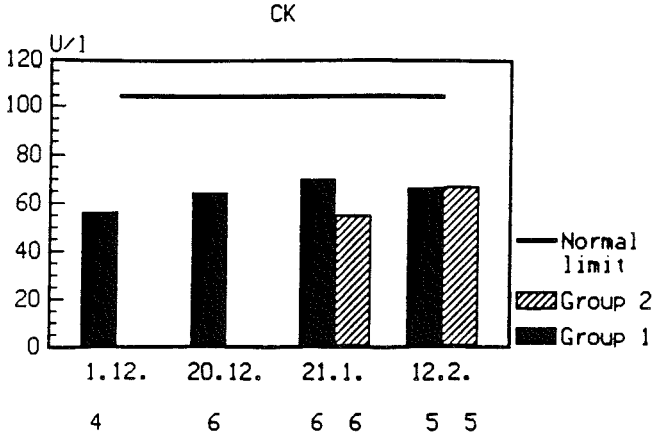


Fig. 1. The activities of the CK in blood serum.

NJF Utredninger no. 98, 1994. In ENGL, 6 pp, 1 table. Author's abstract.

Use of various platforms and nestbox by farmed blue and silver foxes

Hannu Korhonen, Paavo Niemelä

The European Convention has issued a recommendation that each weaned fox shall have a whole-year shelter, either a resting platform or nestbox, but preferably both available. Factors affecting platform use were studied in farmed foxes by monitoring the animals either with 24 hour video measurements or daily visual scanning observations. Both year-round and 5-month-long seasonal experiments were conducted. Great individual variation in the amount of use was found. In both species, however, females typically used the platforms more than males. Previous platform experience and the platform ceiling influenced usage only during the first two study months. Platform type affected usage very significantly. The most favoured platform was the V-type, whose shape resembles that of the sleeping hole used by foxes in the wild. Platform use varied significantly year around, being lowest during winter, and highest in summer. The fundamental reason for a high seasonal variation remained unsolved, however. Seasonal changes in factors such as body weight, body surface area, temperature or daylength are likely involved in this phenomenon. Platform use dramatically decreased after females were given whelping nestboxes as they preferred the nestbox roofs. A preference test system was additionally devised to assess the preferences for various types of resting platforms and for the cage floor. The test system was comprised of 7 small separate cage sections (75 cm wide x 107 cm long) situated inside one large cage (52 cm wide x 525 cm long). This arrangement gave the test animal free access from the large cage into each of the smaller cages. Platform use was low because the test foxes preferred the cage floor. Location of the platform in the test situation affected preference, but the amount of previous individual platform usage did not. The nestbox roof was preferred the most of all the platforms studied.

NJF Utredninger no. 98, 1994. In ENGL, 24 pp, 6 tables, 7 figs., 7 refs. Author's summary.

The effect of cerone treated barley on the reproduction conditions of mink

Birthe Damgaard

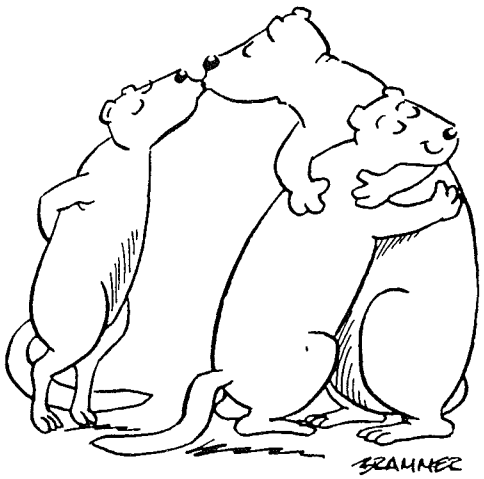
Cerone is a pesticide used in agriculture as a growth regulating factor for cereal crops.

A reproduction-toxicological experiment was carried out with mink according to international guidelines.

The experiment was a two-generation experiment with 42 males and 84 females. The animals were randomly distributed on three experimental groups each with 14 males and 28 females. The three groups were fed diets containing untreated barley, barley sprayed with the normal dose of Cerone, and barley sprayed with 4 x the normal dose of Cerone, respectively. 10% of the diet was barley, corresponding to 20-25% of the dry matter content of the feed mixture. In the experiment no effect could be seen on weight and feed intake for males, females and kits in the two generations. No effects were shown in blood parameters or in pathological and histological examinations, which could be related to the experimental treatment. Reproduction examinations of number of sterile and cryptorchid males, number of mated and pregnant females, number of kits at birth, sexual distribution and number of dead kits in the lactation period showed no difference between groups.

In summary it can be concluded that diets containing 10% barley treated with normal dose and 4 x normal dose of Cerone, respectively, had no negative effect on the variables measured.

NJF Utredninger no. 98, 1994. In DANH, 6 pp, 4 refs. Author's abstract.



Effect of cage environment on behaviour in blue foxes (*Alopex lagopus*)

Teppo Rekilä, Jaakko Mononen, Mikko Harri

Our previous results have shown that the activity during the first minute in the open field was higher among caged blue foxes if they were provided with whole-year nest boxes or resting platforms (*Harri et al., 1994*). These foxes were also less fearful and more active towards man than foxes living in standard cages. However, the behaviour of blue foxes appeared to be affected more by season and age than a changing environment. In this study the effect of whole-year nest boxes, resting platforms and the animal's position in the animal shed on behaviour in the open field and in the home cage was assessed in farmed blue foxes (n=44). The behaviour of the animals was assessed in a novel environment (activity, latency to eat) and in a home cage (capture time, activity).

The results show that the environment of the cage interior had some effect on the animal's behaviour. On the other hand, the environment outside the cage was more important. The animals nearest to the door of the animal shed were most active during the 24-h measurements in their home cage ($p<0.001$) and in the open field ($p<0.01$). Latency to eat in the open field was highest among these animals ($p<0.01$).

According to our earlier studies, high activity in the open field correlated with a high latency to eat. These together may indicate higher fear reaction among the active animals (*Rekilä et al., 1994*). So animals nearest to the door may be more fearful against man than ones living in the other end of the shed. However, further research is needed on description of the types of animal behaviour and activity and the movements of humans inside the shed before the final conclusions can be drawn.

NJF Utredninger no. 98, 1994. Poster, only abstract received. Author's abstract.

720 Beretning fra
Statens Husdyrbrugsforsøg

Report from the National Institute of Animal Science, Denmark

Outi Lohi and Christian Friis Børsting (Eds.)
Dept. for Research in Fur Animals

Research in Fur Animals at the National Institute of Animal Science

Present Status and Future Perspectives

Contribution in honour of Gunnar Jørgensen

The book contains 10 chapters dealing with different disciplines within Fur Animal research at the National Institute of animal Science, Denmark.

All chapters are abstracted in SCIENTIFUR, Vol. 19, No. 1, 1995.

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Experimental infection with *Toxoplasma gondii* in farmed minnk (*Mustela vison* S.)

H.H. Dietz, P. Henriksen, M. Lebech, S.A. Henriksen

Live *Toxoplasma gondii* tissue cysts (Strain 119) were administered orally to five mink(*Mustela vison* S.) and five mink were inoculated with a suspension of ultrasonicated *Toxoplasma gondii* trophozoites (RH-strain).

Seroconversion was observed in all animals administered live *T. gondii* cysts indicating that infection was established. Likewise seroconversion was observed in three out of four animals administered ultrasonicated *T. gondii* trophozoites. Faecal shedding of oocysts of *T. gondii* was not demonstrated in any of the infected animals.

Histologically chronic meningitis with calcification was seen in all animals. Cerebral *T. gondii* tissue cysts were detected in four animals administered live tissue cysts. The study demonstrates that mink can be experimentally infected with *T. gondii*, thus representing a potential infection source for man, when considering the pelting procedure.

Veterinary Parasitology, 47, p. 1-7, 1993. 2 tables, 12 refs. Authors' abstract.

Transmissible mink encephalopathy

R.F. Marsh

Transmissible mink encephalopathy (TME) is a rare food-borne disease of ranch-raised mink caused by an as-yet unidentified contaminant. Because TME is clinicopathologically similar to scrapie, the most probable origin of TME is feeding mink scrapie-infected sheep. However, epidemiologic observations and experimental testing of mink susceptibility to sheep scrapie have been unable to confirm this association. Investigation of a new incident of TME in Stetsonville, Wisconsin, in 1985 revealed that the mink rancher was a "dead stock" feeder using mostly downer dairy cows and a few horses. He had never knowingly fed sheep to his mink. To examine whether this incident of TME may have occurred by feeding infected cattle to mink, two Holstein steers were inoculated intracerebrally (i.c.) with mink brain from the Stetsonville ranch. They developed a fatal spongiform encephalopathy in 18 and 19 months. More importantly, both bovine brains remained highly pathogenic for mink, producing disease 4 months after i.c. inoculation and only 7 months after oral exposure. These findings indicate that there is little species barrier effect between mink and cattle and they are compatible with the Stetsonville incident of TME being produced by feeding mink infected cattle. They also suggest that there exists an unrecognized scrapie-like infection of cattle in the United States.

Prion diseases of humans and animals (edited by Prusiner, S.B., Collinge, J., Powell, J., Anderton, B.) 300-307, 1992. 1 fig., 31 refs. Authors' abstract.

Yersinia enterocolitica Serovar 1,2a,3 Biovar 3 in chinchillas

Hanns-Herbert Wuthe, Stojanka Aleksic

Yersinia enterocolitica (serovar 1,2a, 3; biovar 3, autoagglutination test positive) was isolated in a chinchilla, in which autopsy showed the typical lesions associated with pseudotuberculosis. We assume that this "chinchilla type" of *Yersinia enterocolitica* still persists among stock, more than thirty years after its discovery. A brief overview of the distribution of the pathogen in Europe and North America is given.

Zentralblatt für Bakteriologie, 277, No. 3, p. 403-405, 1992. 17 refs. In ENGL, Su. GERM. Authors' summary.

First report of a *Demodex* sp. in raccoons (*Procyon lotor*)

Amir N. Hamir, Daniel E. Snyder, Cathleen A. Hanlon, Charles E. Rupprecht

Dermodex spp. mites were seen in skin sections of 5 of 53 raccoons (*Procyon lotor*) necropsied on Parramore Island, Virginia (USA). In all in

fections, mites were present in the skin over the lower legs; in one raccoon they also were located in a follicle of a vibrissa. None of the raccoons had *Demodex*-related gross lesions. Histopathologically, minimal lesions were seen in the affected follicles. This is the first documentation of *Dermodex* spp. in raccoons.

Journal of Wildlife Diseases, vol. 29, No. 1, p. 139-141, 1993. 4 figs., 3 refs. Author's abstract.

Sarcoptic mange in ranch foxes

M. Vanderkop, M. Lowes

A severe infestation of Sarcoptes sp. on an established ranch of 1400 foxes is described from Alberta, Canada. Veterinary assistance was only obtained after many animals were severely affected.

In November 1991, 500 of the original 1400 foxes were still alive. Sources of Sarcoptes were thought to be severely infested coyotes attracted to the farm fence where they would scent-mark by rubbing along the fences. Escaped foxes loose in the compound transmitted mites to caged foxes. Ivermectin (Ivomec) had been used at 5 times the recommended dose, even though it is not licenced for use in foxes, and via an incorrect route. It is suggested that ivermectin toxicity may have contributed to mortality.

Canadian Veterinary Journal, Vol. 33, No. 7, p. 473, 1992. 2 refs. CAB-abstract.

Giardia infection in a chinchilla and the risk of human infection

U. Schonball

Giardia is an essential cause of malabsorption and maldigestion in humans and animals. This parasit can be transmitted in the cystic stage by carriers without clinical symptom via direct contact, water-borne or food-borne transmission. It is not yet concluded if wild or domestic animals may play a role as a reservoir for human infections.

A case of infection of a chinchilla serves to emphasize a potential risk of contamination, especially for children.

Kleintierpraxis 37, Heft 11, p. 785-786, 1992. 20 refs. In GERM, Su. ENGL, FREN. Authors' summary.

Outbreak of tuberculosis in *Chinchilla laniger*

M.A.S.C. Portugal, E.M.B. Calili, F.B.N. Farinha, J.L. Guerra

An outbreak of tuberculosis in Chinchilla is presented. 52 animals became sick and were tested for avian and mammalian PPDs.

The results showed that the *Mycobacterium* sp. was present.

Probably a sick boy who worked on the property was the source of infection. The symptoms and the pathologic lesions observed and the results of tuberculinization tests are discussed.

Due to the seriousness of the case, no treatment was recommended and the eradication was adopted.

Arquivos do Instituto Biologico (Brazil), Vol. 57 (1-2), p. 57-61, 1990. 1 table, 6 figs., 23 refs. In PORT, Su. ENGL. Authors' summary.

Cerebrospinal nematodiasis caused by *Baylisascaris procyonis* in chinchillas

S. Ernest Sanford

An outbreak of *Baylisascaris* cerebral disease in chinchillas from 3 ranches in southwestern Ontario, Canada, is described. From June to November 1989, about 100 chinchillas from 3 commercial ranches developed acute progressive central nervous system disease. All chinchillas eventually died or were euthanized. In July 1989, 5 live chinchillas were submitted to the Huron Park Diagnostic laboratory from these 3 ranches. The animals varied in age from 3 to 9 months old. Affected chinchillas exhibited clini-