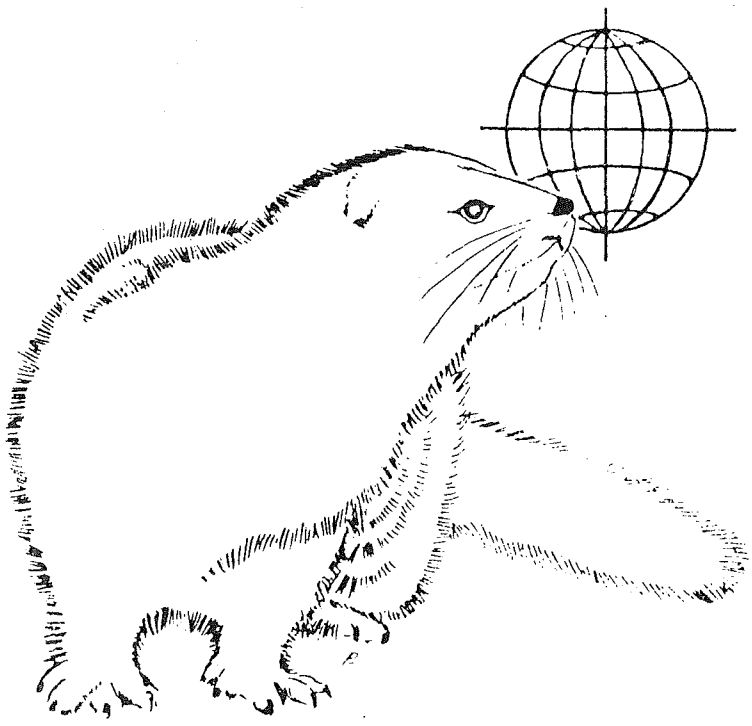

SCIENTIFUR
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AUGUST 1988

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**Early treatment reduces problems with greasy kits.**
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**Questionaire about greasy kits.**
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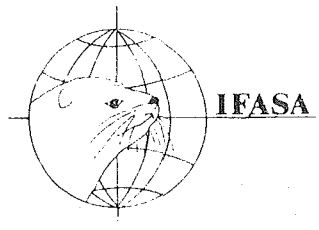

# Scientifur

February 1987

## WHAT IS SCIENTIFUR ?

SCIENTIFUR is a child of the "First International Scientific Congress in Fur Animal Production" arranged by the Scandinavian Association of Agricultural Scientists, Division of Fur Bearing Animals, April 1976 in Helsinki, Finland.

SCIENTIFUR is the SCIENTIFIC NEWSLETTER IN FUR ANIMAL PRODUCTION written in English for those involved in fur animal production.

SCIENTIFUR is a non-profit service agency regarding research and communication for the international fur animal production. By subscription, advertisement, and contribution you, therefore, support the International Cooperation regarding Fur Animal Production.

SCIENTIFUR is a quarterly, published by the Scandinavian Association of Agriculture Scientists, Fur Animal Division.

SCIENTIFUR is the only international journal which supply the Fur Animal Production Industry with news in that specific area in the shape of original reports, abstracts, titles, book reviews, and communication in relation to this. Approx. 500 titles annually.

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## See you in Canada and USA


August 21 - 28, 1988

# Notes

SCIENTIFUR, VOL. 12, NO. 3, 1988.

Writing these notes we are still hoping to receive the program for the 4th International Scientific Congress in Fur Animal Production in Canada - USA August the 21st.-28th. this year, so early that we can bring it in this issue of SCIENTIFUR.

We are sure that the fur animal scientists from the entire world are looking forward to this occassion for meeting colleauges and to hear both through the more than 100 reports given at the Congress and through informal discussions to get an up to date oversight over who is who in the scientific fur animal world, what is going on in research and the ideas being in focus in the future.

At the board in The Scandinavian Association of Agricultural Scientists (NJF), Fur Animal Division, we have been discussing the future very intensive, as mentioned in the Notes of Vol. 12, No. 2. We have also had som contacts with the Scandinavian Fur Breeders Associations. The conclusion of all this is, that many things in the future will depend on willingness to and possibilities for a better international organization of both scientists and fur breeder organizations.

The board of the Fur Animal Division has decided, that SCIENTIFUR will continue throughout 1989 (Vol. 13) nearly in the same shape as in 1988 (Vol. 12), and everybody are engaged in finding the money to realize this.

First of all the subscription price will go up to Dkr. 500,- for Vol. 13, secondly we hope that several international supply companies will advertise in SCIENTIFUR. This advertisement will give the companies access to the leading fur animal people in 30 fur producing countries, and give them the credit for supporting the international scientific information and communication.

During the Congress I will give the documentation for the fact that SCIENTIFUR Vol. 11 (1987) brought more than 450 titles of scientific reports from which 22 titles were original reports, 358 abstracts and 91 only the titles and the original journal of publication.

These reports have been published in more than 150 international scientific journals.

Evaluating the subscription price of SCIENTIFUR, you have to think about your costs for reaching the same information level. The subscription price for all the journals will be no less than 75.000 Dkr. (10-11.000 US $ per year) and the time consumption for finding the relevant reports will be many times higher than for finding them through SCIENTIFUR.

PLEASE, TAKE THESE FACTS IN CONSIDERATION TOO DURING THE DISCUSSIONS AND ACTIONS REGARDING THE FUTURE OF SCIENTIFUR.

All these matters will be presented and discussed by the undersigned at the Congress in Toronto.

It is very disappointing for me to came to the Congress without the new SCIENTIFUR book: "Beauties of Fur Animals - and their colour genetics". The translation into English from the Norwegian edition, which came out in November 1987, has been far more long lasting than planned and promised.

But dear friends, be patient, you will from the Norwegian edition - from which we will bring a few copies see, that you are waiting for a unique presentation of the fur animals.

In this issue of SCIENTIFUR you will once more receive a lot of scientific information. You will also indirectly learn that the leading international initiator and researcher in biochemical fur animal genetics, prof. D.K. Belyaev, from the Institute of Cytology and Genetics, Academy of Sciences of the USSR, Siberian Branch, Novosibirsk is no longer among us.

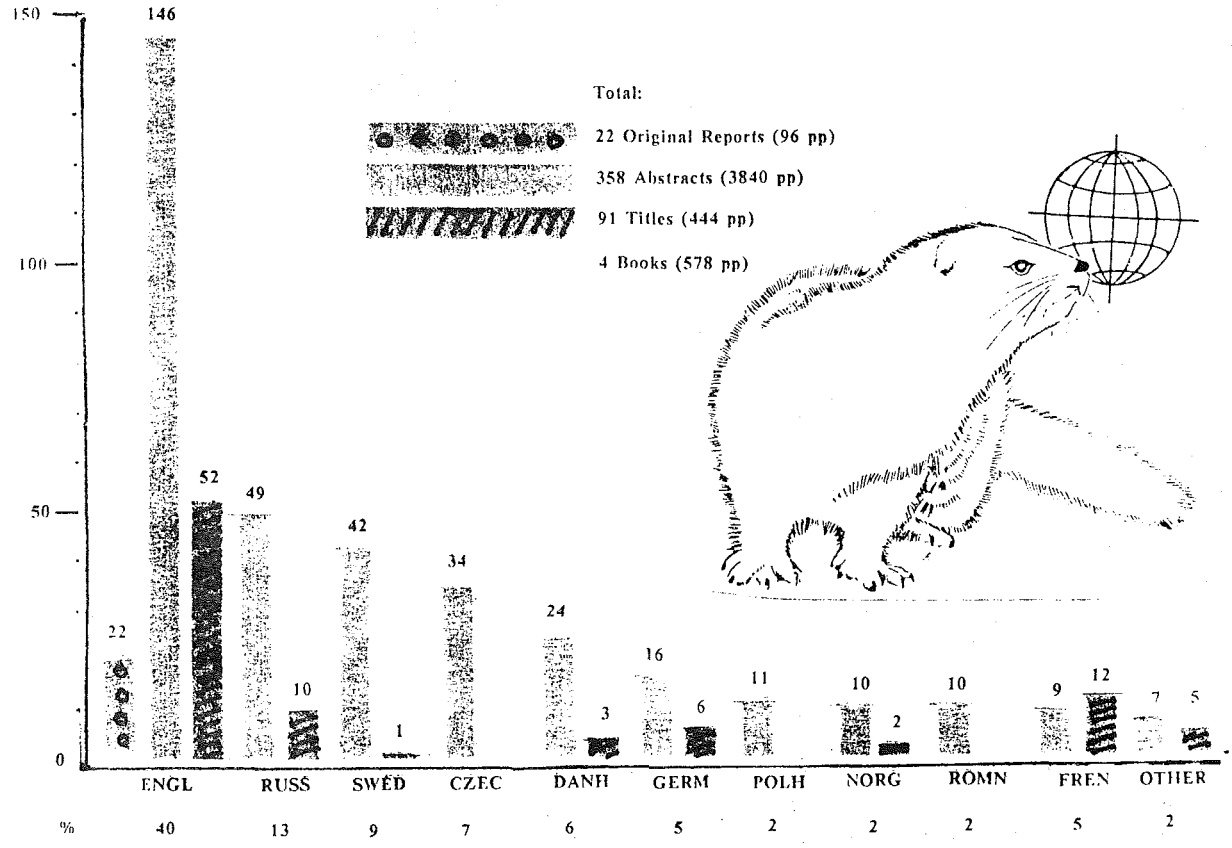
We hope to meet some of his and our colleaugues from Belyaev's Institute at the 4th Congress, and we are sure that the "star" of Belyaev will illuminate the Congress as well as the future research in this field.

See you in Toronto!

Best regards
Your editor

*Gunnar Jørgensen*

NUMBER OF TITLES OF SCIENTIFIC REPORTS GIVEN IN SCIENTIFUR VOL. 11 - 1987
AS ORIGINAL REPORTS, ABSTRACTS OR TITLES ONLY -
- AND THE ORIGINAL LANGUAGES OF THE REPORTS.



*Original report*

# Use of non-specific humoral tests in fur-breeding and veterinary

*G. Malinina,* Institute of Biology of the Karelian Branch of the USSR Academy Of Sciences, II Pushkinskaya street, Petrozavodsk, 185610, USSR.

**Summary**
The level of activity of natural resisting humoral factors in the cage anmimals with various pathologies is studied. It is shown that even at early stages of diseases there is a considerable deviation in lysozyme, beta-lysin and complement level as compared to their values in healthy animals. This allows to use simple, without strict specificity tests for the prophylactic control of stock health and preclinical appearance of trouble.

**Introduction**
Successful management and development of fur-breeding farms greatly depends on the creation and conservation of healthy animal stock. Control of the animal health and opportune detection of various homeostasis damages supposes the use of methods, reflecting in the non-specific base of the physiological state of organism as a whole. They include the methods of determination of humoral non-specific immunity factors activity, which are often used both in medical and veterinary practice. Such an opportunity is based on their high sensibility to the effects of various outward irritants and to the disturbances of inner organism medium constancy.

The lysozyme, beta-lysin and complement activity level in healthy animals at various stages of postnatal development and according to the periods of biological cycle was determined earlier in fur-bearing animals (*Malinina,* 1982; *Berestov* et al., 1982). The aim of the present paper is to study the opportunity of the use of humoral factors on the base of available parameters as a control test of stock health.

**Investigation methods**
Young and adult cage mink and fox were the object of investigation. Blood and serum samples were obtained by the usual methods (*Berestov,* 1981). Determination of the blood serum lysozyme activity was carried out according to *V.G. Dorofeichuk* (1968), that of beta-lysin - by *O.V. Buharin* et al. (1972) method and that of complement by *G.F. Vagner* (1963) - *A.V. Gustov* (1971) method. Before the examination of lysozyme and beta-lysin level, the serum is inactivated on water bath at $56^0$C during 30 minutes to destroy termolabile active components such as complement (*Ogreba* et al., 1969; *Malinina* et al., 1974).

In aspect of the natural body temperature of the animals, sample incubation is carried out at $39^0$C.

**Results and discussion**
Investigation of the state of humoral non-specific immunity in the presence of various pathologies was carried out when getting some signals about the trouble, taking place in the fur breeding farms of Karelia, with regard to the further diagnostics of diseases. Now we have some data on the activity level of natural resisting factors in the fur animals with internal non-contagious (lactation depletion, iron-deficiency anemia), invasionous (toxoskariosis, toxoplasmosis, diphyllobothriasis) and

infectious (Aleut, pasteurellosis) diseases. It is determined that lysozyme, beta-lysins and complement are the sensitive indicators of homeostasis disturbances.

The study of the immunological status in healthy lactating females and those depleted by lactation is performed. When putting forward a diagnosis its clinical manifestation, the litter number and age was taken into account, as for hepatosis and Aleutian disease, they were excluded. The data showed that the humoral factor activity in healthy females had normal values. In the females depleted with lactation, the lysozyme and complement level is increased by 30 and 120% respectively, the beta-lysin activity is decreased by 40% (Fig. 1).

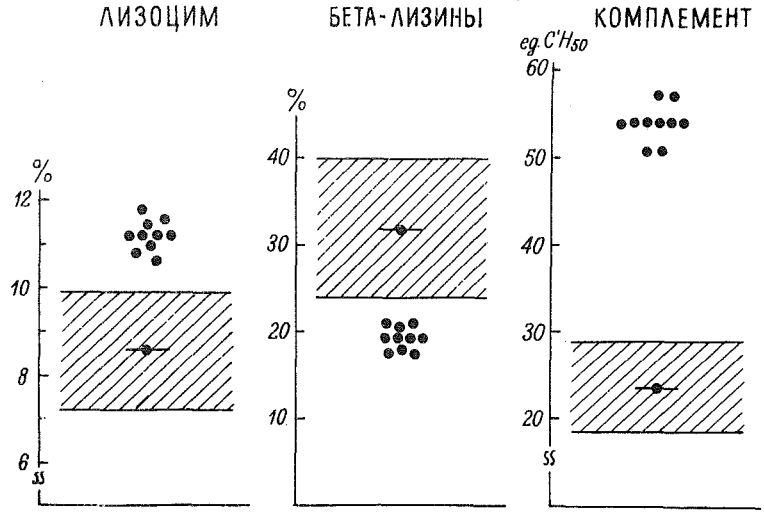



Fig. 1. Level of natural resistency humoral factors in mink suffering from the lactating depletion. Filled circles - individual factor values in ill animals; a hatched bondnorm confidence limit (M ± 6).

Taking into consideration the fact that the beta-lysin synthesis and deposition (*Buharin, Vasiliev*, 1977) are realized by the hypathalamo-hypophysial system it is logical to connect a decrease in the level of this factor with a reduction of hypophysis function observed during the protein-vitamin deficiency. In this case some increase in lysozyme and complement activity is obviously a compensating response on the beta-lysin decrease and is directed to the mobilization of natural protective forces, antiphase of their dynamics provides the necessary degree of organism stability similar to that of some human pathologies.

So, high level of deviation of the indices studied shows deep disturbance in the protein exchange. To normalize the state of lactating females the hydrolysin, L-103 was used. Its effect was expressed in the fall of lysozyme and complement activity on the 8th day and in the total normalization of all indices on the 15th day of the trial.

One more example. To answer the signal of trouble - the frequented mink death - a group of animals was examined in one of the state fur-farms of Karelia. The data indicated that the state of animal humoral protective system was anomalous. In the clinically healthy animals without signs of any diseases, lysozyme and beta-lysin activity did not correspond to the physiological norm and was decreased respectively by 33% and 60% (Fig. 2). The complement activity was elevated in 57% of the animals and normal in the rest.

The homeostasis disturbance with the significant immunosuppression of the first two factors and temporary activation of the third one was obvious, what is characteristic of a member of human and animal diseases at early stage. In fact, the further bacteriological and clinical analysis allowed to diagnose the enterotoxymy, complicated with pasteurellosis.

It is worth nothing for the comparison that the immunosuppression process in the animals with distined symptoms of diseases is

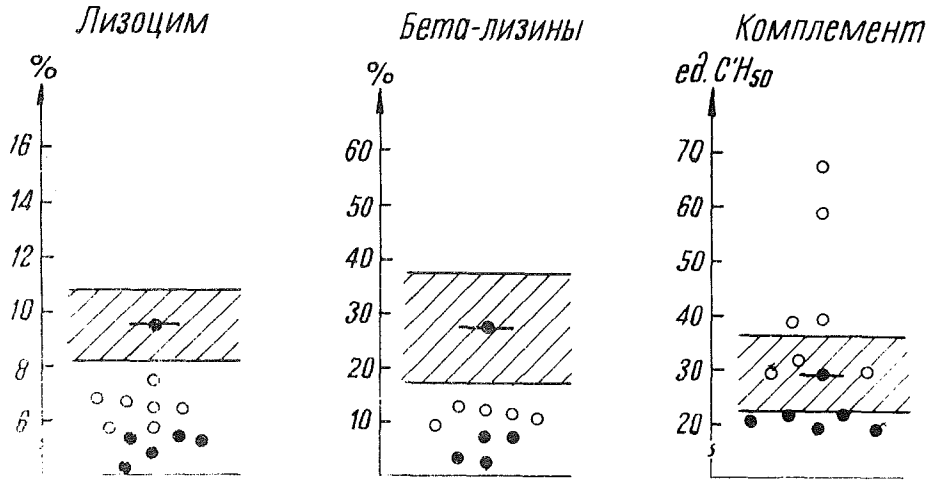



Fig. 2. Level of natural resistency humoral factors in 4-month-old mink suffering from pasteurellosis.
Symbols are the same as in Fig. 1.
An open circle - clinically healthy animals of the same stock.

considerably strengthened: the lowering of lysozyme, beta-lysin and complement activity compared to the average norm indices by 50, 82 and 31% respectively was marked. The reasons are obviously in the disturbance of synthesizing functions of organs and tissues, responsible for the production of protective factors as a result of their infection with the toxic products of pathogen vital activity, inhibitor formation etc.

So the analysis of the available experimental material indicates the deviation of the humoral factor level in the animals with pathologies. This deviation is rather significant and highly reliable what allows to consider the present indices as a good control and additional diagnostic tests, providing, besides the routine methods, an opportune detection of trouble or disease. Moreover, humoral factors are informative enough in the determination of the treatment effectivity and duration, a greatly important fact is that the immunological status disturbances develops in the animals long before the appearance of clinical symptoms and losses. This condition is of principle value for the industrial fur-breeding as it allows to diagnose opportunely the homeostasis disturbance and to take suitable measures for the prophylaxis of the possible undesirable effects.

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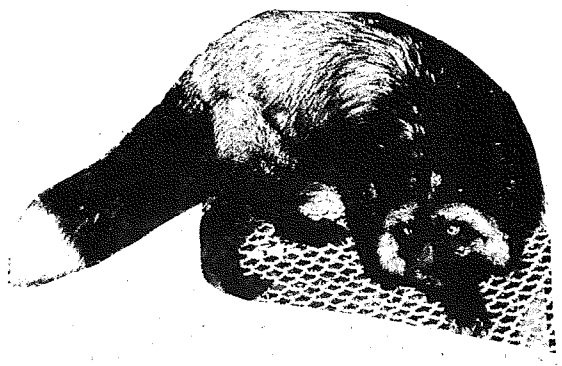
*Original report*



# Effect of experimentally induced stress on cortisol, blood cell parameters and exploratory behaviour in farmed foxes

*Morten Pilgaard Kristensen, and Leif Lau Jeppesen,* Institute of Population Biology, University of Copenhagen, Universitetsparken 15, DK 2100 Copenhagen, Denmark

**Abstract**

Levels of cortisol, circulating leukocytes, and exploratory behaviour were evaluated for their suitability as indicators of ether- and transport-stress in farmed foxes. The experimental treatment was not reflected in the plasma-cortisol-concentration. The concentration of eosinophil leukocytes fell immediately after acute and was increased 21 hours after intensely repeated ether-treatment; it also varied with the time of day and showed other fluctuations. The ratio of heterophils to lymphocytes was more stable and responded to intensely repeated ether-treatment and transport as experimental stressors but also showed some spontaneous fluctuations. The individual fox maintained a constant relative level of eosinophil-concentration and proportion of eosinphils, segmented neutrophils, and lymphocytes in a differential count of leukocytes regardless of experimental treatment and time of measuring. The latency to contact with a novel object- as an indicator of exploratory motivation - was longer of repeatedly ether-treated foxes but also showed a decrease with age. These results suggest that changes in the circulating leukocyte population and in the exploratory behaviour may become reliable indicators of stress in farmed foxes.

**Introduction**

When an animal is placed in an unpleasant situation which cannot be rectified by normally adopted specific physiological or behavioural action, a rather unspecific series of physiological events take place. This set of physiological reactions have been termed stress. Stress in the classical definition of the concept involves an activation of the pituitary-adrenocortical axis, and the dynamics of this structure has been the object of numerous investigations.

Secondary activity in the pituitary-adrenocortical axis is a change in the picture of the circulating white blood cells. It has been known for a long time that acute rises in glucocorticoid concentration induce eosinopenia (*Parrillo, and Fauchi,* 1979). Recently it was demonstrated in mink that repeated stress leads to an increased baseline level of eosinophils upon which the drop seen after each stress encounter is superimosed (*Heller, and Jeppesen,* 1985; *Jeppesen, and Heller,* 1986a and 1986b).

Other subpopulations of leukocutes are, however, also affected by stress. Single footshock was for instance shown to induce neutrophilia and lymphocytopenia in bank voles, whereas repeated exposure to this stressor had the opposite effect (*Kennes, and De Rycke,* 1988); and inter-male fighting lead to neutrophilia, eosinopenia, lymphocytopenia, and monocytopenia in adult bandicoot rats (*Ghosh* et al., 1983). *Gross* and *Siegel* found the most reliable indicator of stress in chiken to be a rise in the ratio of heterophils to lymphocytes (*Gross, and Siegel,* 1983).

It has become evident that the physiological stress-reactions are associated with similarly unspecific modulations of behaviour. Studies on mice have suggested that acute stress facilitates responsiveness demonstrated as increased exploratory and aggressive as well as submissive behaviour, whereas repeated exposure to a stressor leads to a state of general avoidance, during which a decrease in explora-

tory behaviour and aggressiveness is seen, while submissiveness is further enhanced (*Heller*, 1985). Changes in aggression and fear as a result of repeated stress has also been recorded for mink (*Heller and Jeppesen*, 1985).

The purpose of the current study has been to investigate whether the above-mentioned indicators of stress could also be used in the case of farmed foxes. As a direct measure of the activity of the adrenal cortex, the cortisol-concentration of the bloodplasma was assayed, whereas changes in the circulating leukocyte population was examined for reliability as an indirect indicator of stress. Screening of the exploratory motivation was chosen as indicator of the behavioural state of the fox, since this can be easily assessed by measuring the reaction in a novel situation (*Heller*, 1985).

Ether-anesthesation was used as experimental stressor, since ether is known to activate the pituitary-adrenocortical system directly by facilitating the release of ACTH from the pituitary (*Cook* et al., 1973). It was furthermore of interest to investigate whether exposure to a presumably stressful situation, commonly occurring during the captive life of the farmed fox, would yield the same physiological results as the direct physiological influence of ether-anesthesia. For this purpose transportation and permenent transferral to a novel environment was elected as a potential stressor, since this is known to activate the adrenocortical system and also result in behavioural changes in cattle (*Kenny, and Tarrant*, 1987).

Experiment 1

**Materials and methods**

**Animals:** 80 male silver foxes (*Vulpes vulpes*), born in April/May and housed singly in 1m x 1m x 1m net-wire cages with a shelf in one upper corner under normal Danish farm conditions. The foxes were fed once a day usually in the morning.

Experimental procedures: 32 foxes were given ether-treatment during midday for 5 consecutive days in mid-October. Two days prior to the first and 3 hours and 19 hours respectively after the last ether-treatment bloodsamples were collected from 2 groups of 8 animals. Further bloodsamples were drawn from the same 2 x 8 individuals at varying times of day with 1-2 week intervals for the following 2 months including one sample from one experimental group 1 hour after a single ether-treatment.

Immediately preceding the 5th ether-treatment, the response of the foxes to a novel object (ball-test) was recorded. A control-group of 32 foxes were tested 9 days and the remaining 16 foxes 45 days after the experimental animals.

**Ether treatment:** The fox was transferred from its home cage to a smaller cage, which was submerged in a plastic box on top of an aluminium tray continously refilled with diethyl-ether. A glass lid allowed inspection of the progress of the anesthesation, and when unconsciousness occurred the fox was returned to its home cage.

**Bloodsampling:** A quantity of 10 ml of blood was obtained by venous puncture of the front leg. The blood was collected in EDTA-treated tubes which were rotated continously. Fifty micro l of EDTA-blood were mixed with a phloxin-solution and scanned for eosinophil-concentration in a hemocytometer after a 30-90 minute incubation. A smear of EDTA-blood was prepared for differential counting of leukocytes. The rest of the blood was prepared for differential counting of leukocytes. The rest of the blood was spun at 3000 RPM for 5 minutes, and the supernatant frozen and anlyzed for content of cortisol by competitive protein binding technique ("Cortisol $^{125}$I Radioimmumoassay Kit" from Farmos Diagnostica) after extraction with hexane and ethanol at The National Institute for Animal Science.

Ball test: A plastic ball (diameter = 15 cm) was placed immediately inside the cage door and the experimenter withdrew 2 m from the cage. The latency to contact was measured as the timelapse from the cage door was closed after insertion of the ball till the fox made contact (< 2 cm) with the ball. If no contact was made within 600 secs, the fox was considered non-reacting. The ball was rinsed in a solution of a smelling disinfectant ("Rodalon") immediately preceding introduction into the cage.

**Results**

The variations in the levels of plasma-cortisol-concentration did not reveal any significant differences attributable to experimental procedures (table 1).

The morning concentrations of circulating eosinophil leukocytes were significantly higher than those in the early afternoon, when com-

Table 1. Plasma-cortisol-concentration, eosinophil-concentration of heterophils to lymphocytes (H/L-ratio) in the blood at different times after repeated and after single ether-treatment and at various control measurements morning and early afternoon for the two experimental groups A and B (N=8 for both). See text for further details-.

| Date | Time | Treatment | Hours after treatment | Cortisol nmol/l | | Eosinophils /micro-l blood | | H/L - ratio | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | A | B | A | B |
| 10/ 7/87 | 8 | Control | | 82 | | 720 | | 1.03 | |
| 10/ 8/87 | 14 | Control | | | 79 | | 277 | | .68 |
| 10/13/87 | 14 | 5 * ether | 3.00 | 104 | | 448 | | 1.01 | |
| 10/14/87 | 8 | 5 * ether | 19.00 | | 64 | | 343 | | .70 |
| 10/21/87 | 14 | Control | | 87 | | 488 | | .94 | |
| 10/22/87 | 8 | Control | | | 83 | | 328 | | .94 |
| 10/28/87 | 14 | Control | | | 124 | | 289 | | .74 |
| 10/29/87 | 8 | Control | | 78 | | 569 | | .97 | |
| 11/ 3/87 | 14 | Control | | 92 | | 435 | | 1.11 | |
| 11/ 3/87 | 8 | Control | | | 93 | | 355 | | .77 |
| 11/16/87 | 14 | Control | | 111 | | 841 | | 2.36 | |
| 11/24/87 | 14 | Control | | 115 | | 820 | | 1.85 | |
| 11/26/87 | 8 | Control | | | 97 | | 481 | | .83 |
| 11/26/87 | 14 | 1 * ether | 1.00 | 101 | | 628 | | 1.32 | |
| 12/ 1/87 | 14 | Control | | 111 | | 377 | | 1.21 | |
| 12/ 7/87 | 14 | Control | | 107 | | 295 | | 1.12 | |

paring the averages of the measurements on 10/21 and 11/3 for group A and the averages of the measurements on 10/8 and 10/28 with the measurements on 10/22 and 11/3 for group B ($p<0.01$; Willcoxon Matched Pairs Test, one tailed) (table 1).

There was no significant change in eosinophil concentration of the blood 3 hours nor 19 hours after the last of 5 ether-treatments with 24 hour intervals, but there was a significant drop 1 hour after one single ether-treatment on 11/26 as compared with the measurement on 11/24 ($p<0.05$; Willcoxon Matched Pairs Test, one tailed).

The most extreme fluctuations in the concentration of eosinophil leukocytes during the experimental period occurred spontaneously in the control measurements on 11/16 and 11/24 (11/26 for group B) as compared with the average of the measurements on 10/21 and 11/3 for group A and 10/22 and 11/3 for group B respectively. ($p<0.02$, Wilcoxon Matched Pairs Test, two tailed).

The differential count of leukocytes revealed a significant spontaneous increase in the proportion of eosinophils and total heterophils and a decrease in the proportion of lymphocytes at the same measuring point as the spontaneous increase in eosinophil concentration occurred, when comparing the measurements on 11/3 and 11/16 for group A ($p<0.02$; Wilcoxon Matched Pairs Test, two tailed). It was, however, not possible to see an effect of the ether-treatment nor the time of day in the differential count.

Four ether-treatments in 4 days resulted in a longer latency to contact with a novel object as compared to the control group tested 9 days later ($p=0.047$; Mann-Whitney U-test, one-tailed) (fig. 1). The mean latency for the experimental group was 50.2 s (SD=57) and for the control group 37.6 s (SD=72) for the reacting foxes. There was one non-reacting fox in the experimental group and none in either of the control groups. The second control group tested on 25/11 had a mean latency of 13.5 s (SD=29), which was significantly faster than the first control group ($p=0.038$; Mann-Whitney U-test, one tailed).

Table 2 shows that the individual fox maintains a constant level of several of the leukocyte parameters throughout the experiment compared to the other foxes in the group regardless of experimental treatment, time of day, and day of testing.

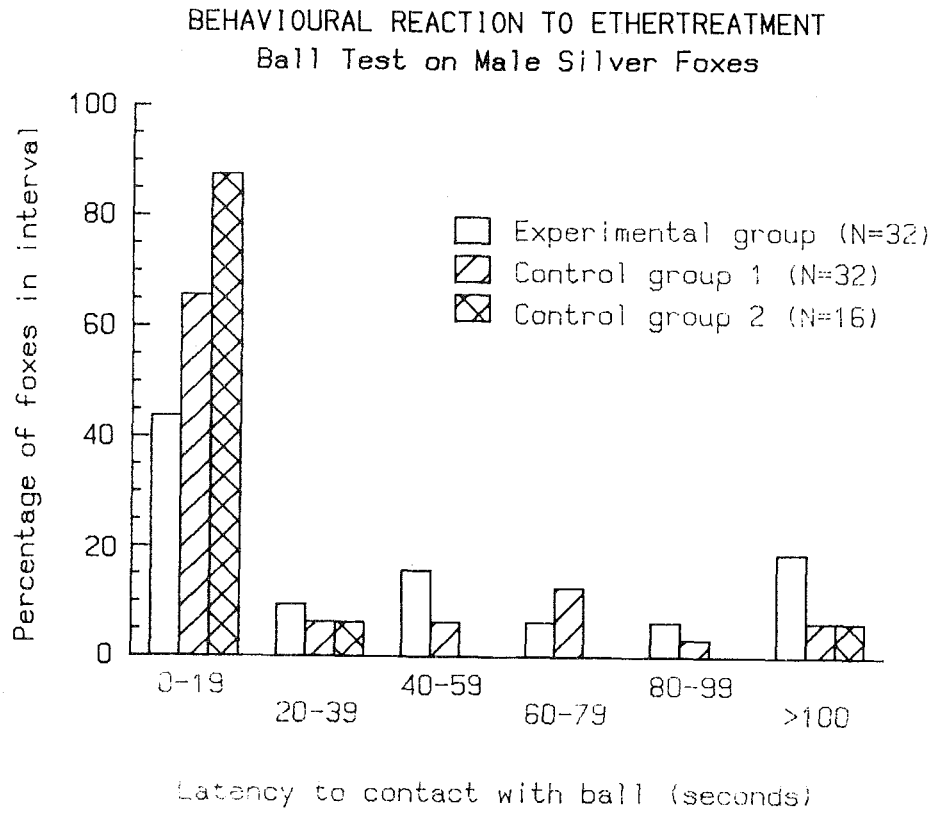



Fig. 1. Distribution of latencies to contact in ball-test for the experimental group tested 24 hours after 4 ether-treatments in 4 days, control group 1 tested 9 days, and control group 2 tested 45 days later. See text for further details.

Table 2. Probabilities of Friedman Two-Way Analysis of Variance by Rank for relative constancy within each experimental group A and B (N=8 for both) for plasma-cortisol and leukocyte parameters. A low probability indicates a high degree of constancy.

| Experimental group | A | B |
|---|---|---|
| Times tested | 10 | 6 |
| Cortisol-concentration | 0.977 | <0.001 |
| DIFFERENTIAL Band neutrophils | 0.127 | 0.152 |
| DIFFERENTIAL Segmented neutrophils | <<0.001 | <0.001 |
| DIFFERENTIAL Eosinophils | <<0.001 | 0.017 |
| DIFFERENTIAL Lymphocytes | <<0.001 | <<0.001 |
| DIFFERENTIAL Monocytes | 0.161 | 0.291 |
| Eosinophil-concentration | <<0.001 | 0.002 |

## Experiment 2

### Materials and methods

**Animals:** 21 foxes of different sex, age, and species (*Vulpes vulpes, and Alopex lagopus*) housed singly in two connected 1m x 1m x 1m net wire cages furnished with a shelf and two breeding boxes. Each fox was assigned to the experimental or the control group, so that the animals were equally distributed with regard to sex, age, and species.

**Experimental procedure:** The experimental animals were first subjected to 3 ether-treatments within 24 hours. Blood samples were collected from the experimental as well as the control animals 3 hours prior to the first and 21 hours after the last ether-treatment. This experimental regime was postponed 24 hours for half of the foxes in each group.

A second test session was carried out 2 weeks after the first. During this the experimental animals were subjected to 3 times

transportation within 24 hours. The experimental animals were placed in standard cages inside a stable with artificial illumination simulating a normal diurnal light-cycle after the first transport and remained there for duration of the experimental period. Blood-samples were collected from the experimental animals 1 1/2 hours after the first and 24 hours after the last transport and furthermore on a day in between the two experimental sessions and on a day after the last. The control group was bled on 3 different days interspersed between sampling days of the experimental group. Blood was collected at 13h and at 10h during the ether-treatment and transport sessions respectively.

**Transportation:** The experimental animals were transferred to transport-cages and driven around on gravel roads on a tractor-pulled trailer for one hour.

Ether-treatment and treatment and analysis of blood-samples were carried out as described in the Materials and methods-section for Experiment 1.

**Results**

Twenty-one hours after 3 ether-treatments within 24 hours, an increase in the concentration of circulating eosinophil leukocytes was seen (p=0.025; Wilcoxon Matched Pairs Test, one-tailed) (fig. 2). The eosinophil levels of

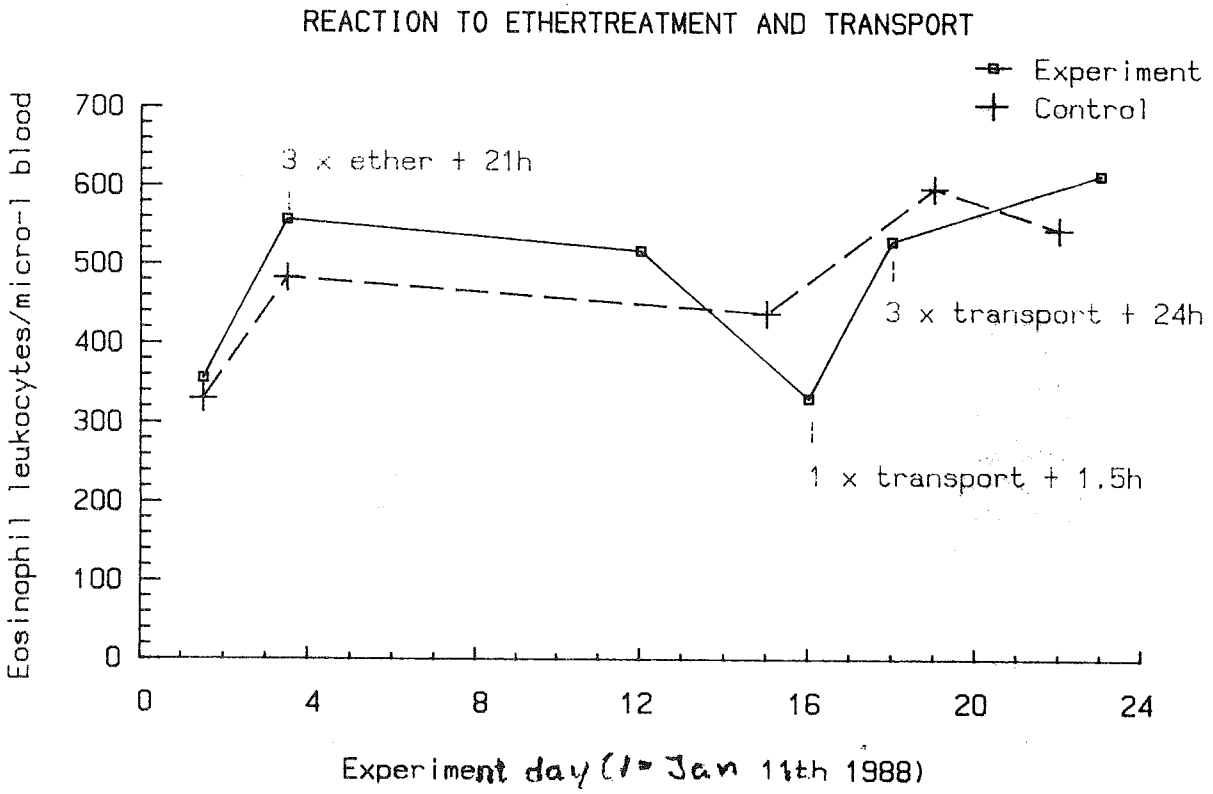



Fig. 2. Eosinophil-concentration in the blood after repeated ether-treatment and single and repeated transport in the experimental (N=11) and the control (N=10) groups. See text for further details.

the control group, however, also showed a significant increase over the same interval (p<0.02; Wilcoxon Matched Test, two-tailed) and a great variation througout the experimental period. The experimental group showed a significant reduction in eosinophils 1 hour after the onset of the first transport session on day 16 as compared to the control measurement on the same group on day 12 (p=0.023; Wilcoxon Matched Pairs Test, two-tailed).

The differential count expressed as the ratio of the total number of heterophils to lymphocytes (H/L) showed a significant increase 21 hours after 3 ether treatments within 24 hours compared to the control animals tested on the same days (p<0.01; Mann-Whitney U.test, one tailed) and compared to the initial control measurement of the experimental animals 2 days earlier (p<0.025; Wilcoxon Matched Pairs Test, one-tailed) (fig. 3). The

H/L-ratio of the control group remained stable throuhout the experimental period. There was also an increased H/L-ratio 1 hour after the first transport on day 16 as compared with the control measurement on the experimental group on day 12 ($p<0.01$; Wilcoxon Matched Pairs Test, two-tailed), whereas there was no reaction 24 hours after 3 transport sessions within 24 hours.

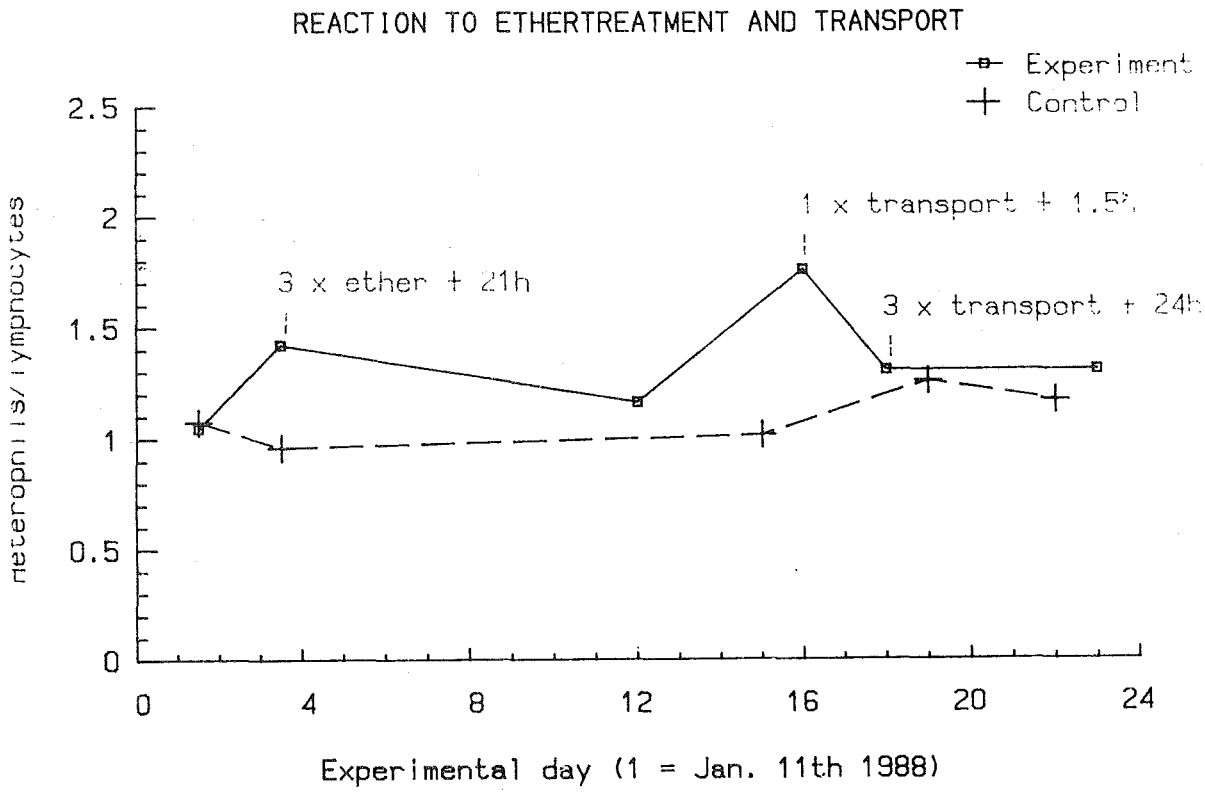



Fig. 3. Ratio of heterophils to lymphocytes after repeated ether-treatment and single and repeated transport in the experimental (N=11) and the control (N=10) groups. See text for further details.

## Discussion

**Cortisol:** The fact that the experimental treatment was not reflected in the measurement of cortisol shall probably be explained by the dynamics of this parameter. There was a tendency during each test for one or a few foxes to have a much higher concentration of plasma cortisol than the rest of animals in the experimenatal group. It was not consistently the same animal that showed this tendency as is indicated by the high probability for individual inconstancy of cortisol levels for group 1 (table 2), so there is no reason to beleive that this variation should be caused by individually distinct baseline-levels of cortisol or sensitivity to stress.

The time lapse from the fox was extracted from its cage till the bloodsample had been obtained was generally kept below 2 minutes, but variations could influence the cortisol measurement, since handling is known to be a stressor in other animals (*Dobraková, and Juricovicová*, 1984; *Hemsworth* et al., 1986), and elevated levels of glucocorticoids have been registered within a few minutes after the onset of a strainful stimulus (*Sakellaris, and Vernikos-Danellis*, 1975). There was no indication of consistently elevated cortisol levels in the first tested animals, which could have been caused by an anticipatory stress reaction, resulting from the disturbance in the hall.

The large variations are probably dur to an ultradian, burst-like release from the adrenal cortex resulting in short-lasting peaks of cortisol, as has been demonstrated in cattle (*Thun* et al., 1981), man (*Hellman* et al., 1970), and sheep (*Fulkerson, and Tang*, 1979). A random time-lapse from the last burst could consequently lead to differences in cortisol

levels between foxes. This effect could also mask a diurnal variation in glucocorticoid level, which is seen in other species (*Hellman* et al., 1970; *Fulkerson, and Tang*, 1981), but not evident from our data.

**Leukocytes:** The fall in the concentration of circulating eosinophils 1 hour after acute ether-treatment in experiment 1 is consistent with the generally accepted theory of glucocorticoids inducing eosinopenia. The diurnal cycle of adrenocortical activity normally seen in mammals, as previously mentioned, could thus account for the demonstrated difference between morning and early afternoon levels of eosinophils.

Previous studies on mink have demonstrated that repeated stress leads to longer-lasting elevations in eosinophil levels (*Heller and Jeppesen*, 1985; *Jeppesen and Heller*, 1986a and 1986b). It was not possible to detect such elevations 19 hours after 5 ether-treatments with 24-hour-intervals in experiment 1, whereas there was an increase in eosinophils 21 hours after 3 ether-treatments within 24 hours in experiment 2. The different stimulus-frequencies may account for this difference in response.

Interpretation of the rise in eosinophil-levels after repeated ether-treatment in experiment 2 is empeded by the concurrent eosinophilia of the control group. This could, however, be the consequence of a psychological stress-effect of the disturbances caused by ether-treatment and blood-sampling of the experimental animals kept in the same house as the control group.

Psychological stimuli have in many cases been hown in themselves to be very potent stressors (*Cook* et al., 1973).

The continued instability of the eosinophil-level in the control animals throughout the remaining experimental period, during which the experimental group was absent from the house, renders interpretation of this part of the experimental impossible.

Such fluctuations in the control values were not seen for the H/L-ratio in experiment 2, nor were there indications of diurnal variations in experiment 1, though some spontaneous variation was seen. *Gross and Siegel* found a corticosterone mediated increase in H/L-ratio after acute as well as repeated stress (*Gross and Siegel*, 1983). Our data also showed an increased H/L-ratio after 3 ether-treatments and after one transport-session in experiment 2. The H/L-ratio thus seems to be a more reliable indicator of stress in foxes than eosinophil-concentration as it is more stable with regard to spontaneous fluctuations.

The rank of the fox in the group with regard to eosinophil-concentration and eosinophil, segmented neutrophil, and lymphocyte levels in the differential count was constant regardless of experimental treatment and time of measurement. This suggests that the fox maintains an individual baseline-level of these leukocyte parameters from which concerted stimulus-dependent fluctuations take place. The phenomenon has not been registered in mink (unpublished comment on previous experiments by *Heller and Jeppesen*, 1985; *Jeppesen and Heller*, 1986a and 1986b); however, it neccesitates control measurements of the individuals in small experimental groups. In addition, independent control groups must be employed in order to correct for spontaneous fluctuations such as those seen in experiment 1 in the eosinophil.concentration and H/L-ratio. This specific incident could be a result of elevated levels of cortisol correlated with moulting, as has been recorded in mink (*McMullen*, 1984) or possibly climatic changes.

**Behaviour:** Previous studies of the behaviour of animals having undergone stressful treatment have shown that they tend to express lessened exploratory behaviour measured as ambulation or latency to contact with a novel object is thus in accord with these earlier studies. The fact that the time-lapse between testing of the experimental and control groups lay next to a period with a presumably ontogenetically caused increase in exploratory motivation and/or decrease in fear, as was indicated by a further decrease in latency of the second control group, does however limit the result to being suggestive of the applicability of changes in behaviour as indicators of stress in foxes. Further investigations precluding extra-experimentally caused changes in exploratory behaviour are needed to establish conclusive evidence to this end.

It must be stressed that the novel object test is not a pure measure of exploratory motivation, since the insertion of the ball into the cage by and the presence of the esperimenter in the house probably increases the fear motivation of the fox, which in turn may increase the latency to contact. This tendency could even be further enhanced in the experimental group where the experimenter may act as a conditioned stimulus anticipatory of stress-treatment. The fear motivation may, however, also be modulated by stress as shown in previous studies (*Heller*, 1985).

**Conclusion:** There is reason to believe that parameters of the leukocyte population and exploratory behaviour through further investigation of their dynamic properties can become reliable instruments for assessing the effect of environmental strains on stress end thereby the well-being of farmed foxes.

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*Original report*

# Observations concerning the fecundity diagnosis at minks affected by the Aleutian disease

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**Summary**

The paper started from the idea that a significant symptom of the Aleutian disease (AD) is constituted by the drastic diminution of the fecundity, manifested through the great number of females which, although mated, don't whelp. When trying to ellucidate certain aspects of this problem it was analyzed the mink females fecundity and its influence by the males.

In the paper there is described a method of analyze for the fecundity diagnose at mink females, by putting into evidence the blastocytes get in from the horns of uterus during a stage previous to implantation. There were done comparative observations between the blastocyts from animals affected by AD and animals with negative reaction at the tests of the disease hunting out, between the blastocyts from different stages of development resulting either from experimentally sacrificed females, or from mortalities from the month of March.

There were also used other methods of fecundity diagnosis, as for example observations concerning the ovaries (being established the average of the evulation instalment) and a series of comparisons linked to the infecundity at a population level.

Another aspect dealt with as for the fecundity of the AD affected minks is that one referring to the action of the Aleutian virus (A) of induction in the males body of certain selfimmunitary phenomena, with later repercussions upon spermatozoous fecundating capacity.

The fecundity of an effective of minks affected by the Aleutian disease (AD) may be partially comprised. At ill minks, after anestrus, heat reappear and shows up apparently normal. The histemorphological analysis of the conception products from the female genital route demonstrates the persistence of the infertility and the diminution of the prolificity at mink are determined by troubles of fecundity, growth and optimal segment of the zygotes.

**Material and method**

In the present investigation the results of the fecundity analysis of the minks affected with Aleutian virus (A), comparative to those with negative reaction (CEP test), was done through sounding sacrificings 20 days after the covering of an experimental lot of 32 females, from an AD tested effective of 4843 Standard mink females, lot farmed of 16 positive females and 16 negative females, in both cases being chosen 8 adult females and 8 young females.

The genital organs drawn (in the period of 22-27 March) were first examined, and then anatomically prepared in view of the uterine horns perfusion for the total gather of blastocyts. The ovaries, after a previous preparation, were examined with the help of a binocular magnifying glass (the power of increase of 2.5 x 25). The analysis of the perfusion liquid were done after the uterine horns washing with help of the stereomicroscope.

Were also examined, by the same method, a number of 23 females coming from the mortalities of the month of March, in order to compare the zygotes of different ages with these resulting from the experimental lot.

The method applied in order to establish the fecundity diagnosis consists of examining the number of the evolutive state of the zygotes with help of the microscope after the uterine horn washing. On this purpose, in order to draw the necessary material for the respective exam, were brought in laboratory the entire genital organs of the females (that have been gashed after sacrificing, or resulting from mortalities). After ablation through the surgical act and washing the oviduct and the horns of the uterus one may pass to the examination, conformably to the principles of the method also described in the case of other species of animals (*Paraipan* 1977, *Paraipan & Bucur* 1981).

After having detached the mesosalpinx, the tuboovarian ligament and the mesometre from the oviduct body and the horn extremities, were done two transversal sections, a superior one near by the utero-tubar junction and an inferior one in front of the cervical ostium.

The perfusion of the horns of the uterus at mink in view of gathering the zygotes in the first stages of segmentation is considered more efficient when it is done from the cervical ostium towards the oviduct. The perfusion technique presumes the introduction of a thin needle with a pointless and in the lumen of the horn of the uterus, needle fixed at a syringe of 2 cc where is found the liquid of perfusion. Then the free extremity of the horn of uterus is hung up above a watch glass, or in the lumen of a funnel made of glass which is introduced in a gathering test tube.

The gathering technique imposes the cautions acting of the syringe piston in order to avoid the blastocyst break and so that the perfusion liquid penetrate slowly in the horn of the uterus. We have to precise that after having inoculated 1 cmc of perfusion liquid the syringe is dislocated, it is charged with air, it is located again at the needle left in the cornual lumen and the air is innoculated. The air innoculated naturally pushes the column of liquid remaining in the lumen, and after that the operation is repeated using the same quantity of liquid.

From the perfusion liquids, in the present case were used physiological salt and Hanks medium. In the situations in which it isn't necessary that the blastocysts remain alive and viable, instead of the mentioned perfusion liquids one may appeal at the solution of 2% formaline.

The observations about blastocysts, especially in the pink-red liquid of the Hanks medium, may be done with magnifying glass or even with the age. They appear like minute tranparent mother-of-pearl vesicles, which initially floate and then fall out at the bottom of the examination vessel in function of the washing liquid.

In function of the purpose aimed at each test-tube must contain all the blastocysts from a horn of uterus and on its label it is specified the adminstrative number of the mink, the horn from which the test comes, as well as the number of alive and dead blastocysts.

As we have anticipated, the blastocysts gathering at mink must be done the latest up to the 2nd of April, when most of blastocysts lengthen and begin to fix endometrially, fact that imposes the gatherings for the analysis to be done up to March 27th - 28th.

For the microscopic examination of the liquid components resulting from the horns of uterus (gynogamets, zygotes in different stages of evolution, alive or dead elements etc), may be used several methods: direct or identifying examinations, examinations of blastocysts, histological section examination, the examination "in toto" etc. In the present case it was appealed to the first two methods.

The direct examination was done at stereomicroscope and with binocular magnifying glass, on the table of the microscope putting the watch glass in which was found the Hanks perfusion liquid. The zygotes being heavier, after calming down, they deposit at the bottom usually in the centre of the watch glass.

To make possible the gathering of all the elements of the liquid analysed (first of all the zygotes) it may be done the examination in drop by micropipette, which, even if relatively difficult and asking for a longer period of time, has the advantage of exactness.

The examination of blastocysts put into evidence the fact that they appear like transparent vesicles, of unequel sizes even at the same age. Besides these vesicle elements were observed smaller formations completely opaque, which represent the blastocysts dead during the previous days of the gathering and which constitute the "blastocytary sand" (*Paraipan* 1971).

In function of the aim of the observations the blastocysts, either intact or crushed

between blade and lamella, may be coloured with methylene blue, and if had in view the nuclei characteristics, the crushed blastocysts are fixed at the flame and are coloured for 45 minutes with Giemsa solution.

**Result and discussion**

By using the analysis method described it may be established precisely enough the fecundity diagnosis at the minks we have examined. The main diagnosis guide marks are the presence, the number and the evolutive stage of the gammetozygotes. These elements show themselves like dark coloured spheres with the ring of the pellucide zone at the periphery, separated from the cytoplasme by a periviteline, narrower or larger in function of the blastomeres and of the polar corpuscles is their main characteristic. Some of these structural aspects, in their evolution, are presented in figure 1.

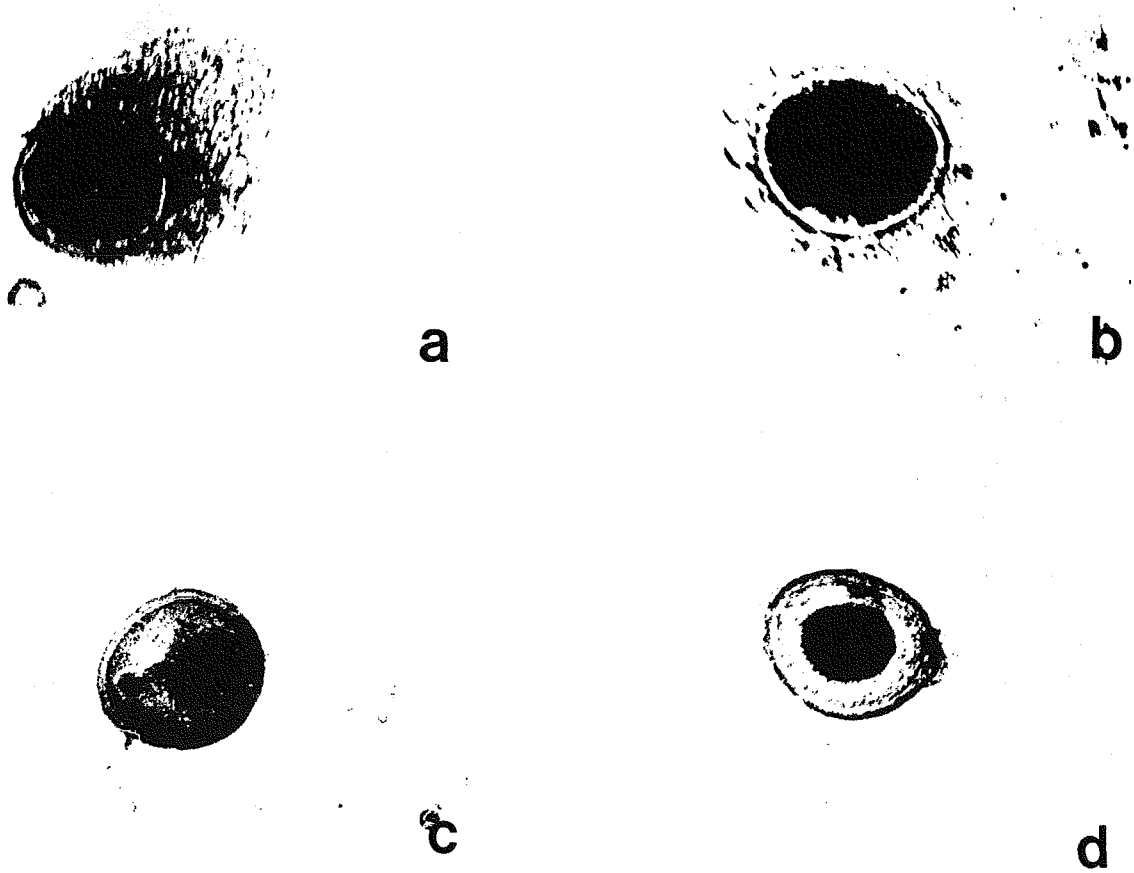


Fig. 1. Evolutive stages of mink zygotes during the pre-implantation period: a. - recently ovulated ovocit, surrounded by egg cumulus; b. - zygote with folicular cells adherent to the corona radiata, after the detachment of egg cumulus, the cell that persists even several days at this species in the case of the brake of the fecundation process (it constitutes the zygote phase the most frequently met in the structure of the blastocytary sand); c. - blastocyts in the stage of 10 days (March 21st); d.- blastocyst in the stage of 20 days (March 28th).

At the pregnant female during the first days after pregnancy installation, among the zygotes with 2, 4, 6 ... etc blastomeres may also met evocytes which haven't been fecundated. As the last ones are old and affected by the process of cytoplasmatic degeneration they may be taken for the blastomeres of the zygotes and that's why it is necessary the examination after "in toto" preparation or after the histologic section of the gammetozygotes.

The alive blastocyst, respectively the coloured blastocytary vesicle, may be diagnosed at stereomicroscope after the cytotissuelary structure of the wall, the absence of the nuclear picnoses and of the unequal sizes of the cells (*Pascu* 1973, *Paraipan* 1977). In the microscopical field are found, especially when

histological actions are practised, abnormal blastocysts, zygotes in different stages, blastocytary sand and in many cases nothing is found after the uterus washing. From the multitude of these aspects, we consider two moments as very important, i.e. the initial one and the final one of the preinstallment period, respectively the ovocyte fecundation by the spermatozoon (fig. 2) and the stage previous to installment (fig. 3).

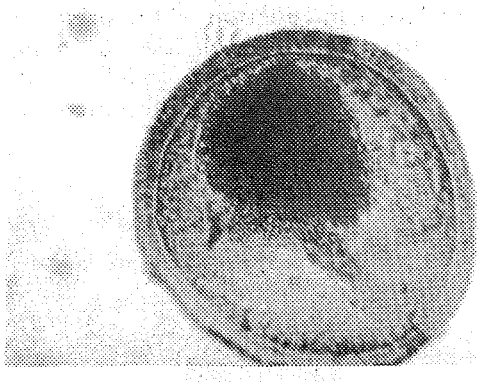

Fig. 2. Blastocyst in the stage of 7 days, at which the periviteline space persists the presence of the tunnel enzymatically carved (arched towards the left) by the motile spermatozoon, capacitated and enzymatically acrosome-reacted.

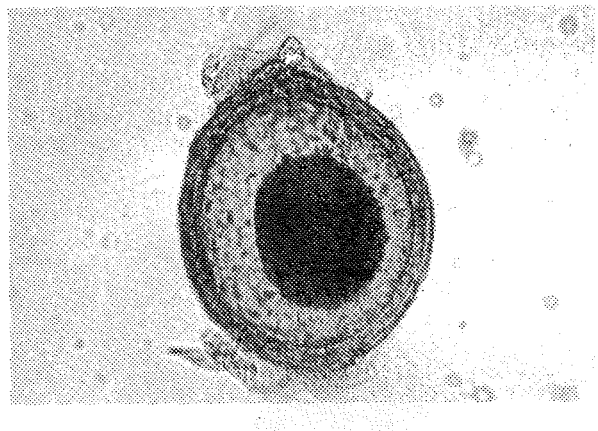

Fig. 3. Mink blastocyst in the stage previous to endometrial implantation.

The analysis method and the establishment of the mink fecundity diagnosis, which may potentially influence the counted reproduction results. In the present paper we are going to refer at one of the pathologic situations with such influences, i.e. the serious affecting of the mink fecundity in the case of the action of the AD virus.

Similar to the lesions provoked in the rest of the tissues and organs, this parvovirus with a characteristic lymphothropism also acts with the same selectivity upon the tissues of the uregenital sphere and mainly upon the materno-embryophoetal complex (*Onet* 1983, *Kaaden* et al. 1984), generating troubles of immunitary enzymatic and hormonal order, many of these aspects being not yet ellucidated. In this direction, an attempt we consider worth to be mentioned and which might widen the perspective of the studies linked to the mink fecundity affected by AD refers to the fact that unfecundity might be favoured by the troubles in the histamine synthesis induced by defficiencies of immunitary order (selfimmunitary phenomena etc), as after certain research workers (*Sander* et al. 1984) the histamine has an important part in ensuring a normal preinstallment development.

The action of the virus is present in all the stages of the reproduction at mink females beginning with ovulation, going on with the deviations of the endometrial synthesis integrity of the embryotroph (characteristic for the embryo-phoetal stage), as well as at the end of gestation and at parturition. The main aim of these observations is to divide into periods and differentiate the viral action along the reproduction cyclogramme, comparative to reproduction evolution at apparently same minks (negative reaction at tests for AD), aspects which, under different farms, are to be found in the observations we have done in this direction, during the gestation period as well as postnatively, is syntetically figured in fig. 4.

We mention that the genital tracts of the minks from the experimental lot presented luteinic corpora on the ovary surface, no matter the presence or the lack of the viral action, fact showing the existence of heats, the felicular ovulation and the formation of secreting luteinic corpora. The registered ovulation value doesn't present significant differences between the minks with negative reaction and these infected with A virus, the average obtained being relatively different only between the cathegories of age: 8.38 at youth and 9.13 at adults (luteinic corpora/female at both ovaries).

The conception value calculated following the hunting out and the number of zygotes by the analysis method consequently underlines the manner of AD influence, this one being reduced at infected minks with 18.7%. At the same time the presence of blastocytary sand also differs, at infected minks it being present

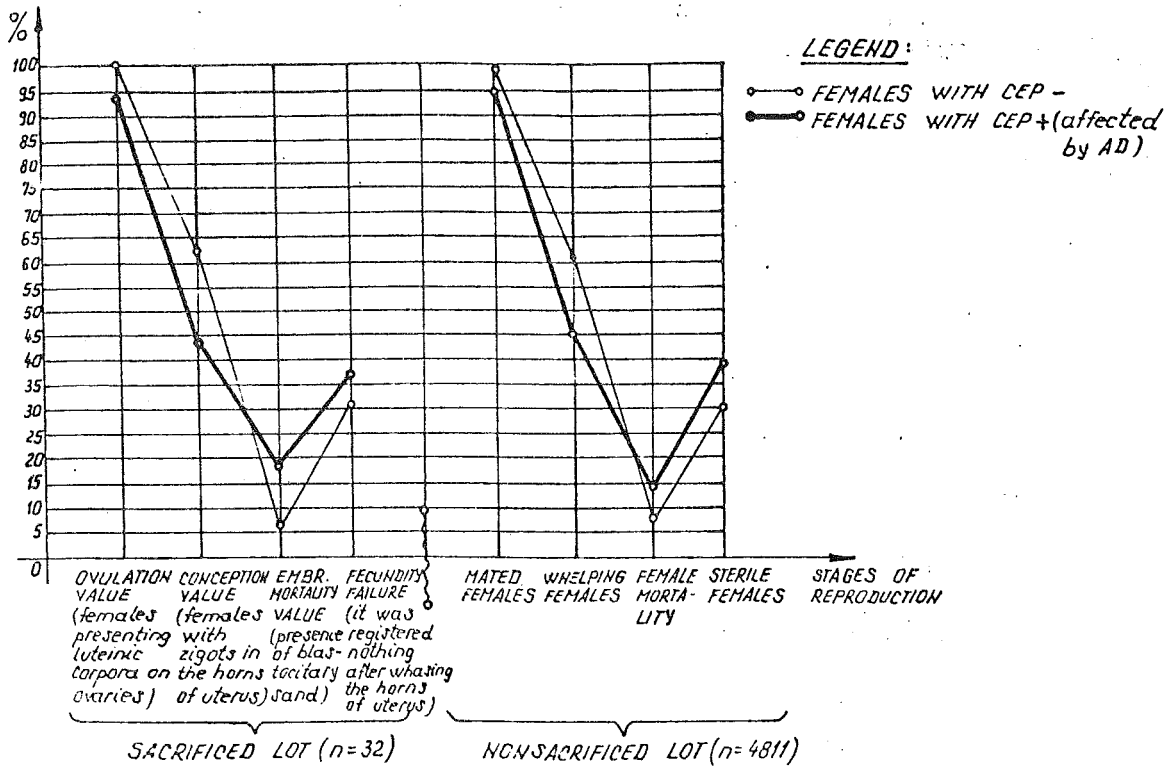


Fig. 4. The influence of AD upon fecundity, the reproductive cycle and the postnatal period at mink.

more frequent with 12.5%, fact that indicates a bigger embryo mortality installment in this case. In the situation in which no other element was found consequently to the washing of the horns of uterus we conclude that in fact fecundation wasn't fulfilled, the difference between infected minks and those from the witness lot being smaller this time (at infected minks fecundation wasn't done at a larger number of animals only with 6.3%).

The explanations of the results of the elements of the liquid drawn from the horns of the uterus concerning the mink fecundity aren't easily to be affected, especially when the gametes of both sexes are affected by the A virus. But generally the done observations show that the mortality share of the conception products in AD is located in the initial period of gestation (especially in the preinstallment period), when the influence of the male gametes superposes to the evolutive action of the disease.

The action of the virus induces in the male organism selfimmunitary phenomena, and in the female organism (inclusively at the level of the uterine horns) determines the production of the breaking of the spermatozoon capacitation phenomenon, which, through troubles of morphological, physiological and biochemical order make unable their penetration among the cells of the corina radiata, or through the pellucide zone of the evocytes in order to fulfill the fecundation process. This one represents one of the explanation of the cases when it wasn't found any element in the liquid drawn from the horns of the uterus.

The A virus, besides the morpho-functional modifications it provokes at the level of the male genital apparatus, may produce the organ function without pointing out the morphological lesions. *Gluhevschi* (1978) mentions that the spermatic anticorps may appear on the background of an immunologic instability from the blood serum and the spermatic liquid and that seminal plasma as well as the testicle contain antigenes commune to other organs (kidneys, liver etc), which seen to (by breaking the process of spermatozoon capacitation) at the reduction of the conceptual installment of the zygotes.

The unfulfilment of certain of the complex biological processes of fecundation (transport and duration of the spermatozoous advance in the genital ducts, the viability, the number and their manner of capacitation, the ovulation moment, migration and evule viability etc) lead either to fecundation unfulfilment or to stopping of the zygote development in certain stages, fact that the mink gametes union in AD, also underlined by some results of the

work method, constitutes an essential aspect of the problem approached, fact that needs discussion of additional aspects.

Usually, as it is known, the spermatozoon penetration in ovocyt and the proper fecundation also takes place at mink similar to the other species, the lytic action being assured by penetration enzymes (CPE - cerena penetrating enzyme) and the attaching being done through complex substances of the type of proteinecarbohydrate molecules and of receiving sitususes (*Gluhevschi* 1983, *Seiciu* et al. 1987).

In the case of AD affection for the fecundation process it will be necessary to take into consideration a larger sphere of aspects, i.e., in order to izolate and precise the elements implicated in the process of spermatozoid-ovocyt attaching will be done, as for other species of animals, immune-chemical analysis and the examination of the lipoconjugations from the spermatozoon surface and of the pellucida zone (*Schmell & Gulyas* 1980, *Myles* et al. 1981, *Ahuja* 1982, *Saling* 1982, *Seiciu* et al. 1987 etc). Thus it was observed that antispermatozoon monovalant antibodies prepared on rabbit inhibited periovocitary cumulus dispersion, tendency that may be like the action of the selfantibodies pointed out in AD at mink. In this context the link of the spermatozoon to the pellucide zone and gametes fusion is disturbed. We may conclude that in the case of immunitary defficiencies in AD, antigenic configuration from the mink spermatozoon surface is evidently broken in the interaction with the receivers from the pellucida zone surface.

The practical importance of gametes attaching at minks affected by AD is in fact a problem of immunoreproduction, that one of antibodies and selfantibodies formation before the pellucida zone, and respectively, before spermatozoous and the appearance of immunitary intolerance phenomenen. In the case of selfimmunopathies, as for example that one appeared as a consequense of A virus action, due to selfimmunitary disturbances appear the self reject and, consequently, is reduced the chance of attaching the spermatozoous of the own species.

More than that, antibodies may block fecundation, not only by spermatozoon agglutination, but also by affecting their viability and mortality, and even after it was fulfilled the acrosome reaction, the attaching and penetration of the pelucida zone, in the period of fusion with the cytoplasmatic membrane of the ovocyte *Gluhovschi* 1983, *Seiciu* et al. 1987 etc).

Given the multitude of these possibilities that affect fecundation we consider that at the basis of partial, or total infecundity, ethiopathogenesis at mink lie izoimmunity phenomena, which through antibodies synthesised by the organism infected with A virus cover the spermatozoon receivers breaking the capacitation and the attaching at suplementary situses from the surface of the pellucida zone of the ovocyte. It was observed at mink females affected by AD a high titre of antibodies and, implicitely, of spermatozoon antibodies, and even if it was practiced heterospermia as a method of counteracting the izoimmunity phenomenen, the females remained unfecundated.

**Conclusions**

1. The diagnosis method of the infecundity and prolificity, by comparative microscopic analysis of blastocytes resulted from positive mink females as well as from negative ones at AD, shows the similitude of the evolutive stages of the zygotes from the preimplantation period, but, at the same time, put into evidence troubles of fecundation, growth and optimal segmentation of the zygotes from the respective disease.

2. If from the point of view ovulation modifications are nonsignificant between minks positive and negative at CEP test, in exchange in the process of fecundation take place perceptible troubles at the females affected by AD, registering a reduction of the zygotes with 18.7%, concomitently with the growth of embryonary mortality with 12.5% (by pointing out the blastocytary sand) in comparison with the witness lot.

3. Selfimmunopathy generated by the A virus action may be considered as an essential element of partial or total fecundity ethyopathology at mink, due to izoimmunity phenomena which lead to the unfulfilment of ovocyte fecundity more frequent with 6.3% comparative to minks negative at CEP test, situation put into evidence by the absence of zygotes at the washing of horns of uterus, and at populational level, by the high amount of mated females which don't become pregnant.

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**Production recording**

*Raija Ingo*

Data on animals at 80 mink, 90 fox and 10 raccoon dog farms in Finland were analysed. Mortality of fox females was 0.52, 0.35, 0.22 and 0.20% resp. in June, July, Aug. and Sep., and that of cubs was 3.78, 1.22, 0.30 and 0.23%. Of blue fox females mated with blue fox or silver fox males and silver fox females mated with silver fox males, 13.64, 17.4 and 18.15% resp. were infertile. For 26284, 368 and 892 blue fox females mated, inseminated or mated + inseminated, using blue fox males, litter size at birth averaged 7.78, 5.18 and 7.89 young resp. vs. 5.78, 5.80 and 4.31 for 1908, 6699 and 138 blue fox females mated, inseminated or mated + inseminated, using a silver fox male, and 3.54, 2.10 and 2.74 resp. for 3023, 350 and 74 silver fox females bred to a silver fox male. In the 3 groups, the corresponding figures for litter size at weaning were as follows: 7.23, 4.73 and 7.24; 5.07, 4.81 and 4.28; and 3.08, 1.96 and 2.33.

*Finsk Palstidskrift; 21; 12; 675-677; 1987*
*In SWED*
*2 fig. 6 tables*

*CAB - abstract*

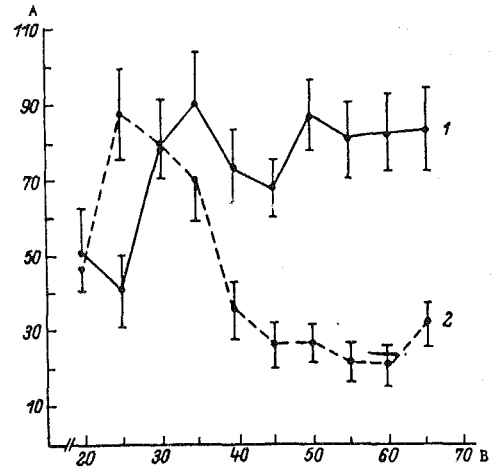



Fig. 1. Total time of motor activity (A, sec) in foxes of different ages (B, days). 1) Domesticated; 2) unselected.

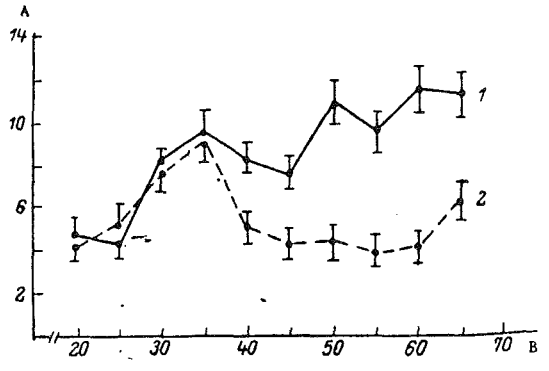



Fig. 2. Amount of running (A) of foxes of various ages (B, days). Designations as in Fig. 1.

**Physiological limits of the sensitive period of primary socialization in silver foxes and changes in the limits in the process of domestication**

*D.K. Belyaev; I.Z. Plyusnina, and L.N. Trut*

An attempt was made to determine the sensitive period for primary socialization in foxes. On the average, by the third week fox pups are able to see and react to sound; orienting-investigative behavior in unfamiliar surroundings begins at that time. Age 20-30 days may be considered as the beginning of the period of socialization; age 30-40 days is evidently the period of greatest active establishing of social bonds since fox pups in an unfamiliar situation exhibit maximum orienting-investigative behavior at that time. Age 40-45 days is the upper limit: at that stage of ontogenesis, the fright reaction to an unfamiliar situation occurs, and this interferes with the investigative reaction. In domesticated pups, the sensitive period of socialization is much longer, and may extend beyond age 60-65 days.

*Journal of evolutionary biochemistry and physiology. New York, N.Y. Consultants Bureau Nov/Dec 1986 (transl. July 1987) v. 22 (6): p. 374-380.*
*Translated from: Zhurnal evoliutsionnoi biokhimii i fiziologii, v. 22 (6), Nov/Dec 1986, p. 555-562. (QH345.25).*
*3 tables, 3 fig., 15 references*

*Authors summary*

**Apparent role of melatonin and prolactin in initiating winter fur growth in mink**

*Jack Rose; James Oldfield, and Frederick Stormshak*

A study conducted to determine the effects of exogenous melatonin and bromocryptine (CB-154), an inhibitor of prolactin synthesis and secretion, on the induction of winter fur growth in mink. Melatonin (10 and 120 mg) was administered to mink (N = 5/group) via silastic implants inserted sc over the scapular area during the last week of June 1985. Treatment of mink (N = 5) with CB-154 alone or in combination with 10 mg melatonin (N = 5) consisted of daily sc injections of 2 mg of the drug in sterile saline from June 25 through July 30. Control animals (N = 5) did not receive injections of vehicle or sham implants. Administration of CB-154 alone or in combination with 10 mg melatonin, as well as 120 mg melatonin alone, initiated growth of the winter fur significantly earlier than that of controls or mink treated with 10 mg melatonin ($P > 0.05$). These data suggest that inhibition of prolactin secretion by melatonin is requisite for induction of molt of summer fur and growth of winter fur of mink.

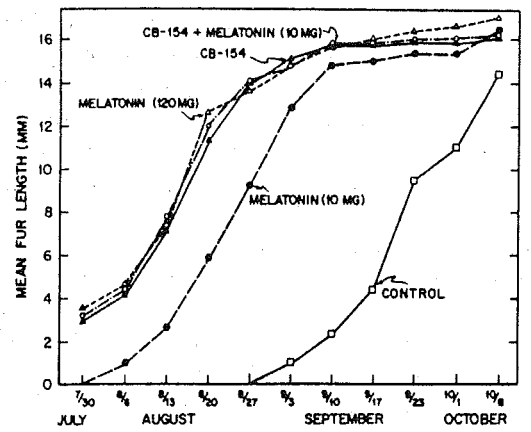



FIG. 1. Fur growth of adult female standard dark mink treated with melatonin (0, 10, and 120 mg) from June 25 through October 8, and bromocryptine (CB-154) either alone or in combination with 10 mg melatonin from June 25 through July 30. The estimate of the common standard error of the mean was ±0.78 mm.

*General and comparative Endocrinology 65, 212-215 (1987)*
*1 fig., 16 references*

*Authors summary*

**Plasma and pineal melatonin levels in female ferrets housed under long or short photoperiods**

*M.J. Baum; H.J. Lynch; C.A. Gallagher, and M.H. Deng*

Ovohysterectomized female ferrets were housed in controlled environment rooms in which the daily lighting schedule was either 15L:9D (long days) or 9L:15D (short days). After 2 weeks some ferrets in each group were given an intrajugular catheter: beginning 1 week later, a blood sample was taken daily at one of eight different clock times over an 8 to 10 day period. One additional blood sample plus the pineal gland were collected from these animals and from uncathetarized animals in each group after decapitation at different clock times. Both plasma melatonin concentrations and pineal melatonin content were elevated in a square-wawe pattern during the dark hours, whith the duration of elevation being longer in ferrets kept under the short days. These results suggest that differences in the duration

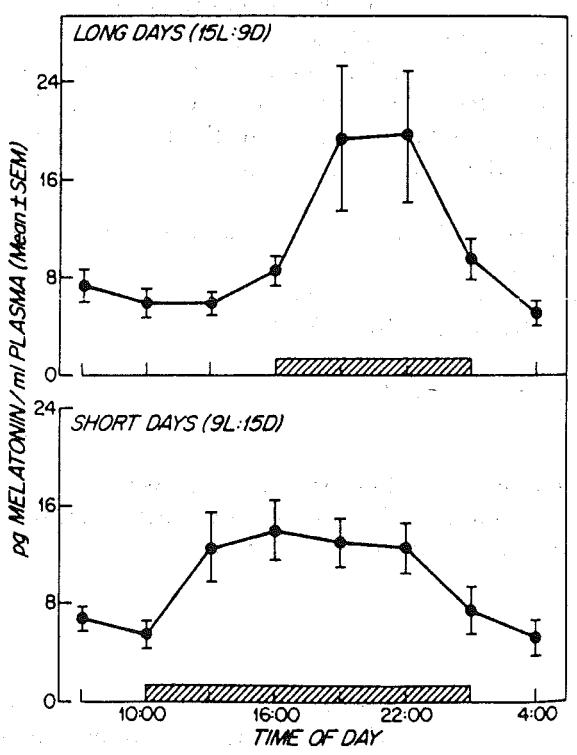



FIG. 1. Plasma melatonin concentrations in ovohysterectomized female ferrets housed under either long or short days. Plasma samples from 6 to 12 ferrets were analyzed at each time point. The samples collected under long days at 16:00 h and under short days at 10:00 h were taken just before the colony lights went off. The samples collected at 01:00 h under both long and short days were taken just before the colony lights went on. *Hatched bar* indicates period of darkness.

of nocturnal increments in melatonin secretion may mediate the stimulatory effects of long and short days, respectively, on ovarian activity in female ferrets.

*Biology of reproduction 34, 96-100 (1986)*
*2 fig., 28 references*

*Authors summary*

**The influence of ivermectin on the fertility and health of foxes**

*A. Kopczewski; A. Malczewski; M. Wróblewska, and T. Zdunkiewicz*

The aim of the work was to check the influence of ivermectin (Ivomec - a 1% sol.) and its application on the fertility of adult animals and state of health of young foxes. The studies were carried out on 598 female polar foxes and popular ones; of the animals 474 were vaccinated and 184 served as controls. Besides 2390 animals born and 2112 grown up were also observed. Ivermecion was given in form of injection subcutaneously at the rate of 200 mcg/kg of body weight. The findings were analysed statiscally by means of "u" test and X square test. There was found statistically significant better results in the experimental group than that in the control one.

*Medycyna Weterynaryjna 43, 2, 102-104. Rok XLIII*
*1 table, 3 fig., 8 references*
*In POLH. su. ENGL, RUSS.*

*Authors abstract*

**Metabolic and behavioural responses of muskrats (Ondatra zibethicus) to elevated $CO_2$ in a simulated winter microhabitat**

*Robert A. MacArthur*

Metabolic and behavioural responses to inspired $CO_2$ were investigated in muskrats housed in a microhabitat designed to simulate winter field conditions. Mean daily rate of oxygene consumption ($Vo_2$) declined from 1.46 mL $O_2$.g.h$^{-1}$ in animals breathing room air to 1.11-1.25 mL $O_2$.g.h$^{-1}$in animals inhaling 4-10% $CO_2$ in the simulated lodge. Daily patterns of $Vo_2$, abdominal body temperature ($T_b$), and foraging activity were minimally affected by chronic $CO_2$ exposure, though muskrats breathing 9-10% $CO_2$ made shorter voluntary dives. The ability of muskrats to rewarm following foraging activity was slightly depressed by hypercapnia. Abrupt exposure of resting animals to ambient $CO_2$ levels of 10-16% often elicited avoidance reactions in the absense of any apparent change in $Vo_2$ or $T_b$. This study provides the first demonstration of behaviuoral and metabolic responses by muskrats to $CO_2$ levels encountered in the winter microhabitat of this species.

*2 tables, 4 fig., 28 references*
*In ENGL., su. FREN.*

*Authors summary*

**Behaviour analysis of polecat ferrets during social play**

*Von Alfred Diener*

The article deals with the social play of polecat ferrets (*Mustela putorius f. furo*). The coordinations in playful romping are compared with parallel functional behaviour patterns. The behaviour shown in play is less stricly coordinated and orientated than the corresponding behaviour sequences in fighting and mating. Some of the forms of behaviour are more intensive and longer lasting in a serious context than they are in play. In the ontogenesis of social play voth continuity and stages of development can be differentiated. The basic patterns of attack and defence are displayed in complete form shortly after the eyes open. The deliberate gripping of the nape of the neck develops gradually. It is probable that this development is partly dependent on learning processes.

The social experience of young polecat ferrets affects the degree of their play motivation. During the experiment, animals wich had been reared alone played together more than three times as much as those reared socially. The withholding of social experience apparently causes a drop in the treshold values of many sequences of play behaviour.

In play, sex difference affects both the readiness to act and the frequency of many forms of behaviour. In general males play more

frequently than females. In encounters between opposite sexes the males play offensively and the females defensively or passively. It is assumed that social play serves tp develop forms of bahaviour which will later be of decisive importance in social behaviour generally and in sexual behaviour in particaular.

*Z. Tierpsychol., 67, 179-197 (1985)*
*6 tables, 3 fig., 60 references*
*In GERM., su. ENGL*

*Authors summary*

**Reproduction in weasels mustela nivalis in Poland**

*Bogumila Jedrzejewska*

Eighteen female weasels *Mustela nivalis* Linnaeus, 1766, in breeding condition were caught in different parts of Poland from 1962 to 1986. All were examined macroscopically. Pregnancies occurred from April to September. Lactating females were caught from May/June to late October. Two females were found to be pregnant and lacting simultaneously. No signs of reproduction were found in winter.

*Acta Theriologica, Vol. 32, 31: 493-496, 1987*
*1 table, 8 references*

*Authors abstract*

**Seasonal marking in an Otter Population**

*Sheila M. MacDonald, and Christopher F. Mason*

Observations were made on the marking activity of a population of otters *Lutra lutra* (Linnaeus, 1758) in Wales, United Kingdom, over the period 1981-1984, with monthly counts of signs at nine 1 km stretches of river. Marking was found to be distinctly seasonal, with peaks in winter and early spring in all three years of study. During the peak period there were more spraints (faeces), more "jellies" (jelly-like secretions of various colours) and more scratching and rolling. During summer more "smears" (tar-like secretions lacking solid food remains) were found. It is suggested that this seasonal marking pattern may be related to the development of re-inforcement of dominance relationships between otters at a time when young animals become independent of their mothers. Judging by the increasing trend in signs over the study period, this otter population may be increasing.

*Acta Theriologica, Vol. 32, 27: 449-462, 1987*
*1 table, 5 fig., 17 references*
*In ENGL., su. POLH*

*Authors summary*

**Use of radio tracking to improve the estimation by track counts of the relative abundance of red fox**

*Jorge I. Servin; Jaime R. Rau, and Miguel Delibes*

Radio tracking of red foxes *Vulpes vulpes* (Linnaeus, 1758) in Coto Donana (SW Spain) was used to obtain a correction factor to transform the number of fox trails crossing a transect into an index of relative abundance, expressed as individual foxes per km. Results prove that the patterns of fox movement and the transect position greatly influence the data obtained through track counts.

*Acta Theriologica, Vol. 32, 30: 489-492, 1987*
*1 fig., 11 references*

*Authors abstract*

**A drinking system with dripping water for mink**

*Steen Møller, and Outi Lohi*

A drinking system for mink, where water is constantly dripping to the tongue of the drinking valve, has been tested during the lactation period and after weaning.

Before the mating season 120 scanblack mink females were divided into an experimental group with the dripping water system, and a control group with traditional drinking valves. Both groups of 60 females were mated and fed according to normal farm routine. The dripping water system was opend in the beginning of May, when most litters were delivered.

Fifteen females with litters of 5-6 kits, born on the 2nd or 3rd of May, were chosen from each group. The females and their kits were weighed every ten days until weaning. The drinking behaviour was observed twice a day from the 9th of June to the 30ht of June.

After weaning. male and female pairs (litter mates) of kits were placed 60 pairs in cages with dripping water system and 60 pairs as kontrol in cages with traditional drinking valves. Both groups were weighed every two weeks until the 26th of August.

The water temperature in the two systems was measured during the test period.

The dripping system had no effect on the loss of weight of the females, nor on the weight gain of the kits during the lactation peiod or after weaning. There was no difference in the drinking water temperature between the two systems.

However, the dripping water system had a positive effect on the drinking behaviour of the kits. Less problems in learning to activate the drinking valve were detected, and the kits in the experimental group in average had their first succesful try at an earlier age than in the control group even though this difference was not significant.

The fairly cold and humid weather characteristic of the lactation period 1987, might explain why the observed differences in behaviour did not effect weight of the minks.

*Statens Husdyrbrugsforsøg, meddelelse No. 711,*

*4 pp*
*5 tables, 1 fig.*
*In DANH.*

*Authors summary*

**Induction of winter fur growth and puberty with melatonin in male mink kits**

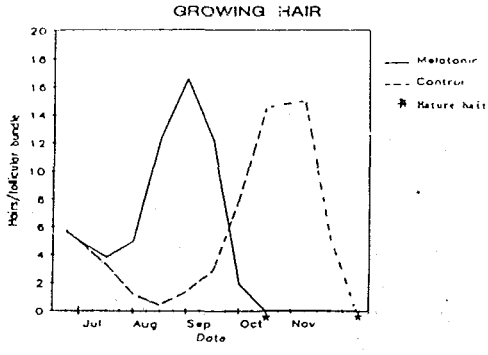
*M. Valtonen; L. Blomstedt; C. Sundqvist, and A. Lukola.*

In mammals seasonal coat changes and the reproductive cycle are regulated by the length of the daily photoperiod acting through the pineal gland. In mink *Mustela vison* decreasing day length in late summer initiates autumn moult and the growth of the winter fur. After priming genital recrudescence starts in late November. These changes can be induced with melatonin (*Allain et al.*, 1981). To study the effect of melatonin in kits, a silastic implant containing 12 mg melatonin was inserted in 42 male mink kits after weaning during the last week of June. Nine biweekly blood samples were collected from the beginning of August.

A faster increase in feed intake and weight gain was observed in the melatonin treated minks during August. They also produced a fully prime winter fur six weeks earlier than control animals. The testicular development and an increase in plasma testosterone occured a month earlier than in controls. The peak rise in testosterone was preceded by a rise in plasma thyroxine. It seems that melatonin is progonadal in male minks.

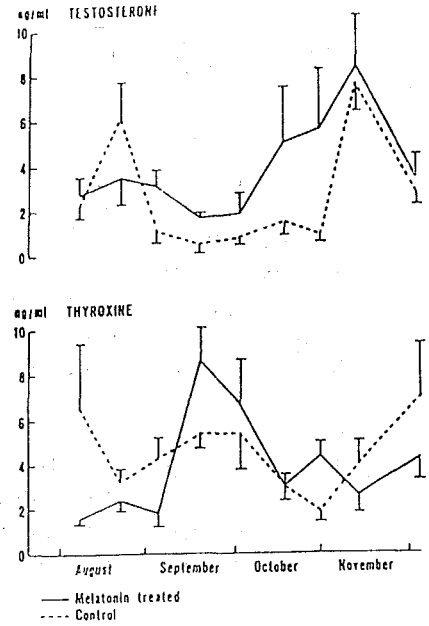
*XXX Congress of International Union of Physiological Sciences, Vancouver, Canada, 1986.*

*Authors abstract and figures only abstract received*

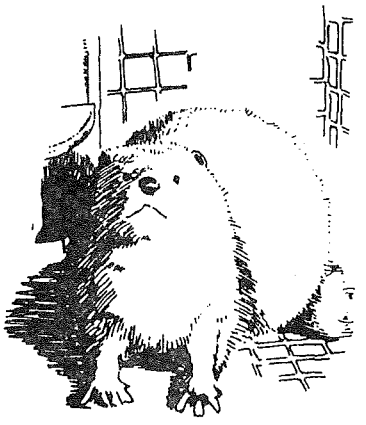



TESTICULAR DEVELOPMENT

| Date | Group | Testicular weight g (M ± SD) |
|---|---|---|
| October 9 | Melatonin | 2.45 ± 0.92 |
| December 4 | Melatonin | 6.0 ± 2.66 |
| December 4 | Control | 1.6 ± 0.18 |



*Original report*



# DanMink, a computerized breeding system

*Niels Glem-Hansen*, Danish Fur Breeders Association, 60 Langagervej DK 2600 Glostrup, Denmark.

**Summary**

In fur production, as well as in any other animal production, it is important to develop and utilize the best possible genetic potential. Traditional selection has until now been based on individual evaluations. The use of computer programmes make it possible to include a certain number of relatives by calculation of family indices and thereby achieve a higher degree of certainly in the estimation of the genetic potential of an animal.

The DanMink system is based on the latest scientific knowledge and the method of estimation of indices has been published in well known scientific journals.

From 1988, it is offered to Danish mink ranchers and at present approximately 250 farms with 300,000 breeding females are DanMink users.

## Introduction

The time consuming work of writing cards on a mink ranch was the motivation for making the first computerized breeding systems and also for some farmers to use such systems. However, the incorporation of advanced calculations to obtain more accurate estimates of breeding values, based on family indices have changed the systems from a labour saving facility to valuable tool in the breeding work on the farms.

The use of computers in the breeding work has not changed the work on the farms during selection, mating and whelping, but it has increased the demand for data dicipline to a level which is not common on all farms. This will be new to many ranchers, but it is important to realize that computers are not in any way miraculous machines which are able to create useful results from inaccurate or wrong

However, the computer can be a great help if it is properly used.

Besides including a number of relatives the programmes can create a general breeding value of the animals by the weighing of single characteristics into a general index, which enables the rancher to decide the weight of each single character for the creation of the breeding value.

The Danish Fur Breeders Association has developed a system called DanMink, which has been created to follow the annual cycle on a mink farm. It is based on easy to handle menues, following the natural cycle of the mink.

## Reproduction (mating and birth)

The information concerning mating and birth has to be entered before weaning. The coding can be made by collection of the cards, but it can also be entered into a hand terminal either by normal coding or by using bar codes! A score board can be used for the numbers which are not on the cards in bar codes.

All indices have to be based on calculation within a closed line. Therefore, all information concerning a certain line has to be entered before the calculation of the indices. Comparison of indices can only be made within lines.

A number of statistics can be made on the basis of the reproduction, such as:

- Mortality after males, which is a ranking of males due to the mortality of their offspring. The mortality can be hereditary and, therefore, it could be reasonable to exclude offspring from these males as future breeders.
- Percentage of empty females after males. To point out which males are less fertile a list of males after percentage of empty females can be made, and the kits can be excluded as breeders.
- Fertility index can also be used to make ranking lists as a help in the later selection of kits as breeders. Kits which you want to ignore due to the above criteria can be excluded from the rank list for fertility. If you want to take fertility index into consideration, you can make a limit which gives you, for example, twice the number of animals needed as breeders and then make your selection according to other important characteristics.

## Growth

Mortality, disease, and defects can be hereditary. DanMink gives the possibility to point out families which tend to have higher mortality, greater disease problems or too high frequency of defects. These families can be eliminated by choice.

## Selection

The most powerful facility in the DanMink system is the possibility of making family indices for pelt characteristics. The precondition for the calculation of these indices is a grading of all animals in a certain line. This seems to be very laborious, especially on a big farm. However, one of the biggest farms in Denmark has developed grading equipment and a handterminal system which makes it practicable, even on their farm, with approximately 60,000 kits. Using bar codes and portable equipment they make the grading with minimum labour costs.

When the grading is completed and the individual indices are calculated, the system enables you to try different weighings of the individual indices into a breeding value as the final criterion for selection. When you have chosen the number of breeders you need and the weighing you want, the system calculates the average indices for each single characteristic. Different weighings can be made until you feel you have reached the best possible progress and then a ranking list can be printed for your final selection. Kits wich have been sorted out due to the above mentioned procedures will be excluded from this list.

Old breeders can be evaluated on the basis of their offspring and listed in ranking order for the selection.

## Report Generator

The basic information for each single animal is filed to enable all possible kinds of analyses. Only your fantasy sets limit for which analyses can be made. The purpose of such analyses could be used as a control of the breeding work and estimation of the progress.

## Conclusion

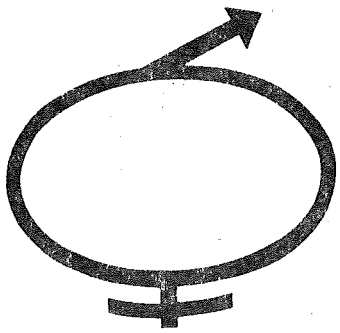
The system was developed in 1985-86 and it was tested on 40 practical farms with approximately 60,000 breeding females in 1987.

The system will be translated into English and, hopefully, presented later this year at the 4th International Scientific Congress in Fur Animal Production in Toronto.

## References

*Børsting, E.* (1988). Family index for live grading in mink. Report to the 4th International Scientific Congress in Fur Animal Production, Toronto 1988.

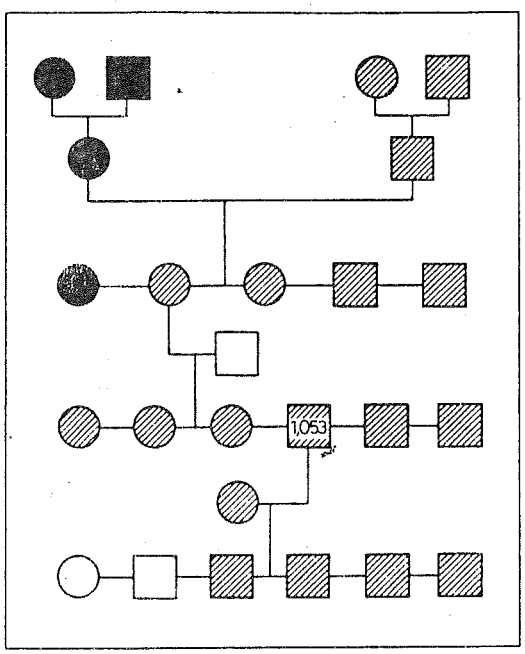
*Einarsson, E.J.* (1981) Heritability for litter size in mink, with special reference to methods of estimation and influence of maternal effect. Acta Agriculture Scandinavia 31, 219-228.



**Genetic polymorphism of IgG in the mink**
III. Instability of expression and the problem of the genetic control of C gamma-allotypes

*A.V. Taranin; L.V. Mechettina; O.Yu. Volkova; I.I. Formicheva; O.K. Baranov, and D.K. Belyaev*

Quantitative expression of C gamma-allotype H4 of mink immunoglobulins was studied by enzyme-linked immunosorbent assay. The results presented suggest that production of H4 is under specific regulation. The concentration of H4 varies three orders of magnitude (10-10,000 microgram/ml) from one mink to another. Fifteen percent of the sera of normal minks have the low H4 concentration, undetectable by the standard procedure of double immunodiffusion routinely used to test mink IgG allotypes. However, expression of these 'minor' allotypes may be significantly enhanced by hyperimmunization. Instability of this kind seems to be main cause of earlier described deviations from Mendelian inheritance of C gamma- allotypes H2, H3 and H4.

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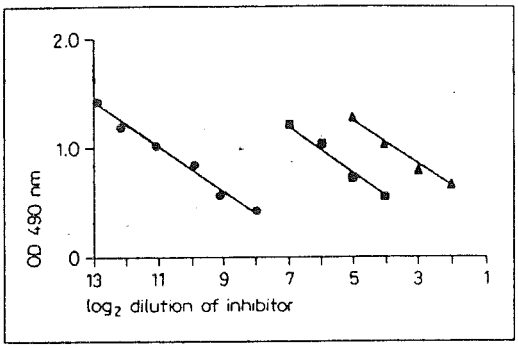
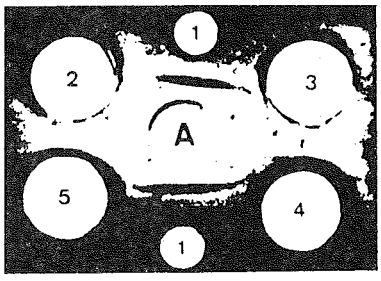



3a




3b

Fig. 2. Fragment of a pedigree showing the inheritance of H4 according to the data of DID and ELISA. ■ = H4-positive by DID; ▨ = H4-positive only by ELISA; □ = H4-negative.

Fig. 3. Test for antigenic identity between minor and standard H4. a Inhibition of binding of enzyme-labelled H4-IgG with anti-H4 antibodies by dilutions of 2 sera H4-negative as judged by the DID data. ● = Standard H4-IgG; ▲ = serum 1091; ■ = serum 1062. b DID of anti-H4 antiserum (A) with 1/5 diluted standard H4 serum (1), serum 1024 (2), serum 1053 (3), serum 1016 (4), serum 1062 (5).

*Expl clin. Immunogenet. 4: 73-80 (1987)*
*1 table, 5 fig., 27 references*

*Authors abstract*

**Genetic polymorphism of IgG in the mink**
IV. Identification and genetic control of L3 allotype of the light chains

*O.Yu. Volkova; I.I. Fomicheva; A.V. Taranin; O.K. Baranov, and D.K. Belyaev*

A new allotype of the mink light chains, designated L3, was identified. This allotype is inherited as a Mendelian character at a frequency of 0.46 in the mink population. Data were obtained indicating that L3 is independent of the C gamma-heavy chain allotypes of mink immunoglobulins. The gene $L^3$ is closely linked to a gene encoding L1, another light chain allotype. Alloantigens L1 and L3 are presumably markers of the light chains of two different subtypes. In contrast to L1, which occurs in many mammalian species, L3 is species-specific, i.e., it is a case of light chain polymorphism representative of the whole mink species.

*Expl clin. Immunogenet. 4: 81-88 (1987)*
*5 tables, 4 fig., 18 references*

*Authors abstract*

**Immonogenetics of immunoglobulins in the American mink**
V Instability of expression and problem of genetic control of $C_Y$ allotypes.

*O.K. Baranov; D.K. Belyaev; O.Yu. Volkova; L.V. Mechetina; A.V. Taranin, and I.T. Fomicheva*

Results are described in the article of a study of expression of $C_y$ allotypes of immunoglobuline (H2, H3, and H4) in blood serum of minks. It was found that with intense hyperimmunizations with different antigens, quantitative and qualitative (according to data of double immunodiffusion) changes in expression of these allotypes can occur in mature minks with high frequency (~0.37), i.e., sharp intensification of quantitative expression and even appearance of the allotype again. Using a highly sensitive immunoemzymatic method adapted for testing of H4, three facts supplementing the results listed above were established: 1) many mink sera considered to be H4-negative according to data of double immunodiffusion do in fact contain this allotype in a minor concentration, 10-200 microgram/ml, characteristic of latent allotypes; 2) minks in which H4 reached normal concentration in blood serum (1-10 mg/ml) in the course of hyperimmunization and, consequently, became detectable with double immunodiffusion as a newly manifested trait, had it even before the start of immunization in a minor concentration; 3) the latent (minor) character of H4 expression is transmitted by inheritance. The set of indirect data permits it to be considered that minor expression and frequent transitions from it to normal quantitative level are very common in allotypes H2, H3, and, possibly, other $C_y$ markers in mink populations. The unprecedently high frequency of latency and instability of expression are obviously a basic, if not the only, reason for deviations noted in minks of $C_y$ allotypes from Mendelian inheritance and difficulties in identifying genetic interrelationships between them.

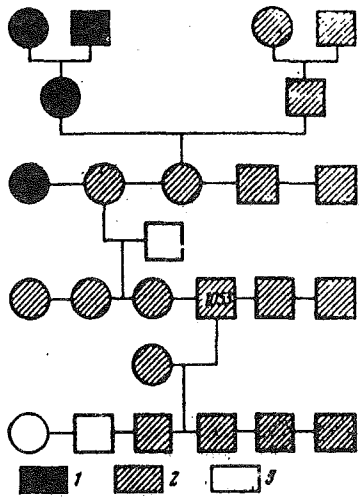


Fig. 3. Part of genealogy of mink, in blood serum of which allotype H4 was tested by double immunodiffusion (DID) and immunoenzymatic analysis (IEA); symbols: 1) mink with normal concentration, registered by DID, of H4 in blood serum; 2) mink with minor concentration of H4 (H4 registered by IEA, but not registered by IEA); 3) mink negative for H4 both by DID and IEA.

*Institute of Cytology and Genetics, Academy of Sciences of the USSR, Siberian Branch, Novosibirsk. Translated from Genetika, Vol. 22, No. 8, pp. 2167-2178, August, 1986.*
*3 tables, 3 fig., 41 references*

*Authors summary*

**The organization and evolution of the immunogenetic systems in the American mink**

(In memory of *D.K. Belyaev).*

*O.K. Baranov*

The genetic systems of mink serum allotypes identified and characterized in Belyaev's laboratory are described. These are the multigene families of Lpm, the gamma (?)-heavy and light chains of immunoglobulins, and the simple Ld-system of low density lipoprotein. The species-specific genes for these systems were identified. The mink differs from the other Mustelidae representatives in these systems. The saltatory transformation in the phylogenesis of the mink gene families Lpm and immunoglobulin C gamma is emphasized. The hypotheses explaining the appearance of 9 new mink Lpm-genes contributing mainly to the allotypic polymorphism of the Lpm-system are briefly presented. The possible causes of the unusually high frequency of unstable quantitative phenotypic expression of the C gamma-genes in adult minks and the evolutionary-genetic mechanisms of the saltatory evolution of this multigene family are discussed. A rapid appearance during phylogenesis of mink under domestication showing great genetic variability and instability similar to the mutations of homeotic genes may be largely the result of the activation of silent genes and inducted by destabilizing selection according to *Belyaev.* Taken together, the results conform with punctualism assigning the main role to macromutations in speciation.

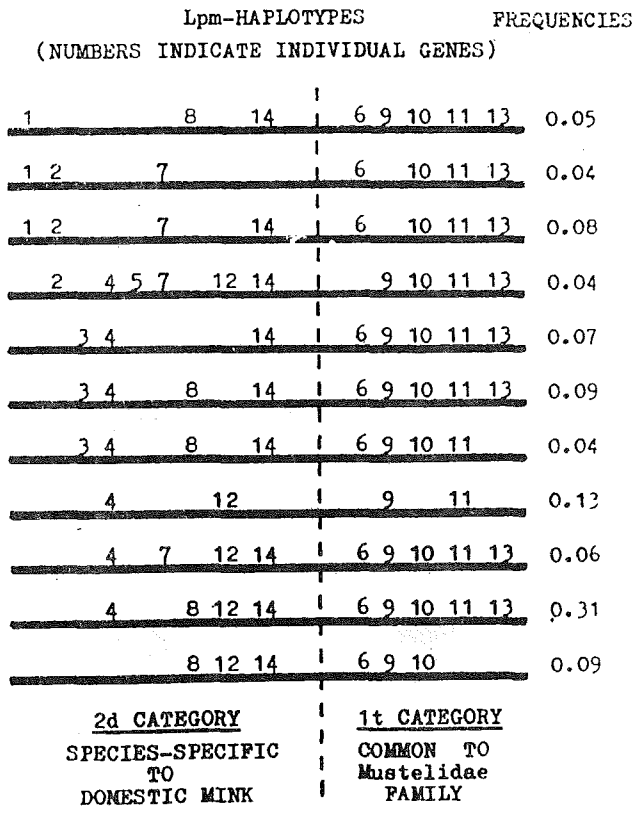



*Fig. 2.* Lpm-haplotypes, intra- and interspecific expression of two categories of Lpm-genes

*J. Anim. Breed. Genet. 105 (1988) 91-102*
*2 tables, 4 fig., 45 references*
*In ENGL., su. ENGL., SPANH., FREN., GERM.*

*Authors summary*

**The variable rates of evolutionary transformations and their parallelism in terms of destabilizing selection**

(In memory of *D.K. Belyaev)*

*L.N. Trut*

The variable rates of evolutionary changes and their parallelism are discussed with reference to *Belyaev's* concept of destabilizing selection.

The morphophysiological reorganization of animals is considered as a result of changes in the regulatory systems of development. The variable rates evolutionary changes are determined by different vectors of selection acting in different evolutionary situations. It is suggested that selection for integrated physiological and behavioural traits accelerates evolutionary transformations. This appears plausible because these traits are correlated with the status of the neurohormonal system. Hormones and Mediators, the carriers of information from neurohormonal system are also involved in the regulation of genetic processes and the integration of embryogenesis.

Similar changes in the regulation of development associated with the same selection vector may underlie the hormologous patterns

of evolutionary changes.

*J. Anim. Breed. Genet. 105 (1988) 81-90*
*3 fig., 45 references*
*In ENGL., FRENH., ITAL., GERM*

*Authors summary*

It is suggested that inherited activation of genes is one of the radical mechanisms of the evolutionary reorganization of gene activity. The concept of dormant genes, as well as the experimental data directly or indirectly supporting it, are considered. Emphasis is on the manifestation and inheritance of the dominant gene fused in the house mouse as a model of gene activation - inactivation. Decreased penetrance of this gene is shown to be an event of less generality masking its inherited inactivation. A scheme is offered for the related events. Similar morphological variability and the *de novo* appearance of inherited characters during domestication suggest that dominant and semi-dominant mutation may be involved in the morpho-functional reorganization of species. Of relevance is prof. *Belyaev's* concept of dormant genes kept in reserve. The use of this reserve at particular steps of evolution or selection can produce a drastic increase in hereditary variability and evolutionary novelties.

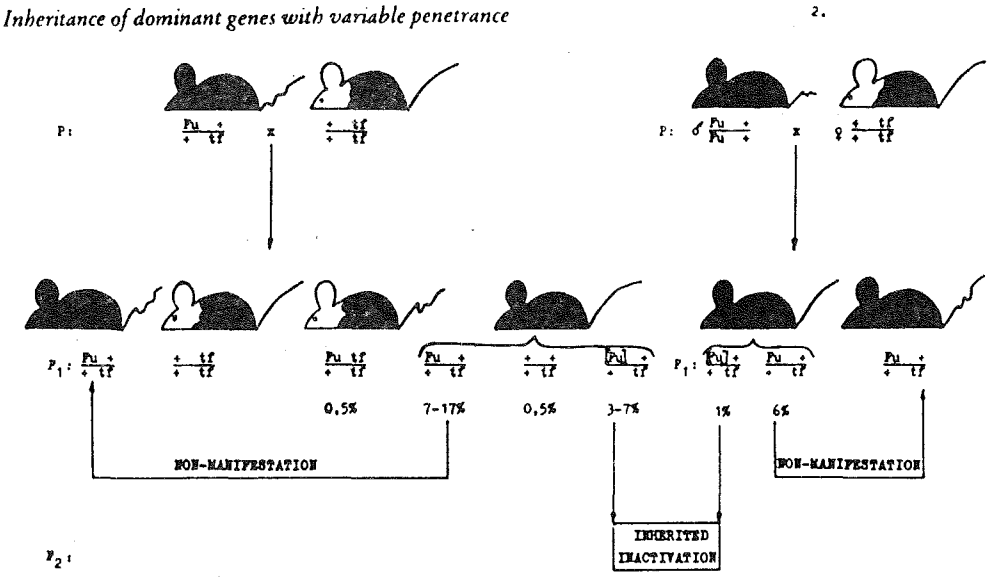



*Fig. 1.* A scheme for genetic analysis of the fused gene in the house mouse

*J. Anim. Breed. Genet. 105 (1988) 103-111*
*2 fig., 42 references*
*In ENGL., su. ENGL., FREN., SPAN., GERM.*

*Authors summary*

## Inheritance of dominant genes with variable penetrance: An evolutionary aspect

(In memory of Prof. *D.K. Belyaev)*

*A.O. Ruvinsky*

## Genetic interrelationships of specific changes in standard coloring of silver-black foxes ("singes" and "stars") arising in the process of domestication

*D.K. Belyaev, and L.N. Trut*

Results are presented of a genetic analysis of specific coloring of domesticated foxes, characterized by the appearance of yellowish-brown spots ("singes") against a background of silver-black color. It is shown that "singes" are inherited as an autosomal monogenic recessive trait. Rather tight linkage was revealed between the $e^p$ gene, which controls the origination of "singes" in homozygous state, and the semidominant gene S, which deter-

mines another specific change in color of silver-black foxes in heterozygous state: the appearance of a white spot on the head, or a "star". Factual material is presented which

TABLE 1. Ratio of Normal and Aberrant Progeny in Those Litters of Normal Parents in Which Cubs with "Singes" Were Recorded

| Litter size (n) | Number of litters (x) | Ratio of aberrants : normal | | | $x^2$ |
|---|---|---|---|---|---|
| | | expected | | observed | |
| | | in one litter q'n | in all litters q'nx | | |
| 1 | 1 | 1,000 | 1 : 0 | 1 : 0 | 0 |
| 2 | 1 | 1,143 | 1,143 : 0,857 | 1 : 1 | 0,041751 |
| 3 | 8 | 1,297 | 10,376 : 13,624 | 10 : 14 | 0,024001 |
| 4 | 22 | 1,463 | 32,186 : 55,814 | 34 : 54 | 0,161292 |
| 5 | 23 | 1,640 | 37,72 : 77,28 | 35 : 80 | 0,291873 |
| 6 | 9 | 1,825 | 16,425 : 37,575 | 18 : 36 | 0,217044 |
| 7 | 10 | 2,020 | 20,20 : 49,80 | 17 : 53 | 0,712552 |
| 8 | 5 | 2,222 | 11,11 : 28,89 | 15 : 25 | 1,885808 |
| 10 | 1 | 2,649 | 2,649 : 7,351 | 3 : 7 | 0,063270 |
| Total | 80 litters 404 cubs | | 132,8 : 271,2 | 134 : 270 | Total $x^2 = 3,397$; $df = 9$; $0,90 < P < 0,95$ |

$\chi^2$ for combined data = 0.016; df = 1
0.75 < P < 0.90

indicates that the eP locus influences the functional activation of the S gene linked with it.

*Authors summary*

*Institute of Cytology and Genetics, Academy of Sciences of the USSR, Siberian Branch, Novosibirsk. Translated from Genetika, Vol. 22, No. 1, pp. 119-128, January, 1986*
*8 tables, 6 fig., 10 references*

**Enzyme genetic variation in the silver fox population**

*Kari Saarenmaa*

An account is given of enzyme polymorphism in 2 unrelated populations of Finnish silver foxes, 1 population of imported American silver foxes, and 1 population of American x Finnish foxes. Data are tabulated for the allele frequencies at the phosphoglucose isomerase and isocitrate dehydrogenase loci in the 4 populations.

*Rapporter, Nordiske Jordbrugsforskers Forening: (No. 27): 6: 1-7, 1986. NJF Cooloquim no. 110 on fur Bearers, Kuopio, Finland*
*5 references*

*CAB - abstract*

**Fecundity of colored female American mink heterozygous for certain fur color genes**

*V.I. Evsikov; Yu. V. Vagin; T.D. Osetrova, and E.K. Matysko*

A study of the genetic-physiological mechanisms of the regulation of mink fecundity has revealed a number of regularities of the formation and realization of their reproductive capacities. Knowledge of these regularities makes it possible to develop appropriate methods of a breeding program aimed at increasing the fecundity of the animals. Such measures include the method of heterogeneous crosses of mink which makes it possible to clearly plan the breeding program and to use most completely the advantages of monohybrid heterosis of colored mink under farming conditions: increased reproductive qualities of the heterozygous females and obtainment of young with a more valuable color.

Earlier investigations of monohybrid heterosis, which is expressed in an increase of the fecundity of females heterozygous for a number of color genes, were carried out in the Altai and in Karelia, the climate of which substantially differs from the climate of the Ukraine. Since the phenotypic expression of genes, including those determining heterotic effects, is to some extent limited by the environmental conditions, it was necessary to

repeat such investigations at one of the fur farms of the Ukraine. And only thereafter, in the case of a positive result, is it possible to recommend to the fur farms of the republic the use, on the basis of the method of heterogeneous crosses, of monohybrid heterosis for increasing the reproductive potential of the stock of colored mink.

Our report gives data of an analysis of the fecundity of silver-blue female mink heterozygous for the aleutian color gene (genotype ppAa) and royal-pastel heterozygous for the gene socklot (bbTt$^s$). Investigations of the bbTt$^s$ mink were carried out in Karelia, being the final stage of the work begun earlier.

The fecundity of silver-blue mink heterozygous for gene aleutian (ppAa) and of royal-pastel mink heterozygous for gene socklot (bb Tt$^s$) on the whole is higher than for mink homozygous for these genes.

Their reproductive success is due to a decrease in the portion of barren females and a reduction in early postnatal death of the kits.

*Tsitolgiya i Genetika, Vol. 19, No. 5, pp. 377-383, 1985*
*2 tables, 13 references*

*Authors introduction and conclusion*

**Phenotypic and genetic characteristics of the fox colour varieties (Vulpes vulpes L.) bred in Poland**

*Grazyna Jezewska*

Twenty different types of matings of several colour varieties of the fox have been made. The obtained results of colour variation in the offspring enabled verification of the hypothesis accepted until now which pointed to the genetic determination of the coat colour in the fox. The red colour appeared to be the dominant trait as compared with all the remaining varieties. The silver black colour was dominant over the pastel colour. The genes of the platinum colour and white neck pattern occured exclusively in the heterozygotic form and when they were present the animal had a clear outline of the "ring" and "mask" irrespective of the background on which the trait is transferred. The possibility of passing the pattern of the platinum mask or the white neck on different backgrounds pointed to independence of this locus from other colour determining genes. The pastel colour genes were not only inherited independently of the platinum colour genes but also of the red colour genes. This was proved by obtaining the pastel cross fox and pastel red one. The results of segregation of colour varieties in the oofspring obtained in mating pastel red foxes with other varieties are in conflict with the inheritance model used so far. An appearance of cross foxes and frequency of their occurrence do not confirm the accepted assumption that this colour is determined by a double heterozygotic system. The author has formed a hypothesis that two pairs of genes A, a and B, b determine the red, black and cross fox colour but the homozygotic system aa affects epistatically locus B making animals aa black independently of the gene arrangement in locus B. The cross fox phenotype is determined by the heterozygotic arrangement Aa with the homozygotic genotype bb. The suggested model is compatible with all the results of colour splitting obtained.

*Seria Wydawnicza - Rozprawy Naukowe, 105*
*18 tables, 2 fig., 7 colour photos, 75 references*
*In POLH., su. ENGL.*

*Authors summary*

**Phenotypic and genetic parameters for body size and fur characteristics in mink**

*Hilkka Kenttämies, and Veijo Vilva*

Kits of black (standard and jetblack) and royal pastel genotypes were judged for body size and fur traits on five farms in August and November. Phenotypic and genetic parameters were estimated for the traits. Variation in scores was generally greater for males than for females and differences in variation were observed between farms. The frequency of the kits with pelt defects at different stages varied from 15 to 31%. The most common defects were metallic in black, and white hairs and spots in pastel. Some defects, particularly metallic reduced general appearance scores. Heritability estimates for general appearance in August and November were $0.43 \pm 0.20$ and $0.20 \pm 0.16$ for black males, and $0.07 \pm 0.12$ and $0.05 \pm 0.12$ for pastel males. Phenotypic correlation coefficients for type and sex

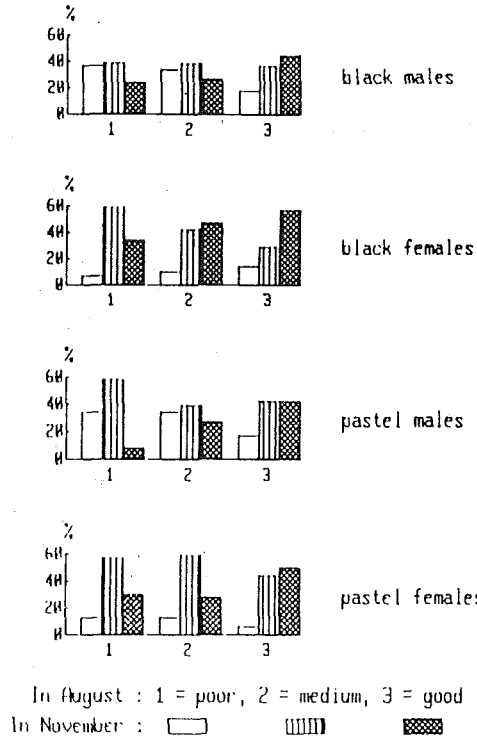



*Fig. 1.* Relationships between general appearance graded in August and November among black and pastel males and females.

between general appearance graded in August and in November remained in the best group after moulting. The correlations between the traits indicated that general appearance measures the separate traits in a manner which can be predicted by an assessor.

*Acta Agric. Scand. 38: 243-252, 1988*
*7 tables, 1 fig., 19 references*

*Authors summary*

## Heritability for littersize in silverfox (Vulpes vulpes) and blue fox (Alopex lagopus) theory, experiments and own examinations

*Jørgen Kjær*

The littersize is one of the most important traits to consider in a breeding programme, and the heritability is an essential parameter when using modern technology (computers) in these programs.

Only very few estimates of heritability for littersize in silverfoxes and bluefoxes are reported (*Narucka*, and *Zuk*, 1980, *Einarsson*, 1985 and *Syrnikov*, 1973).

The expansion in the use of artificial insemination in foxbreeding will change the structure of the population, and therby change the asuumptions of estimating $h^2$.

In this report, the heritability for littersize has been estimated on Danish and Norwegian foxes.

Different models have been applied:

1) Daughter nested within sire
2) Daughter nested within sire nested within herd
3) Daughter nested within dam nested within sire within herd
4) Regression of daughter on dam

The Danish material has been quite small.

In chapter V model no. 1 has been applied on 727 daughters of inseminated silverfox from differnt herds. Estimates of $h^2$ for littersize at birth/weaning was $0.11 \pm 0.10$ / $0.07 \pm 0.05$. For 208 daughters of bluefox the material was too small.

In chapter VI model no.4 has been applied on about 250 pairs of daughter and dam. $h^2$ was estimated to $0.15 \pm 0.13$ / $0.37 \pm 0.13$.

The Norwegian material consist of about 8680 litters of silverfox and 3180 litters of bluefox. This gives very solide estimates.

It is possible to divide the material in two groups: inseminated and non-inseminated. But estimates from these subgroups has a quite large variation supposing some confounded effects between environment and the genetic components.

Models 1 to 3 applied on all observations without any corrections on data gives estimates seen in table 7.11, 7.12 and 7.13.

A few estimates are given here:

| Norwegian silverfox, all | $h^2$ - birth | $h^2$ - 3 weeks |
|---|---|---|
| model 2 FATHER-component | $0.191 \pm 0.027$ | $0.160 \pm 0.025$ |
| model 3 FATHER-component | $0.161 \pm 0.025$ | $0.140 \pm 0.023$ |
| model 3 FATHER+MOTHER | $0.127 \pm 0.022$ | $0.105 \pm 0.020$ |

| Norwegian bluefox, all | $h^2$ - birth | $h^2$ - 3 weeks |
|---|---|---|
| model 2 FATHER-component | $0.237 \pm 0.058$ | $0.478 \pm 0.072$ |
| model 3 FATHER-component | $0.118 \pm 0.036$ | $0.419 \pm 0.067$ |

*Thesis report in animal genetics*
*59 tables, 50 references*
*In DANH., su. ENGL.*

*Authors summary*

**Synaptonemal complex analysis of the B-chromosomes in spermatocytes of the silver fox (Vulpes fulvus Desm.)**

*M. Switonski; I. Gustavsson; K. Höjer, and L. Plöen*

The mitotic and meiotic chromosomes of four male silver foxes *(Vulpes fulvus* Desm.*)* having, due to inter- and intraindividual variation, 1-4 B chromosomes in addition to the standard karyotype, were investigated with special attention given to pachytene chromosome behaviour as revealed by electron and light microscopy. When occurring as univalents the B-chromosomes demonstrated a progressively folding back behaviour ending in intrachromosomal pairing. When two B-chromosomes occurred in the same cell they paired normally as a bivalent with one central and two lateral elements. However, occasionally also two univalents were seen. In the presence of three B-chromosomes, a trivalent occurred in most cells, but sometimes two normally paired chromosomes and one folded univalent were seen in late pachytene. The chromosomes comprising the trivalent were never completely paired, however. Due to competitive pairing and low frequency of chiasmata the trivalents most often dissolved into one bivalent and one univalent and only a few trivalents remained at diakinesis-metaphase I. On the basis of pairing behaviour and morphology it is assumed that the B-chromosomes of the silver fox are homologous. Although pairing was never observed, there was a tendency of association at pachytene between B-chromosome configurations and the sex bivalent in those individuals that had univalents and trivalents.

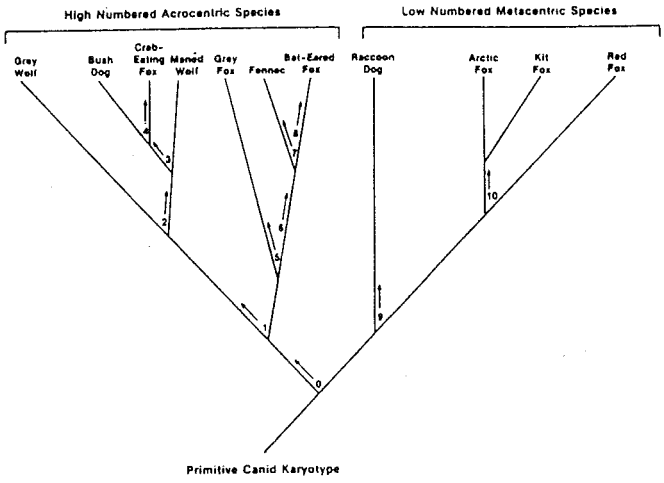
*Cytogenet Cell Genet 45:84-92 (1987)*
*3 tables, 5 fig., 41 references*

*Authors abstract*

**Chromosomal evolution of the canidae**
II. Divergence from the primitive carnivore karyotype

*R.K. Wayne; W.G. Nash, and S.J. O'Brien*

The Giemsa-banding patterns of chromosomes from the arctic fox *(Alopex lagopus)*, the red fox *(Vulpes vulpes)*, the kit fox *(Vulpes macrotis)*, and the raccoon dog *(Nyctereutes procyonoides)* are compared. Despite their traditional placement in different genera, the arctic fox and the kit fox have an identical chromosome morphology and G-banding pattern. The red fox has extensive chromosome arm homoeology with these two species, but has only two entire chromosomes in common. All three species share some chromosomes with the raccoon dog, as does the high diploid-numbered grey wolf *(Canis lupus*, 2n = 78*)*. Moreover, some chromosomes of the raccoon dog show partial or complete homoeology with metacentric feline chromosomes which suggests that these are primitive canid chromosomes. We present the history of chromosomal rearrangements within the Canidae family based on the assumption that a metacentric-dominated karyotype is primitive for the group.




*Cytogenet Cell Genet 44:134-141 (1987)*
*2 tables, 4 fig., 29 references*

*Authors abstract*

**Possibilities of improving pelt characters in mink and foxes by means of breeding**

*Einar J. Einarsson*

Work on selection for pelt quality in mink and foxes is reviewed. The bibliography is not printed.

*Norsk Pelsdyrblad: 61(6): 15-18, 1987*
*2 tables, 7 fig.*
*In NORG.*

*CAB - abstract*

*Original report*

# An evaluation of exploratory and fear-motivated behaviour as a predictors of reproductive succes in silver fox vixens

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**Abstract**

The purpose of the current study has been to examine selected elements of investigative and agonostic behaviour for their predictive potential with regard to reproductive succes in silver vixens. The behaviour was recorded in three different tests: The ball-test assaing exploratory motivation, the capture-test assumed to elicit mostly fear-motivated behaviour, and the stick-test measuring the reaction of the fox to the experimenter and a hand-held stick, and thus exposing the fox to a conflict of motivations of fear and exploration. The test-results were examined for correlation with the number of cubs weaned by each vixen. The only parameters showing such correlation were the position of the fox in the cage in reaction to the experimenter, and the tendency to contact with and speed of approach to the stick, the vixens weaning the most cubs placing themselves closer to the experimenter, and approaching the stick with greater propensity and faster, in the stick test. This shows, that the vixens showing the least fear motivation, when subjected to a situation of conflict between approach and avoidance, have the greatest reproductive potential; and suggests that such a test in contrast to assessments of pure exploratory or fear-motivated behaviour has practical applicability in selecting the breeding stock. There are however limitations to the employment of such a test in that the reaction of the animals was found to be variable with regard to the time of day, past experience with the test and possibly the feeding- and heat-states of the fox.

**Introduction**

One of the changes often accompanying domestication is increased reproduction. This is specifically due to the intense selection on the trait, but also to a certain extent caused by the genetic adaption of the domestic animals to their captive environment (*Price*, 1985). The increase in reproduction is evident after a few generation in captivity (*Price*, 1985).

In spite of this, the reproductive succes of the domesticated silver fox continues to be relatively low, but great variations are seen (*Braastad*, 1988). If it were possible to employ reliable behavioural indicators of behavioural adaption to the environment and high reproductive potential in selecting the breeding stock, it would thus have great economic importance, and assumedly facilitate the continued adaption of the population to the captive environment also resulting in improved well-being for the animals.

Previous studies have shown that silver vixens showing aggressive as opposed to defensive facial expressions in reaction to a human gesture and a handheld object, lose fewer cubs (*Bakken*, 1988), and wean more cubs (*Braastad*, 1988), respectively. It has also been demonstrated that cub-killing vixens show diverging agonistic reactions to humans (*Kaleta*, and *Lewandowska*, 1987). Groups of male, and female silver foxes with different determined temperament have been shown to vary with regard to mating behaviour (*Kaleta* et al., 1983), and reproductive performance (*Maksimov* and *Shevchenko*, 1984), respectively. So there is evidence that certain behavioural motiva-

tions may be predictive of reproductive potential.

The purpose of the current study has been to examine a variety of elements associated with the exploratory and/or fear-motivated behaviour for their indicative value with regard to reproductive success. The "ball-test", previously employed to screen for changes in exploratory behaviour as a result of induced stress (*Kristensen* and *Jeppesen*, 1988), was used to assess the exploratory motivation. The earlier investigations of the relation between behaviour and reproduction in silver foxes have focused on the reaction of the fox to a human approaching the cage (*Kaleta* and *Lewandowska*, 1987)and hand-held objects inserted into the cage (*Braastad*, 1988). In this study these procedures were attempted repeated by recording the reaction of the fox to an experimenter standing in front of the cage and a stick held into the cage in the "stick-test". Furthermore the reaction of the fox to capture was investigated in the "capture-test". This was expected to elicit mostly fear-motivated behaviour, since handling is known to be a stressor in other mammals (*Hemsworth* et al., 1986) and most foxes either resist capture activly with agonostic behaviour and/or increased motoric activity, or passively by withdrawing to the back of the cage.

## Materials and methods

**Animals:** 290 female silver foxes (*Vulpes vulpes*) of varying age, housed singly in 1mx1mx1m net-wire cages under normal Danish farm conditions. 160 of the vixens were cubs from May 1987. Several color variants were included in the population.

The experimental period fell in the breeding season, during which each vixen was extracted from its cage every third day beginning on January 28th for visual inspection of vulvar swelling indicating the onset of heat. The vixens in heat were monitored for ovulation status by daily intravulvar electrical resistance measurement. These observations were performed between 8h and 9h.

Each vixen was attempted mated at least twice, primarily with a male of suitable coloration and secondarily with a male which was considered to be efficient in mating.

The vixens were moved to new cages quite often, either intendedly to the proximity of a male to facilitate the induction of heat or to a new cage after mating, or fortuitously after attempted mating in the cage of the male.

**Experimental Procedures:** From February 1st to March 1988 the foxes were subjected to from one to three stick-tests and one or two ball-tests. These tests were carried out between 9h and 16h. In connection with the visual heat inspections on February 6th, 9th, 18th and March 1st parameters related to the capture were recorded.

The data from the stick-, ball- and capture-tests were examined for correlation with the number of cubs in each litter on July 5th. By this time 48 litters remained to be weaned, the youngest being 6 weeks of age and lacking 3 weeks till weaning. The data were considered a reliable estimate of the number of cubs weaned by each vixens, since very little cub-killing or -death for other reasons were expected after this time.

The vixens were for statistical purposes divided into groups weaning 0, 1-3, 4-5, and 6-8 cubs respectively. The group with 0 cubs comprised vixens, that never came into heat, were unsuccesfully mated, were infertile, aborted, had still-born cubs, killed all their cubs, or whose cubs died during infancy. Cronism and cub-death for other reasons was also prominent in the other groups.

Only data for vixens born in 1984 and later were used.

**Stick-test:** Firstly the experimenter positioned himself in front of the cage without fixating the fox with his eye. After 15 secs. the position, posture and point of fixation of the fox was noted. Then a wooden stick held by the experimenter was inserted through the front netting and the latency to contact and type of contact was noted. It was also recorded whether or not the fox sniffed in the air or at objects in the environment or if it emitted cough-sounds.

**Ball-test:** A plastic ball (diameter = 15 cm) was placed immediately inside the cage-door, the door closed and the experimenter withdrew 2m from the cage. The latency to contact with the ball was timed.

The stick and the ball respectively were rinsed in a solution of smelling disinfectant ("Rodalon") before being introduced into the cage.

**Capture-test:** The time needed to catch the fox with a pair of tongs for visual heat inspection was recorded. Furthermore the activity, selected elements of vocalization, and whether or not the fox bit the tongs, during the capture-process were recorded.

**Ethogram and parameters measured**

Stick-test

Reaction to experimenter:
Position:
Rated on a scale from 1 to 4. A score of 1 signifies that the head of the fox was in the quarter of the cage closest to the experimenter, etc.

Posture:
The fox was recorded as either lying down ("niederliege/bachlage"; *Tembrock*, 1957), sitting ("sitzen"; *Tembrock*, 1957), standing ("Stehen"; *Tembrock*, 1957) or moving about in the cage.

Fixation-point:
The fox was recorded as either looking at the experimenter, looking away to the side, or looking down (at the bucket containing the disinfectant).

Reaction to stick:
Latency:
The time in secs. from the stick was fully inserted till the fox made physical contact with it. If the fox made contact with the stick before it was fully inserted it was assigned a latency of 60 secs.

Reaction:
It was noted whether the fox bit, sniffed at or made no contact with the stick.

Racts:
As above, but scores for biting and sniffing were combined.

Object-sniffing:
It was noted whether or not the fox sniffed at the netting or other parts of the environment during latency ("winden"; *Tembrock*, 1957).

Air-sniffing:
It was noted whether or not the fox sniffed in the air (after the scent of the stick or the experimenter) during latency ("wittern"; *Tembrock*, 1957).

Cough-sounds:
Whether or not the fox emitted cough-sounds ("Kaff-lyd"; *Braastad*, 1988) during latency.

Ball-test

Latency:
The time-lapse from the cage door was closed after the ball had been inserted till the fox made contact with the ball (<2cm). The foxes, that made contact with the ball before the door was closed were assigned a latency of 0 secs.; and if no contact was made within 2 minutes, the fox was assigned a latency of 120 secs.

Capture-time:
The time from the cage door was opened till the fox had been caught with the tongs and turned around to allow inspection of the vulva.

Avoidance:
Whether the fox moved about (actively avoiding the tongs) or was immobile (passively awaiting capture).

Growling:
It was noted whether or not the fox growled during latency ("knurren"; *Tembrock*, 1957).

Cough-sounds:
As for the stick-test.

Screaming:
Whether or not the fox screamed during capture-time.

Biting:
Whether or not the fox bit the tongs during capture-time.

The average of the latencies in the stick- and ball-tests and the capture-time calculated in the following are arbitrary values due to the grouping of fast and non-responding animals. They are only relevant for relative comparisons and all statistical testing has been carried out on ranked values.

**Results**

The distribution of the data from the stick- and ball-tests on litter-sizes are shown in table 1, and the results from the capture tests in table 2. The only parameters, that showed significantly different values for the various litter-sizes were the position of the fox as a reaction to the presence of the experimenter,

Table 1: Distribution of the latency, position, and the numbers of the observed behavioural elements in the first stick-test, and the latency of the first ball-test on the different litter-sizes. Only afternoon data were used. The probabilities (p) for the latencies and positions data are one-tailed values for Kruskal-Wallis One-way Analysis of Variance: The distribution of the behavioural elements were tested with Chi-Square Tests, and the p-values are two-tailed values.

First stick-test

| | | Cubs weaned: | 0 | 1 - 3 | 4 - 5 | 6 - 8 | N | P |
|---|---|---|---|---|---|---|---|---|
| Reaction to experimenter: | | | | | | | | |
| | Position to (Avg.): | : | 2.1 | 2.3 | 2.2 | 1.7 | 244 | 0.034 |
| | Posture | Lies: | 7 | 4 | 7 | 3 | | |
| | | Sits: | 3 | 1 | 3 | 3 | | |
| | | Stands: | 69 | 37 | 63 | 31 | | |
| | | Moves: | 5 | 3 | 2 | 3 | 244 | 0.947 |
| Fixation-point: | | Down: | 7 | 4 | 4 | 5 | | |
| | | Away: | 21 | 9 | 17 | 7 | | |
| | | Experimenter: | 57 | 31 | 54 | 28 | 244 | 0.863 |
| Reaction to stick: | | | | | | | | |
| | Latency (Avg.): | (s): | 42.0 | 38.3 | 40.5 | 26.0 | 245 | 0.011 |
| | Reaction: | No: | 54 | 26 | 46 | 15 | | |
| | | Bites: | 8 | 4 | 9 | 4 | | |
| | | Sniffs: | 23 | 15 | 20 | 21 | 245 | 0.108 |
| | Reacts: | No: | 54 | 26 | 46 | 15 | | |
| | | Yes: | 31 | 19 | 29 | 25 | 245 | 0.041 |
| | Object-sniffing: | Yes: | 18 | 5 | 9 | 7 | | |
| | | No: | 60 | 37 | 62 | 31 | 229 | 0.283 |
| | Air-sniffing: | Yes: | 9 | 5 | 11 | 7 | | |
| | | No: | 64 | 37 | 60 | 31 | 229 | 0.730 |
| | Cough-sounds: | Yes: | 6 | 0 | 7 | 5 | | |
| | | No: | 72 | 42 | 64 | 33 | 229 | 0.142 |
| Ball-test | | | | | | | | |
| | Latency (Avg.) | (s): | 10.2 | 13.1 | 5.2 | 7.9 | 269 | 0.481 |

the latency to contact with the stick and whether or not the fox made contact with the stick in the stick-test.

The foxes that weaned the most cubs positioned themselves closer to the experimenter and had a shorter latency till, and a greater tendency to, make contact with the stick.

The foxes reacted faster and with greater propensity to the stick and positioned themselves closer to the experimenter in the second and third stick-test, but there was no difference between the capture-times for the four capture-tests (table 3).

There was also a significant difference between morning and afternoon scores obtained in the first stick-test. The average latency to contact was 24.5s before noon and 38.7s after ($p=0.005$; Mann-Whitney U-test, one-tailed), and the average position of the fox was 1.7 in the morning and 2.1 in the afternoon ($p=0.013$; Mann-Whitney U-test, one-tailed).

The latency to contact in the first ball-test showed no variation between morning and afternoon levels, but the foxes tested on February 9th had a significantly longer latency (11.3s) than the animals tested first on March 1st (3.9s) ($p<0.001$; Mann-Whitney U-test; two-tailed).

**Discussion**

The result are in accordance with previous findings, in that the agonistic and exploratory behaviour in reaction to a human may indicate

Table 2: Distribution of the capture-time and the numbers of the observed behavioural elements in the capture-test on the different litter-sizes. The latencies (averages for teh 4 tests) were ranked and tested with a Kruskall-Wallis One-Way Analysis of Variance. The second column divides the animals into groups having shown the observed behavioural elements in none (0), some (1-3) or all (4) of the 4 tests. These data were tested with Chi-Square Tests All probabilities (p) are two-tailed values.

Capture tests

| | Cubs weaned: | 0 | 1 - 3 | 4 - 5 | 6 - 8 | N | P |
|---|---|---|---|---|---|---|---|
| Capture-time (Avg.) | (s): | 10.7 | 10.7 | 10.6 | 10.6 | 263 | 0.824 |
| Avoidance: | 4: | 5 | 2 | 7 | 3 | | |
| | 1-3: | 20 | 6 | 18 | 9 | | |
| | 0: | 59 | 40 | 59 | 39 | 267 | 0.670 |
| Growling: | 4: | 6 | 4 | 9 | 6 | | |
| | 1-3: | 21 | 7 | 20 | 8 | | |
| | 0: | 59 | 37 | 55 | 37 | 269 | 0.655 |
| Cough-sounds: | 4: | 2 | 6 | 19 | 13 | | |
| | 1-3: | 20 | 10 | 25 | 7 | | |
| | 0: | 54 | 32 | 40 | 31 | 269 | 0.115 |
| Screaming: | 4: | 2 | 1 | 1 | 0 | | |
| | 1-3: | 3 | 1 | 4 | 6 | | |
| | 0: | 81 | 46 | 79 | 45 | 269 | 0.307 |
| Biting: | 4: | 5 | 2 | 7 | 5 | | |
| | 1-3: | 23 | 11 | 25 | 7 | | |
| | 0: | 58 | 35 | 52 | 39 | 269 | 0.397 |

Table 3: Difference between average scores for parameters of the 2 ball-tests, the 3 stick-tests and the 4 capture-tests.

| | FIRST | SECOND | THIRD | FOURTH |
|---|---|---|---|---|
| Stick-test | | | | |
| Position (Average) | 2.7 | 1.9* | 1.7* | |
| Latency (Avg.) (s) | 40.6 | 26.7* | 21.3* | |
| Reacting foxes (%) | 41.3 | 65.0** | 69.2** | |
| Ball-test | | | | |
| Latency (Avg.) (s) | 14.2 | 17.7*** | | |
| Capture-test | | | | |
| Capture-time (s) | 10.5 | 9.9 | 10.2 | 11.5**** |

* p<<0.001; Willcoxon Matched Pairs Signed Ranks Test, two-tailed. Compared to first test.

** p<0.001; McNemar Test for the Significance of Changes, two-tailed. Compared to first test.

*** p=0.150; Sign Test, two-tailed. Compared to first test.

**** p=0.140; Friedmann Two-Way Analysis of Variance, two-tailed. Comparing all four tests.

the reproductive potential of a silver vixen. The only parameters correlating with littter-size were the position of the fox in the cage in reaction to an experimenter and the reaction to a hand-held stick analogus to the "pencil"-test (*Braastad*, 1988; *Bakken*, 1988). The facial expression of the fox, and specifically the position of the ears found predictive of the number of surviving cubs by *Braastad* and *Bakken* were not recorded in this study, but the interaction with the stick and the timing of the responses in itself was found to vary with the number of weaned cubs. The proportion of animals reacting to the stick was however within the ranges of foxes found sniffing at or biting the pencil by *Braastad* (1988).

The foxes tested in the morning positioned themselves closer to the experimenter and responded with greater propensity and speed to the stick. This was probably caused by the diurnal variation in activity level. Being that the foxes are nocturnal animals mostly active at dawn and at dusk. The lowest level of activity is found in the afternoon even in foxes kept in captivity (*Tembrock*, 1957). The difference in latency in the ball-test between

the foxes tested on February 9th and March 1st could be caused by the fact, that the foxes had not yet been fed at the time of testing on the latter day, or that the heat status of the animals had progressed. For the measures to have predictive value, the whole population must be screened under the same circumstances.

The parameters of the capture-test showed no correlation with the litter-size. This may be a result of fear-motivation by itself having a low predictive potential. The capture-test is assumed to be mostly fear-motivating as mentioned in the introduction, and none of the elements of investigative behaviour recorded in the stick-test, such as air-sniffing or object-sniffing were seen during capture, while all of the elements noted belonged to the category of agonostic behaviour (*Tembrock*, 1957).

The latency to contact with the ball in the ball-test did not vary significantly between groups of litter-size. the ball-test monitoring the reaction to a novel object was expected to reveale the exploratory motivation of the fox, even though it is probably not a pure measure of exploration as previously discussed (*Kristensen* and *Jeppesen*, 1988). The exposure to novelty need however not be fear-motivating in itself as demonstrated by *Misslin* and *Cigrang* (1986), as long as the animal has a possibility of exploring the unknown stimuli at its own pace having retreat to a familiar environment. The ball being placed in the home cage of the fox could therefore be expected to elicit mostly exploratory behaviour, and none of the agonistic behaviour seen in the stick- and capture-tests were noted. At least the ball-test, with the experimenter being placed at a distance must be expected to be less fear-motivating than the stick-test, where the experimenter was positioned immediately outside the cage and held the stick as the novel object in this test.

The stick-test may thus be assumed to elicit conflicting motivations of exploration and agonistic behaviour to a greater extent than the capture- and ball-tests, and investigative as well as agonistic behaviour were recorded in the stick-test. It is the group of vixens taking position closest to the experimenter, and the vixens making contact with the stick and perhaps most rapidly, and consequently showing the least fear-motivation, that wean the greatest number of cubs. It is therefore reasonable to believe, that subjecting the vixens to a situation of conflict between approach and avoidance and selecting the vixens showing least fear motivation will yield the highest reproductive result.

The parameters measured however had very little predictive potential for the individual, since many responding vixens were found in the groups weaning a few or no cubs. This is emphasized by the fact that the non-reproducing vixens positioned themselves closer to the experimenter than the vixens weaning 1-3 and 4-5 cubs. The reason for this discrepancy shall probably be sought in the multitude of causes for the low reproductive result of the group weaning 0 cubs mentioned in the Materials and methods section, and not all of them related to the motivational state of the animal.

The foxes adapted rapidly to the testing situation in the stick-test in that the propensity to react increases and the latency to contact decreases drastically between the first and the following test-sessions. This excludes the possibility of preforming the same test repeatedly in order to obtain a more reliable score for the individual. Such a tendency was not seen for the parameters of the capture-test. Capture is a recurring event in the life of domesticated foxes, so they may already be adapted to the process and respond with learned helplessness commonly seen after repeated stress, the handling probably being stressful as demonstrated in other mammals (*Hemsworth* et al., 1986). This is perhaps supported by the fact, that the primiparous vixens to a greater extent attempted actively to avoid capture, whereas most of the older animals were immobile awaiting capture (data not shown), though this could also be caused by selection against agitated individuals. It has been shown that the farmers sometimes select for behavioural traits, such as the placement of the fox in the cage (*Braastad*, 1988).

It may be possible upon further investigation to set up a behavioural index capable of ascertaining the fearfulness of the vixens and predicting the reproductive potential with greater precision employing the parameters found in this investigation and those identified by other researcers such as facial expressions. Such indices of fear have been proposed as tools in selecting guide-dogs (*Goddard* and *Beilharz*, 1986).

There were many non-reproducing among primiparous vixens, whereas hardly any in the older animals. This is off course due to the hard selection after the first year excluding all non-reproducers from the breeding stock. The parameters indicative of reproductive potential were however applicable for the

whole population of vixens born 1984 and after.

For the fearfulness of the fox to be a useful tool in selecting the breeding stock, it must be ascertainable before the pelting season in the fall. The works on establishing a behavioural index for potential guide dogs has shown, that the fearfulness can be estimated already from the age of 2 months, though the predictive potential of the index increase with the age at testing (*Goddard* and *Beilharz*, 1986).

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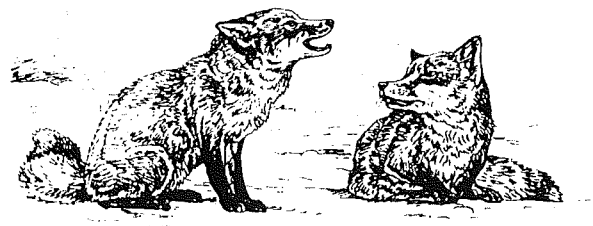
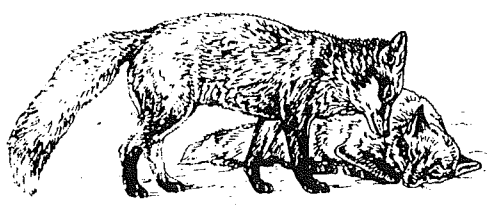
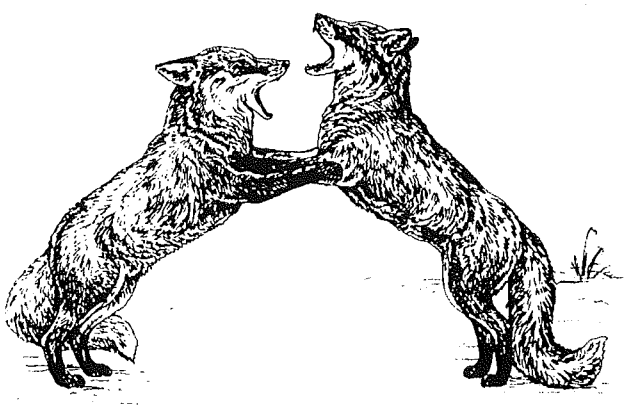






**Reproduction and oestrus diagnosis in farmed foxes** (incl. litter size, mating)

*Pontus Elvingsson*

The world production of farmed foxes has increased by more than threefold since the beginning of the 1970's, mainly due to higher fur prices.

There is a growing interest among fox-farmers in Scandinavia for using artificial insemination in the breeding of foxes, for example as a way to produce valuable crosses and bastards (silverfox x bluefox). With large scale production in fox breeding, the importance of using precise and efficient oestrus diagnosis methods in connection with artificial insemination will increase. A detailed description of the reproduction cycle and oestrus diagnosis methods for blue and silverfox is given in the review. An analysis was made of data obtained in 1983 and 1984 from an average size Swedish foxfarm. Two methods of oestrus diagnosis technics were studied and analysed; Electrical detection of oestrus in silverfoxes and microscopic diagnosis of oestrus by vaginal smears in blue foxes.

The results indicate that the best time for mating bluefox vixens according to vaginal smear test is when the smears contain mainly flattened scale or leaf-like cells.

The optimal time for mating silverfox vixens according to electrical detection diagnosis seems to be 1-2 days after maximum resistence values are reached.

*Uppsala, Sweden, 1986. 58 p. Examensarbete. Institutionen foer Husdjursfoeraedling och Sjukdomsgenetik, Sveriges Lantbruksuniversitet, Sweden no. 128*
*23 tables, 11 fig., 8 photos, 62 references*
*In SWED., su. ENGL.*

*Authors summary*

**The sex system activation in young mink males and females of two genotypes outside the season of mating under the change photoperiodic conditions**

*R.G. Gulevich; D.V. Klochkov, and L.N. Ivanova*

Weight of gonads, levels of sex hormones in blood and gonad incubates were measured in young mink males and females of standard and sapphire genotypes under the changed light regime. In females vaginal smears, vulva swelling and weight of uterus were also investigated.

It was found that in November the levels of sex hormones in blood and the specific production of testosterone by testes in the control standard minks were significantly higher than in sapphire minks of the respective group.

The additional illumination from 17.30 h to 9.30 h in the period June, 22 - July, 21, followed by the shortened 8 h daylight from July, 22 to October, 10 caused the increase of vulva swelling and uterus weight in females and the appearance of oestrus in some females. In males the increase of testes was observed. The present photoperiodic conditions were concluded to stimulate the sex system in minks of both genotypes.

*Izvestiya Sibiskogo otdeleniya AN SSSR. Seriya biologicheskikh nauk (USSR). (1985). v. 18(3) p. 97-102.*
*2 tables, 18 references*
*In RUSS., su. ENGL.*

*Authors summary*

**The duration od sexual reflexes in male foxes**

*O.N. Preobrazhenskii*

Data were obtained on 40 males aged 1-10 yr, during 51 matings. For silver-black males the interval from intromission to ejaculation averaged 12.2 s (7-21), ejaculation duration 18.7 s (3-65), and the interval from ejaculation to separation from the female 30.0 min (0-68). Corresponding figures for red males (all aged 2 yr) were 11.0 (8-15), 15.7 (4-35) and 26.8 (8-52). The shortest ejaculation time was obtained for 6- to 7-yr-old black males (10.0 s).

*Sbornik Hauchnykh Trudov, Kazanskii Veterinarny Institit: (No. 86): 89-91, 1984*
*1 table*
*In RUSS.*

*CAB - abstract*

**Effect of PMSG pretreatment for ovulation induction and stimulation with GnRH on reproductive performance in once - mated female minks**

*H. Hattenhauer; P. Tschauschev; R. Kreig; A. Pötschulat, and R.Stein*

In the frame of four experimental series involving experimental and control groups of 20 to 25 female minks each, studies were made on the possibility of improving the generally low reproductive performance of female minks mated once by means of biotechnical treatment to draw level with the results of twice-mated females. For this purpose the following methods were tested: ovulation induction (OI) with 10 microgram GnRH applied to each mink eight days before planned mating date; OI with 10 microgram GnRH per animal pretreated (three respective four days before OI) with 50 iU PMSG; OI with 10 microgram GnRH per animal receiving additionally 50 IU PMSG five days after OI; ovulation stimulation (OS) with 10 microgram GnHR per animal within one hour after mating, and OS with 10 microgram GnHR per animal pretreated (three to four days before OS) with 50 IU PMSG. In comparison with all other methods, OI produced higher reproductive results in terms of conception rates and litter size. The method contributed to raise the reproductive performances of once-mated female minks so that they were better than the results of untreated animals mated twice. The results were similarly good after OS with PMSG pretreatment, especially when the animals were mated in the last two weeks of March. The other methods tested found to be to some extent disadvantageous and not satisfactory.

*Arch. Tierz., Berlin 30 (1987) 6, 529-538*
*10 tables, 9 references*
*In GERM.*

*Authors abstract*
*Only abstract received.*

**In Vitro binding and utilization of lipoproteins by luteal cells from ferrets treated with dopaminergic drugs during pseudopregnancy**

*K. Rajkumar; S.D. Martinuk; G.O. Agu, and B.D. Murphy*

The effects of administration of dopaminergic drugs *in vivo* on the binding and utilization of lipoproteins for progesterone synthesis *in vitro* by ferret luteal cells were investigated. Pimozide, a dopamine antagonist, and bromoergocriptine (CB-154), a dopamine agonist, were administered to a pseudopregnant ferrets to alter prolactin (PRL) concentrations daily beginning the day after ovulation. The control group received the vehicle solution only. Corpora lutea taken on Day 13 after ovulation were dissociated and the cells were incubated with canine lipoproteins, cyclic adenosine monophosphate (cAMP), and 5-cholesten-3ß-25-diol (25-(OH-cholesterol). Canine high-density lipoprotein (HDL) and low-density lipoprotein (LDL) stimulated progesterone accumulation by luteal cells from pimozide-treated animals but not from CB-154-treated ferrets. However, when 25-OH-cholesterol, which bypasses the LDL receptor, was provided as the substrate, steroidogenesis was stimulated in all groups. Together these observations suggest that dopaminergic alteration of PRL levels preferentially affects the utilization of lipoproteins. The uptake of canine HDL and LDL by luteal cells was saturable, and a high degree of cross-reactivity was observed. Heparin released surface-bound HDL and LDL, suggesting that

HDL was binding to the LDL receptor. The quantity of LDL which could be released from luteal cells by heparin treatment was greater in animals treated with pimozide and decreased by treatment with CB-154, relative to luteal cells from control animals. It was concluded that the chronic administration of pimozide or CB-254 alters serum PRL levels *in vivo*, and influences the subsequent binding and utilization of lipoproteins by luteal cells *in vitro*. PRL may increase the number of LDL binding sites in luteal cells, thereby enhancing lipoprotein uptake for progesterone synthesis.

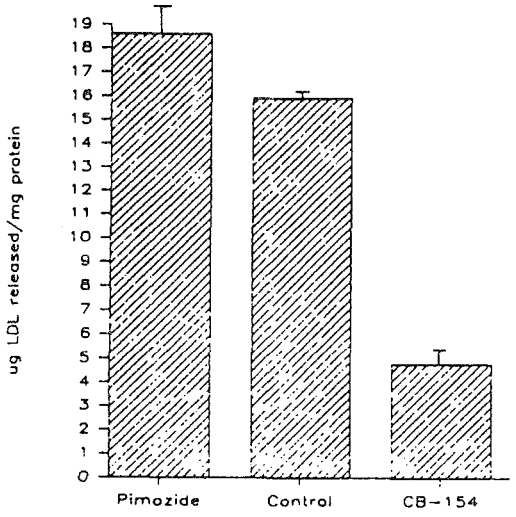



FIG. 8. Effect of dopaminergic pretreatment on heparin labile membrane bound [$^{125}$I]LDL. Luteal cells from ferrets pretreated with pimozide, CB-154, and vehicle were exposed to 100 μg of [$^{125}$I]LDL for 2 hr. The cells then were washed twice and incubated in MEM with or without 10 mg/ml heparin. Heparin labile radioactivity was determined and expressed as micrograms protein released/milligram cell protein. Each point is the mean ± SEM of six replicates.

*General and Comparative Endocrinology 67, 282-291 (1987)*
*8 fig., 29 references*

*Authors abstract*

**Whelping results in 1987**

*Kaj Lindh*

Of 974715 mink, 18069 polecat, 455647 blue, 152761 silver fox and 17414 raccoon dog females mated in 1987 in Finland, 22.10, 17.01, 28.54, 31.32 and 32.78% resp. were infertile. The number of young per mated female averaged 3.80, 5.88, 5.71, 3.02 and 5.02 resp. in the 5 species.

*Finsk Pälstidskrift: 21(9): 446-447, 1987*
*In SWED.*

*CAB - abstract*

**Whelping results at the experimental farms in 1987**

*Jaakko Mäkelä, and Fjalar Fors*

For standard mink, polecat and raccoon dog females at Kyrkslatt experimental farm in Finland, the percentage of infertile females + females which lost their litters averaged 13.9, 13.3 and 43.5 resp. in 1987, and the number of young produced per mated female averaged 4.3, 7.6 and 3.8. At Maxmo, the percentages of infertile females + females losing their litters were 10.0, 23.0, 31.0 and 20.0 resp. for mink, polecat, blue fox and raccoon dog females, and the number of young per mated female averaged 4.6, 6.3, 5.6 and 3.8

*Finsk Pältidskrift: 21(9): 447, 1987*
*1 table*
*In SWED.*

*CAB - abstract*

**Observations concerning ferret reproduction (Mustela putorius furo)**

*Nicolae Pastirnac, and Romulus Gruia*

The paper tries to combine a series of aspects linked to the reproduction biology at ferret with certain observations concerning the reproductive activity of the females and respectively of the males of a ferret population from a farm with an intensive system breeding.

In connection to the females reproduction there was done a division into periods in time of their annual sexual activity, considering its

theoretical structuration into three main stages: the I-st stage - April, the II-nd stage - May and June and the III-rd stage - July and August. Thus could be studied, comparatively, the stages of the reproduction cyclogramme.

As a consequence of these aspects the study underlines the importance of certain biological and technological elements of the breeding industrial system, which confirm to a great extent the data offered by the literature, elements referring to: the maturation of the ovarian folicles, the folicular dehiscency, the vulve oedemacy, the optimal moment of the matings and their repeat, the duration of the gestation and its reference to the mating date, at prolificity, at light conditions etc. We must mention that the medium registered duration of the gestation was of 41 days, as well as the fact that there was achieved a new gestation at more than half of the females, fact that finally led to a prolificity of 6.7 kits/female.

Referring to the reproductive activity of the ferret males it was underlined the importance of their selection, due to the reproductive lot structure in function of the number of kits resulted during a reproductive season. To this purpose were done a series of observations concerning the testicle state at the end of the reproductive season and the correlation with the number of matings and resulted kits, in order to establish the selection criteria for the next reproductive season.

The genotypical phenotypical quality of the males is extremely important at this species, as the selection pressure achieved through them is obvious if we have in view that from the total of existing males only a quarter achieved almost 84% from the total of resulting kits.

From the data presented in the paper it may be concluded that the studies referring to the ferret reproduction, done at a populational level, may suggest certain directions concerning the profound investigations done at an organismic level, especially in connection to their applicative aspect in the fur production.

*Productia animala - zootehnie si medicina veterinara, 1988, 2: 18-27*
*4 tables, 7 fig., 8 references*
*In ROMN.*

*Authors summary*
*Only abstract recieved.*

**Uterine luminal proteins during the preimplantation period in the ferret**

*Kerry R. Foresman*

The pattern of synthesis of uterine luminal proteins during the 6-day preimplantation period of the ferret has been analyzed by polyacrylamide gel electrophoresis and flourography. The results demonstrate that several classes of protein, in particularly those of molecular weights of 75,000, 58,000, 50,000, 18,000, and 8,000, are actively synthesized and appear in the uterine lumen during this period. Quantitative changes in the amount of radioactivity incorporated by specific proteins as viewed on autoradiograms are also suggested in association with the observed qualitative changes and both become more prevalent as implantation approaches.

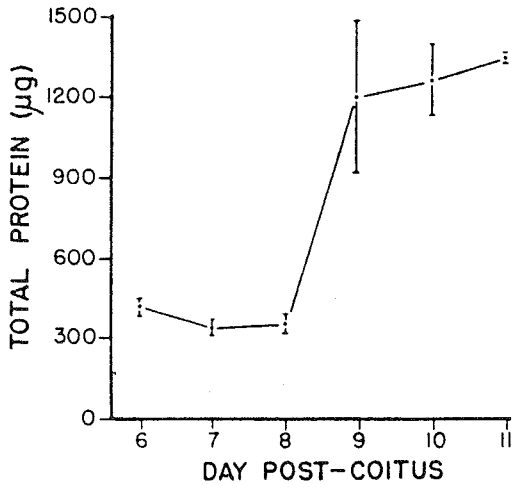



Fig. 3. Change in total protein content of uterine flushings during the preimplantation period of the ferret. Values given are the means for two animals per day; bars depict the range.

*The Journal of Experimental Zoology 243: 103-109 (1987)*
*3 fig., 34 references* *Authors abstract*

**Sex difference in the effect of mating on the pulsatile secretion of luteinizing hormone in a reflex ovulator, the ferret**

*R.S. Carroll; M.S. Erskine, and M.J. Baum*

Sex differences in the pulsatile secretion of

LH were examined in male and female ferrets after mating. Female ferrets which were either gonadally intact and in estrus or gonadectomized and maintained on a pulsed regimen of daily estradiol ($E_2$) injections exhibited a prolonged rise in plasma LH, characterized by an elevation in mean LH levels and an increase in the number of LH pulses after receiving an intromission from a stud male. By contrast, no such increase in LH secretion occurred in males which achieved an intromission with a female, regardless of whether they were gonadally intact and in breeding condition or gonadectomized and given pulsed estrogen. In fact, intact breeding males which achieved an intromission had significantly fewer LH pulses 1-5 h later than inmated males bled serially over the same time period. This decrease in LH pulse frequency was followed by a significant rise mean plasma levels of androgen 5-12 h later. When a sexually dimorphic LH response to intromission was obseved in gonadectomized $E_2$-treated ferrets, we asked whether this could reflect a sex difference in pituitary responsiveness to the endogenous release of GnRH. Thus, plasma LH levels were measured in gonadectomized and gonadectomized $E_2$-treated ferrets for 2 h after iv injection of GnRH. In the absence of gonadal steroids, ferrets exhibited a sex difference in LH responsiveness to GnRH; however, no sex difference was apparent under influence of $E_2$. These findings demonstrate that ferrets' sexually dimorphic LH responses to intromission probably reflect a sex difference in the processing of somatosensory inputs from the genitalia or in the neural control of GnRH release into the pituitary portal vessels.

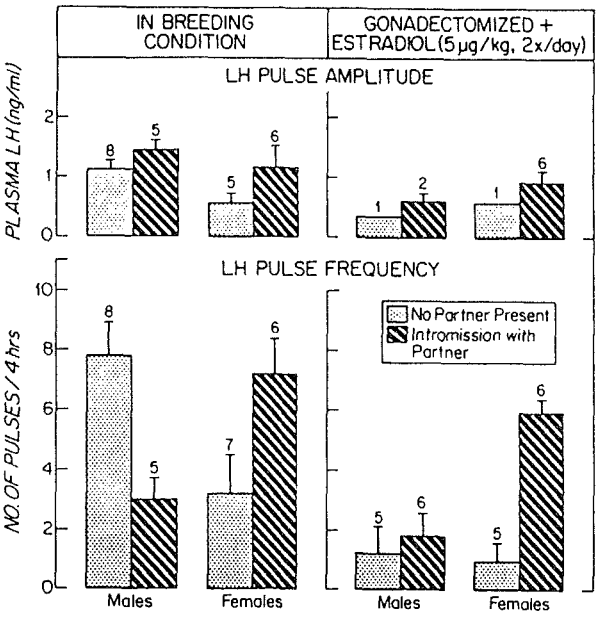
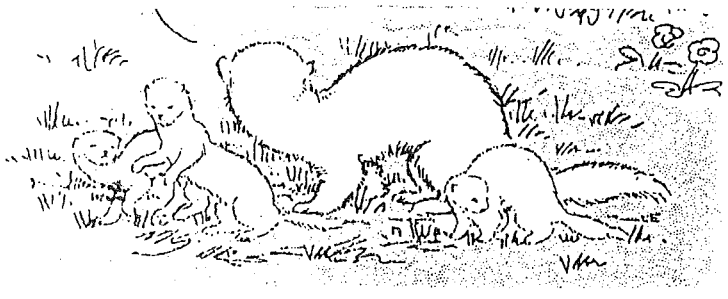



FIG. 3. Effect of intromission on LH pulse amplitude and frequency in male and female ferrets. Data are expressed as mean ± SEM. The number of ferrets in each group is given above each *bar*.

*Endocrinology 212: 1349-1359, 1987*
*2 tables, 6 fig., 64 references*

*Authors abstract*

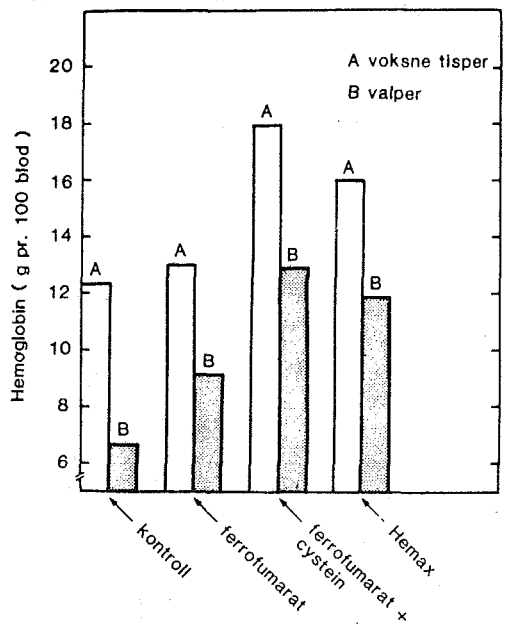


## Effects iron supplements and cystine on mink during the mating season

*Anders Skrede*

Of mink females (24 per group) fed (1) the iron preparation Ferrofumarat, (2) Ferrofumarat plus cysteine, (3) Hemax or (4) no supplement (controls) during the mating season, 4, 4, 8 and 2 resp. did not conceive. In the 4 groups resp., the number of kits born per litter averaged 5.8, 5.9, 5.5 and 5.6, the number weaned 3.5, 4.9, 4.4 and 4.3 and kit weight at 42 days of age 206, 270, 276 and 232 g for males and 168, 232, 230 and 204 g for females.

Figur 1. Hemoglobinkonsentrasjon i blodet hos voksne minktisper og valper etter avvenning (ca. 7 uker etter valping).




*Norsk Pelsdyrblad: 61(8): 14-15, 1987*
*2 tables, 1 fig., 1 reference*
*In NORG*

*CAB - abstract*

## Results of feeding experiments during the 1987 breeding season

*Ilpo Pölönen, and Jaakko Mäkelä*

Of mink females at Maxmo (100 per group) fed a standard diet during the breeding season (controls), diets containing (1) 4% maize gluten, (2) lactic acid-treated offal, (3) 10% tinned fish, (4) 40% protein, 36% fat and 24% carbohydrates or (5) 15% sardines, 6.5, 17.3, 14.0, 7.2, 3.1 and 7.3% resp. were infertile or killed their young, and the number of kits produced per mated female averaged 4.51, 4.43, 4.01, 4.34, 5.25 and5.41. For blue fox females, (50 per group) fed the standard diet or diets 1, 2, 3 or a diet containing 15% cereals (5% raw oats and 5% raw barley), the percentage of infertile females plus females which killed their young was 20, 21, 36, 38 and 42% resp., and the number of cubs weaned per mated female averaged 6.95, 7.49, 5.38, 5.26 and 4.27. Of silver fox females (20 per group), fed a standard diet or a diet containing 4% rumen and 4% liver, 29 and 40% resp. produced no young, and litter size at weaning per mated female averaged 2.18 and 1.60.

*Finsk Pälstidskrift; 21; 11; 610-612, 1987*
*1 table*
*In SWED.*

*CAB - abstract*

## Varied energy concentration in mink diets
I. Apparent digestibility of the experimental diets

*Anne-Helene Tauson*

In a 2-year project with mink of the standard colour type, the effect of varied dietary energy concentration at almost constant protein level and fat: carbohydrate ratio was stydied regarding apparent digestibility of the diets, kit growth performance, female weight changes in the lactation period, water turnover

and length of the digestive tracts of the experimental kits. Here, effects on apparent digestibility are reported from trials with adult males and kits were fed all diets to evaluate possible effects of the preceding treatment. Comparison of the results for adult males and kits showed a tendency for improved apparent protein digestibility of adult males. By exchanging protein feedstuffs of high digestibility with less digestible protein sources and/or vegetable products with a high fibre content, protein per MJ of ME and the fat: carbohydrate ratio could be kept almost constant as planned. Nutrient digestibility was independent of preceding feeding of the kits and no interaction effects between diet and preceding treatment were found.

*Acta Agric. Scand. 38: 223-229, 1988*
*6 tables, 20 references*

*Authors summary*

**Varied Energy Concentration in mink diets**
II. Effects on kit growth performance, female weight changes and water turnover in the lactation period

*Anne-Helene Tauson*

Effects of varied energy concentration at almost constant protein level and fat: carbohydrate ratio on kit growth performance, female weight changes in the lactation period and water turnover were studied in a 2-year project with mink. The studies reported here were preceded by a series of digestibility trials. In one experiment (II) 4 treatment groups of each 9 females and 54 kits and in the other (III) 3 treatment groups of each 15 females and 90 kits were used. Litter sizes were 5-7 kits and litter size distribution was equal in all groups. In Expt. II, 3 females per group were used for collection of data regarding water turnover during lactation. The experimental feeding started within the first week of lactation and was terminated 42 days after parturition for the females and at the age of 56 days for the kits. The variation in energy concentration of the diets was achieved by dilution of a basic diet with cod offal and wheat and oats bran. Kit growth performance was positively affected by a high energy concentration, and the effects were most evident from weaning at 42 days of age until the termination of the experiment. However, kit performance was strongly dependent on female effects. Female weight losses during lactation were in the order of 25% and independent of diet, but there was a tendency for high yielding females to regain weight at a slower rate after lactation than others. Water turnover data implied that females having the highest water balances raised the best performing kits. Final body weight and skin length of kits indicated that a good performance during the early growth period was determining for kit development during the total growth period.

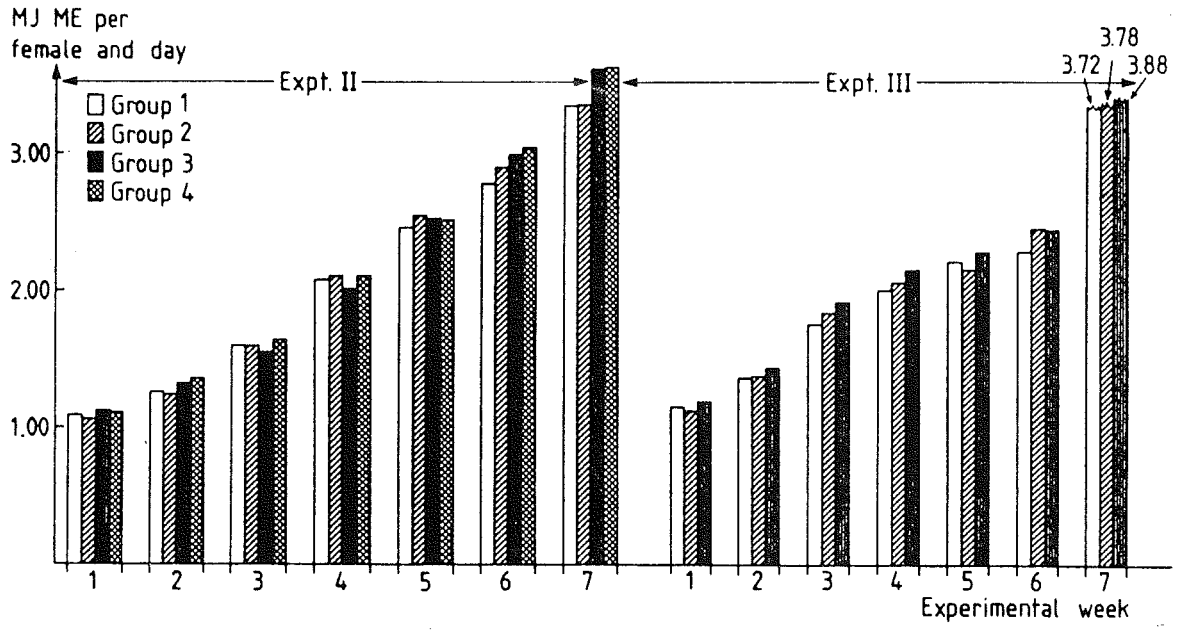



*Fig. 1.* Daily energy consumption on a weekly group basis.

*Authors summary*

*Acta Agric. Scand. 38: 231-242, 1988*
*7 tables, 3 fig., 20 references*

## Studies on the mechanism of the acute and carcinogenic effects of N-nitrosodimethylamine on mink liver

*P.E. Martino*

Outbreaks of liver necrosis and liver hemangiosarcoma were detected in a mink breeding colony in Argentina. Analysis of the minks' food revealed the presence of 2.6 ppm dimethylnitrosamine (NDMA) in it, apparently as a result of the addition of nitrite as preservative. Previous studies gave evidence of the particular susceptibility of minks to NDMA and other hepatic insults.

We have determined several biochemical parameters known to correlate with NDMA hepatotoxic effects and compared them with those in rat liver. NDMA administration to both species resulted in the formation of reactive metabolites able to interact with liver DNA to give $N^7$-methylguanine and $O^6$-methylguanine adducts. Biotransformation of NDMA by liver slices to $CO_2$ was significantly less in mink than in rat liver. The CB of NDMA reactive metabolites to microsomal proteins was not significantly lower in minks as compared to the rat, and the same holds true for the biotransformation of NDMA to formaldehyde by microsomal preparations. Results suggest that the high susceptibility of minks to NDMA might be partially due to a decreased ability to detoxicate NDMA but also to a higher intrinsic suspectibility of their liver cells to a given chemical insult.

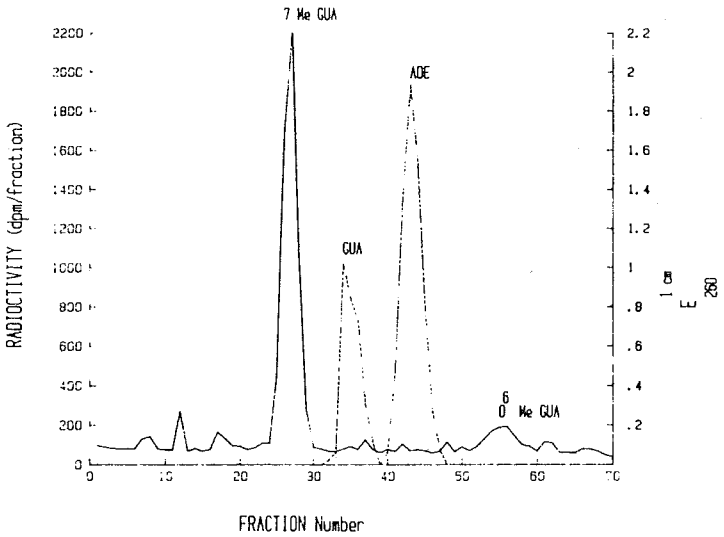



**FIGURE 1.** Sephadex G-10 chromatography of a 0.1 *M* HCl hydrolysate of DNA isolated from livers of male minks killed 4 h after an injection of [$^{14}$C]NDMA (10 mg/kg, specific activity 1.3 mCi/mmol): ——— radioactivity; ———, $E^{1cm}_{260}$. For details, see materials and methods section. For simplicity, only the $E^{1cm}_{260}$ corresponding to guanine (Gua) and adenine (Ade) were represented.

*Journal of Toxicology and Environmental Health, 23:183-192, 1988*

*4 tables, 1 fig., 32 references*
*Authors summary*

## Acute and chronic toxicity of 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin in mink

*Steven J. Bursian*

Adult female mink (*Mustela vison*) were fed diets containing 0.00, 0.001, 0.01, 0.1, 1.0, 10.0 or 100.0 pp[b] 2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin (TCDD) for 28 days. In addition, adult male mink were administered oral dosages of 0.00, 0.001, 0.01, 0.1, 1.0 or 10.0 microgram TCDD/kg body weight. Food consumption and body weight changes for all animals were determined weekly. Food and water were available *ad libitum*. Following in-test mortality and upon termination of the studies expired animals were subject to gross necropsy. The Litchfield-Wilcoxon method for evaluating dose-response experiments was used to determine a dietary $LC_{50}$ of 4.3 ppb TCDD for adult female mink. Results of the range finding test for adult male mink indicate that the $LD_{50}$ for TCDD would be 1.0 to 10.0 microgram/kg body

weight. These findings indicate that mink are among the most sensitive species to 2, 3, 7, 8 - TCDD.

*Washington, D.C. Dept. of Agriculture 1983 (6) leaves, 59-32U4-4-30*

*Authors summary*

**The effects of polychlorinated biphenyls and methylmercury, singly and in combination, on mink. I: Uptake and toxic responses**

*C.D. Wren; D.B. Hunter; J.F. Leatherland, and P.M. Stokes*

Rancch-bred mink *(Mustela vison)* were maintained in outdoor cages and fed experimental diets containing either polychlorinated biphenyls (Aroclor 1254) and/or MeHg (methylmercury) for eight months. Unexpected mortality of some mink was attributed to a combination of cold stress and exposure to 1.0 microgram/g MeHg. Mortality was lower in the group exposed to a combination of 1.0 microgram/g MeGh plus PCB. There were no observed treatment effects on the thyroid, pituitary, adrenal glands or serum T4 or T3 levels of adult mink. There was evidence of significant placental transfer of MeHg to the fetus, and transfer of PCB to growing kits via the mother's milk.
*Arch. Environ. Contam. Toxicol. 16, 441-447 (1987)*
*4 tables, 32 references*

*Authors abstract*

**The effects of polychlorinated biphenyls and methylmercury, singly and in combination on mink. II: Reproduction and kit development**

*C.D. Wren; D.B. Hunter; J.F. Leatherland, and P.M. Stokes*

Adult ranch-bred mink *(Mustela vison)* were fed diets containing either 0, 1.0 microgram/g polychlorinated biphenyls (PCB) (Arocolor 1254), 1.0 microgram/g methylmercury (MeHg), a combination of 1.0 microgram/g PCB plus 1.0 microgram/g MeHg, or 0.5 microgram/g PCB plus 0.5 microgram/g MeHg. Fertility of adult male mink, percentage of females whelped or set of tissues was collected from all animals and placed in buffered formalin. The rats displayed no clinical signs of illness following the administration of either congener, nor were there any significant gross or microscopic lesions created in this species. Mink in the 2, 4, 2', 4'-TCB and control groups remained free of clinical signs and significant gross or microscopic lesions. Mink in the 3, 4, 3', 4'-TCB group developed anorexia within 48 hr after the initial injection, and depression and melena by Day 4. Necropsy on Day 7 revealed a severe necrotizing enteritis with moderate to marked villus atrophy and fusion in the small intestines of all mink in this treatment group. The epithelium was often moderately hyperplastic. The mechanism by which 3, 4, 3', 4'-TCB causes this unique lesion is unknown.

*Fundamental and Applied Toxicology 8, 15-22 (1987)*
*1 table, 2 fig., 23 references*

*Authors abstract*

**Comparative toxicology of tetrachlorobiphenyls in mink and rats**
II. Pathology

*Deborah M. Gillette; Richard D. Corey; Linda J. Lowenstine, and Lee R. Shull*

Young female pastel mink and young female Sprague-Dawley rats were injected intraperitoneally on 3 sequential days with 50 mg/kg of either 2, 4, 2',4' tetrachlorobiphenyl (TCB) or 3, 4, 3', 4'-TCB and sacrificed after 7 days. Two control groups were established for each species; one allowed free access to food, and one pair-fed to the 3, 4, 3', 4'-TCB-treatment group. Heart blood was collected from each mink immediately after sacrifice. A complete number of kits born per female were not affected by the treatments. However, growth rate of kits nursed by mothers exposed to 1.0 microgram/g PCB was significantly reduced. There was a synergistic effect of PCB and MeHg which reduced kit survival in groups receiving both chemicals simultaneously. Kit survival to weaning in the control, 0.5 microgram/g PCB/MeHg, and 1.0 microgram/g PCB/MeHg groups was 72.0%, 62.7% and 35.8%, respectively. The results suggest that growth and survival of mink kits are adversely affected at dietary levels of PCB and MeHg currently present in some environments.

*Arch. Environ. Contam. Toxicol. 16, 449-454 (1987)*
*4 tables, 16 references*

*Authors abstract*

**Hematological and clinical-chemical investigations on mink kits fed fresh herring by-products**

*Asbjørn Brandt, and Georg Hillemann*

The effect of differently treated fresh herring by-products (Clupea harengus) was investigated in mink kits in a feed trial at Nordjydsk Pelsdyrforsøgs farm A.m.b.a. Sixteen percent of the feed was substituted with fresh/iced, fresh/silaged, frozen and fresh/frozen herring offal. No differences in growth rate or pelt quality measurements were registrated due to the treatments as compared to conventionally fed controls.

The alpha-tocopherol status measured as the plasma content, and the cell membrane integrity - indirectly measured as the blood plasma content of endoplasmatic enzymes- were not altered due to the different treatments and/or the presence of herring by-products.

*Meddelelse, Statens Husdyrbrugsforsøg, Denmark, 1987, No. 668, 4 p.*
*4 tables, 3 references*
*In DANH*

*Authors abstract*

**The effect of supplemented iron and vitamin-C on mink kits fed conventionally**

*Asbjørn Brandt*

The effect of vitamin-C and iron on normal managed and fed (Danish standard) Pastel mink kits were subject to a factorial trial from weaning until pelting with the following treatments: vitamin-C (asorbic acid) status before weaning, dietary vitamin-C in combination with chelated iron (Fe-EDTA) and iron sulphate ($FeSO_4$). Supplemented vitamin-C had a positive effect on plasma-ascorbic acid content and to a lesser extent on the growth rate, haemoglobin concentration and number of erythrocytes. Iron sulphate in the feed had a similar effect.

There were no effect of EDTA-iron or vitamin-C supplementation in the lactation period prior to the experiment start on the measured variables.

The result did not reveal any interactions between the main tretments, which for instance could demonstrate an enhanced intestinal uptake of vitamin-C reduced iron.

In conclusion vitamin-C supplementation had a beneficial effect on the growth and general performance in Pastel mink kits from weaning until pelting.

*Meddelelse, Statens Husdyrbrugsforsøg, Denmark; 1987; SH.; Copenhagen*
*4 tables, 5 references*
*In DANH.*

*Authors abstract*

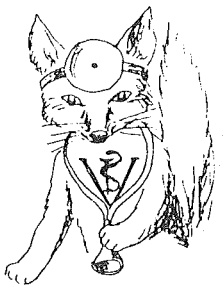
**Determination of PH in the gastro-intestinal tract of mink in relation to time after feeding**

*Heddie Mejborn*

Determination of PH in the gastro-intenstinal tract of adult male mink were made at different times after feeding a conventional mink feed with PH 6.5. The determinations were made during a period of 6 1/2 hours after feeding, and in this period almost all feed had passed through the animals. the lowest PH (about 5) was measured in the stomach, and PH increased throughout the intestine from about 6 in duodenum to slightly over 7 in colon. There was a tendency that PH in the stomach and duodenum was affected by the time from feed intake, while PH in ileum and in colon was independent of time from feed intake.

*Statens Husdyrbrugsforsøg, Meddelelse No. 663, 3 pp.*
*2 tables, 1 fig., 2 references*
*In DANH.*

*Authors summary*



VETERINARY

## Investigations into the infection route of Aujeszky's disease virus in fur-bearing animals

*Janina Oyrzanowska, and Jerzy Kita*

During the recent years in Poland cases of Aujeszky's disease (Ad) were frequently found among the fur-bearing animals, such as minks and foxes. Numerous studies of foreign authors agree that carnivores are infected through alimentary tract, while the basic infection source is meat offals and after-slaughter garbage using from sick or recovered pigs. This opinion finds confirmation also in the Ad cases described in Poland in which it was found that mass outbreaks among fur-bearing animals, as well as dogs and cats, occurred after they were fed on raw after-slaughter garbage, coming from Ad infected pigs.

In investigations were used 12 foxes of Piesak variety and 3 minks, Standard veriety. The strain of Ad virus which was used in experiments, was isolated from foxes in August 1962 during the enzootic in some farms on the terrain of the Kilce district.

**Conclusions**

1. In foxes and minks fed on minced meat of an Ad infected rabbit, the disease was not engendered.
2. The same animals fed on the same food after previous injury to the skin or mucosa- became sick and died.
3. In the course of natural infection the undamaged skin or mucosa are not the entry site of Ad virus.
4. Susceptibility of animals, after oral introduction of virus, to infection through injured skin or mucosa, as well as susceptibility to much smaller doses introduced subcutaneously is an indication of the lack of resistance of animals after introduction of virus through alimentary tract.
5. Appearance of itching after subcutaneous and intradermal infection indicates the site of the virus entry into tissue.
6. After intramucosal infection - no itching was observed, either general or local.
7. The results of investigations indicate that, natural infection is conditioned by injury to skin or mucosa which become the site of the Ad virus entry.

*18 references*

*Translated from Polish for the OICD, APHIS, USDA by Mrs. Geti Saad, Ag TT 84-4-1160.*
*Med. Weter., Vol. 22, No. 10; 579-581, 1966*

*Part of authors introduction and conclusions.*

## Aujeszky's disease in silver and blue mutation mink

*Jerzy Szaflarski*

Aujeszky's disease (Ad) is an acute infectious disease of animals and birds, attacking in exceptional cases man also. Only heterothermic animals are, according to investigations up to now, completely immune.

Ad is caused by a pantropic virus of 180-220 millimicrons in size. We find it in the blood, in the internal organs (particularly spleen and lung tissue), in the brain and spinal cord, in bone marrow, milk, in nasal dischargof pigs and in urine, it has not been found in bile, feces and saliva unpolluted with blood or nasal discharge (in pigs).

Ad on farms with fur-bearing animals is usually observed during summer and fall seasons. The source of infection is usually after-slaughter garbage coming from pigs infected with this disease. The sickness reveals itself 2-4 days after the infected material has been consumed.

**Conclusions**

1. Ad is a severe sickness of foxes and minks.
2. On the basis of observations of farms with fur-bearing animals it should be accepted that our piggeries are not free from Ad.
3. Dead pigs and after-slaughter pig garbage can be the source of Ad in foxes and minks and for this reason the garbage should not be given in an unboiled form.

4. The use of aureomycin and terramycin in the early stages of this disease seems advisable.
5. The disease does not leave a lengthy virus-carrying state and also the virus does not persist for a long time on the terrain of the fur-bearing animal farms.

*Translated from Polish for the OICD, APHIS, USDA by Mrs. Geti Saad. Translated from: Med. Wet., Vol. 18, NO. 4: 201-204, 1962*
*3 fig., 29 references*

*Parts of authors introduction and conclusion In ENGL.*

**Intracisternal protein in the type II pneumocyte of the ferret, guinea pig, and mongrel dog**

*M.L. Miller; A. Andringa; W. Adams, and M.J. Radike*

An intracisternal protein in the type II pneumocyte of the ferret, guinea pig, and mongrel dog was examined by light and electron microscopy and morphometry. The basic pattern of layering in this membrane-bound, ribosome-studded structure (cisternal body) was visualized in cross sections as dense layers separated by approximately 0.1 micrometer with seven fine layers between. In all species the central fine band of the seven was occasionally more prominent than the other six. In the guinea pig the seven fine layers alternated in density from light to dark. The cisternal body of the dog was similar to that of the ferret, but was very much smaller and encountered infrequently. No function has been ascribed to this structure; however, its relation to lamellar bodies, the perinuclear membrane, and surfactant apoprotein is discussed.

*Journal of Ultrastructure and Molecular Structure Research 95, 131-141 (1986)*
*1 table, 9 fig., 13 references*

*Authors summary*

**Susceptibility of nutria (coypu) to various species of tubercle mycobacteria**

*G.A. Krasnikov, and V.N. Lisitsyn*

Groups of six nutria were inoculated s/c with 1 mg of cultures of M. tuberculosis, M. bovis or M. avium and killed 15 or 30 days later. The severity and distribution of lesions indicated that nutria were most susceptible to M. bovis, which produced generalized miliary tuberculosis involving the lungs, liver, spleen and lymph nodes. The next most pathogenic species was M. tuberculosis (microscopic lesions in the lungs, liver, and lymph nodes).

*Veterinariya, Kiev. USSR: 60: 21-25, 1985*
*1 table*
*In RUSS.*

*CAB - abstract*

**Analysis of molecular cloned DNA reveals minor differences among three virus strains of Aleutian disease of mink parvovirus**

*M.E. Bloom; D. Lechner; D.L. Wiedbrauk, and J.B. Wolfinbarger*

Molecular clones representing a 1.55 kbp genomic segment three strains of Aleutian disease parvovirus (ADV) were studied. All three clones directed synthesis of viral structural antigens. In addition, 19 of 23 restriction sites were shared among viruses.

*Arch Virol (1987) 92: 175-181*
*3 fig, 21 references*

*Authors summary*

**Apparent lack of neutralizing in Aleutian disease is due to masking of antigenic sites by phospholipids**

*Birgit Stolze, and Oskar Rüger Kaaden*

It is generally accepted that Aleutian disease

virus (ADV) cannot be neutralized by antibodies either *in vivo* or *in vitro*. We found several ways to demonstrate neutralization of ADV by specific antibodies from mink. It was essential to make ADV monodisperse by treatment with sodium lauroyl sarkosyl or *n*-butanol or by filtration through 0.05-micrometer membranes before neutralization tests. In kinetic experiments, there was a 95% loss of virus infectivity within the first 5 min of reaction, but a resistant fraction of about 1% remained after 1.5 hr or incubation. Neutralization titers between 1:160 and 1:640 were found in sera from naturally and experimentally infected mink. A positive relation was consistently found between neutralization and ELISA titers. Furthermore, separation of phospholipids from ADV was shown by thin-layer chromatography of butanol-extracted virions. By reconstitution of monodispersed ADV with various lipids, phospholipids were found to interfere with virus neutralization by attachment to the virus surface.

*Virology 158, 174-180 (1987)*
*2 tables, 3 fig., 26 references*

*Authors summary*

**In situ molecular hybridization for detection of Aleutian mink disease parvovirus DNA by using strand-specific probes: Identification of target cells for viral replication in cell cultures and in mink kits with virus-induced interstitial pneumonia**

*Søren Alexandersen; Marshall E. Bloom; James Wolfinbarger, and Richard E. Race*

Strand-specific hybridization probes were utilized in in situ molecular hybridization specifically to localize replicative form DNA of Aleutian mink disease pavovirus (ADV). throug-out in vitro infection, duplex replicative form DNA of ADV was located in the cell nuclei. Single-stranded virion DNA and capsid proteins were present in the nuclei early in infection, but were later translocated to the cytoplasm. In neonatal mink, ADV causes acute interstitial pneumonia, and replicative forms of viral DNA were found predominantly in alveolar type II cells of the lung. Viral DNA was also found in other organs, but strand-specific probes made it possible to show that most of this DNA represented virus sequestration. In addition, glomerular immune complexes containing intact virions were detected, suggesting that ADV virions may have a role in the genesis of ADV-induced glomerulonephritis.

*Journal of Virology, Aug. 1987, p. 2407-2419*
*4 tables, 7 fig., 46 references*

*Authors summary*

**Temporal distibution of transmissible mink encephalopathy virus in mink inoculated subcutaneously**

*William J. Hadlow; Richard E. Race, and Richard C. Kennedy*

Information was sought on the temporal distribution of transmissible encephalopathy virus in royal pastel mink inoculated subcutaneously with $10^{3.0}$ 50% intracerebral lethal doses of the Idaho strain. As determined by intracerebral assay in mink, extremely little replication of the virus occurred during the preclinical stage of infection. It seemed largely limited to lymph nodes draining the site of inoculation. Virus first appeared in the central nervous system (CNS) at 20 weeks, when all mink were still clinically normal. Early spongiform degeneration, limited to the posterior sigmoid gyrus of the frontal cortex, was first found at 28 weeks, or a few weeks before onset of clinical disease in most of the mink. Once virus reached the CNS, where greater concentrations occurred than elsewhere, it appeared in many extraneural sites ( spleen, liver, kidney, intestine, mesenteric lymph node, and submandibular salivary gland). These seemingly anomalous findings, especially the limited extraneural replication of virus as a prelude to infection of the CNS, suggest that mink are not natural hosts of the virus. The results of this study support the generally held view that transmissible mink encephalopathy arises from chance or inadvertent infection of ranch mink with an exogenous virus, most likely feed-borne wild scrapie virus.

*Journal of Virology, Oct. 1987, p. 3235-3240*
*1 table, 1 fig., 42 references*

*Authors summary*

**Restricted viral antibody specificity in many ferrets infected with the ferret Aleutian disease parvovirus**

*D.D. Porter; Helen G. Porter; A.E. Larsen, and M.E. Bloom*

The majority of ferrets infected with a ferret strain of Aleutian disease virus (ADV) produce antibody only to a detergent-sensitive common determinant on the two closely related virion proteins. Ferrets with high antibody titers and mink infected with this virus also produce antibody to one or more virion immunogenic determinants unaffected by detergent

*Arch Virol (1987) 93: 155-161*
*2 tables, 3 fig., 20 references*

*Authors summary*

**Analysis of Aleutian disease of mink parvovirus infection using strand-specific hybridization probes**

*Marshall E. Bloom; Richard E. Race, and James B. Wolfinbarger*

A7 - 95 map unit segment of DNA from Aleutian disease of mink parvovirus (ADV) was subcloned into a bacteriophage SP6 based transcription vector and used to produce radiolabeled viral RNA transcripts corresponding to either 'plus' or 'minus' sense. The radiolabeled transcripts were reacted against Southern blots of whole cell DNA from ADV infected cell cultures as hybridization probes. The 'plus' sense RNA probe hybridized both to duplex replicative forms (RFs) as well as to single-stranded virion DNA (SS DNA), which is 'minus' in sense. In contrast, the 'minus' sense RNA probe reacted preferentially with the duplex RFs. When these probes were tested against DNA extracted from mink infected with the virulent ADV-Utah I strain, RFs were detected at 10 days after infection in mesentric lymph node, liver, spleen and gut, but only in gut and mesentric lymph node at 43 days. SS DNA was noted in these tissues at 10, 43 and 60 days, and was more abundant than RFs. Only SS DNA at very low levels was observed in bone marrow celles. Serum contained large amounts of SS DNA (probably in virions) at 10 days, less at 43 days, and no detectable DNA at 60 days. These findings suggest that ADV replication may have occurred in the gut as well as lymphoreticular tissues, and that bone marrow was not a major site of ADV replication.

*Intervirology 27: 102-111 (1987)*
*4 fig., 25 references*

*Authors summary*

**Shedding of gravid proglottids and destrobilation in experimental infections of foxes with Mesocestoides leptothylacus Loos-Frank, 1980 (Cestoda)**

*Brigitte Loos-Frank*

The implications of confused taxonomy of the genus *Mesocestoides* and the misuse of the name *M. lineatus* are described. In Southwest Germany rodents are intermediate hosts and red foxes are definitive hosts of *M. leptothylacus*. The shedding patterns of experimentally infected foxes showed that destrobilation occurs frequently and that there are long periods during which no gravid proglottids are shed at all. Lengths of worms can be taken as a measure of a possible crowding effect only when worms with gravid segments are present, i.e. at the end of the prepatent period (11 to 13 days) or at the beginning of a shedding period.

*Journal of Helminthology (1987) 61, 213-218*
*1 table, 1 fig., 8 references*

*Authors abstract*

**Experimental Pneumocystis carinii pneumonia in the ferret**

*Dennis C. Stokes; Francis Gigliotti; Jerold E. Rehg; Richard L. Snellgrove, and Walter T. Hughes*

*Pneumocystis carinii* pneumonia (PCP) was provoked in the ferret. *Mustela pulorius furo, by immunosuppression with daily long-term administration of cortisone acetate, 10-20*

*mg/kg subcutaneously for 9 to 10 weeks. Microscopically P. carinii* was observed in the lungs of all 11 treated animals: mild to moderate in five and extensive disease in six. The histopathological features of PCP in the ferret included interstitial pneumonitis, scant mononuclear cell alveolitis, with abundant cysts and trophozoites visible in a focal distribution. There were few neutrophils present. Electron microscopy showed large numbers of both cysts and trophozoits in close association with type I cells. No bacterial pathogens were isolated from the lungs of immunosuppressed animals but an unexplained eosinophilic enteritis was present in treated animals. *P. carinii* pneumonia developed without significant body weight loss during corticosteroid administration, unlike previously described studies using corticosteroid-treated rodents. Ferrets thus appear to be a 'steroid resistant' animal, like man, and therefore a more suitable model for immunological studies of host response to PCP than rodents. This new model also has practical advantages over previously described animal models of PCP, including larger lung and airway size.

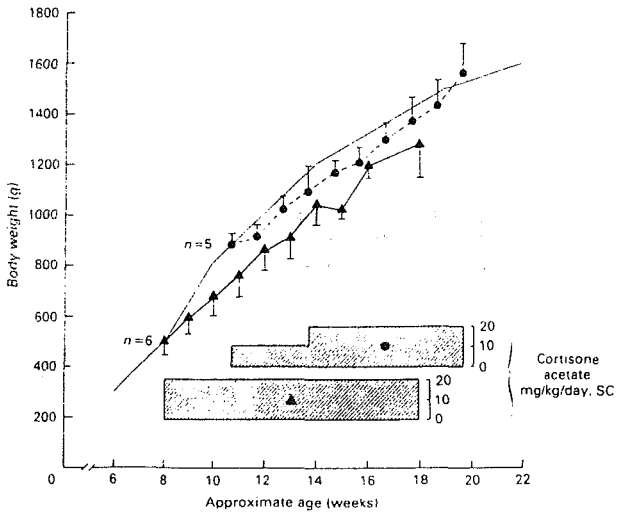



Fig. 1. Mean body weights (± 1 s.d.) for the ferrets during corticosteroid immunosuppression (●, 10 mg/kg/day × 4 weeks, then 20 mg/kg/day; ▲, 20 mg/kg/day). Thin solid line represents growth curve for normal male ferrets (courtesy of Marshall Farms, North Rose, NY; no standard deviations available).

*Br. J. exp. Path. (1987) 68, 267-276*
*5 fig., 25 references*

*Authors summary*

**Veterinary prophylaxis in keeping of European otter (Lutra l. lutra)**

*A. Rubel; B. Hauser; R. Baumgartner, and E. Isenbugel*

Post-mortem results obtained from European otter at the Zoo of Zurich as well as in other zoological gardens exhibited some pathological patterns which were very common. Prophylactic measures taken for the prevention of such diseases are discussed. Emphasis is laid on liver fibrosis, liver cirrhosis, pyelolithiasis, and infectious diseases. Also discussed in a vaccination programme for European otter.

*Verhandlungsbericht des Internationalen Symposiums uber die Erkrankungen der Zootiere: 29: 285-291, 1987*
*2 tables, 16 references*
*In GERM., su. ENGL, FREN.*

*Authors summary*

**Treatment of coccidiosis in mink**

*M.D. Umurzakov, and K.K. Nukerbaeva*

60 mink aged 2-3 months were infected with at least 300 oocysts of the species Eimeria vison, E. furonis and Isospora laidlawi. Four drugs, added to the feed, were compared in this experiment and in field trials on 300 2-month-old mink naturally infected with coccidia: Coccidin (dinitolmide), Rigecoccin, Khimkoksid-6 (Chemcoccid-6) and Coyden-25. The first three were highly effective at dose rates of 50, 40 and 500 mg/kg body weight, respectively.

*Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Biologichskaya; No. 4; 83-84, 1987*
*7 references*
*In RUSS.*

*CAB - abstract*

**Infection of Alopex lagopus with coccidia and Taxoscaris**

*K.K. Nukerbaeva*

In 1970-1980, 1424 A. lagopus at fur-farms in Kazakhstan, in Altai Territory and in the Novosibirsk region, USSR, were examined for coccidia and T. leonina. 6 species of coccidia were recorded: Isospora buriatica, I. canivelocis, I. vulpina, I. pavlodarica. I. triffitti and Eimaria imantauica. T leonina was found on 9 of 12 farms investigated. Infection with ccoccidia and the nematode together were rare.

*Izvestiya Akademii Nauk Kazakhskoi SSR, Biologicheskaya: (No. 1): 27-30, 1987*
*1 table, 10 references*
*In RUSS.*

*CAB - abstract*

**Apparent lack of effect of vaccination against mink enteritis virus (MEV). A challenge study**

*Åse Uttenthal*

The mink enteritis virus part of a triple vaccine was tested in mink. No raise in antibody response was measured after vaccination. Subsequent challenge of groups of vaccinated or not-vaccinated animals revealed no differences in virus excretion or antibody response in the different animals.

*Arch Virol (1988) 99: 153-161*
*2 tables, 1 fig., 18 references*

*Authors summary*

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IFASA

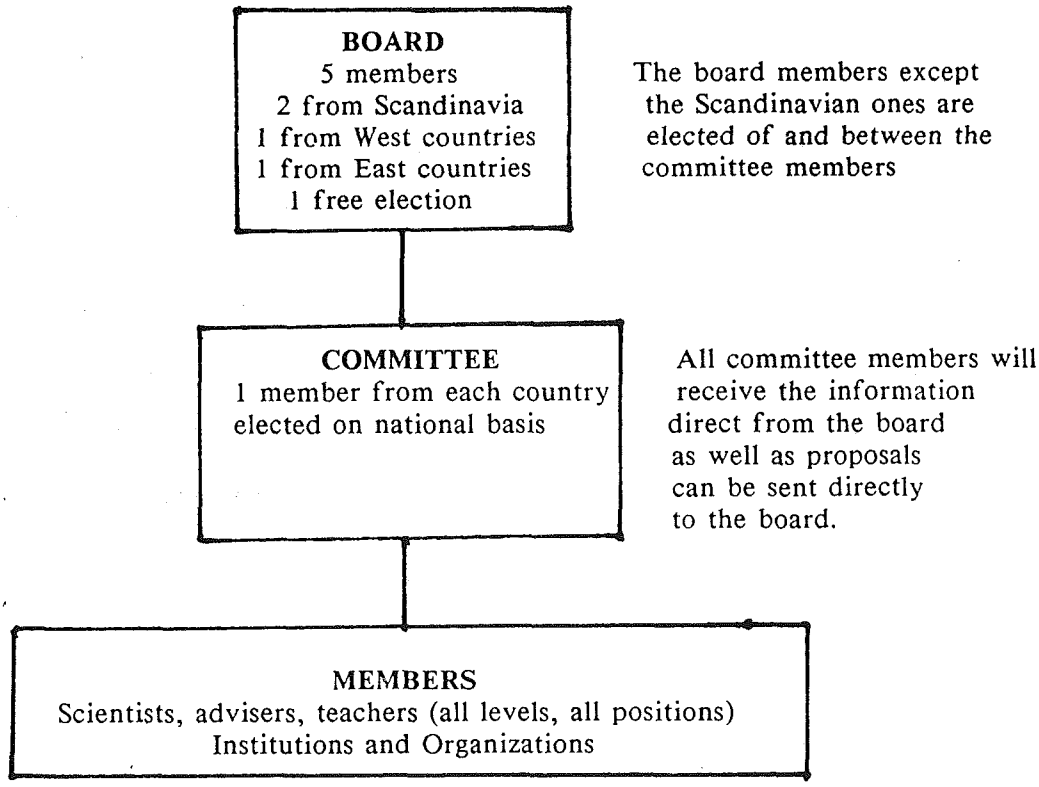
# PROPOSAL
for
establishment
of
# INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION
# (IFASA)

In the following, we will present the idea about IFASA and the way to organize and run the organization.

## AIM AND ORGANIZATION OF IFASA

1. IFASA will be the organisatory background for the international cooperation in fur animal science.
2. IFASA must coordinate and arrange international scientific meetings and congresses.
3. IFASA must act as the formal link between breeder organizations, authorities and scientists on an international level.
4. IFASA must be engaged in establishment, production and distribution of the journal: INTERNATIONAL FUR ANIMAL PRODUCTION.
5. IFASA must basically have personal members, but institutions and organizations can also be members for special fee.
6. INTERNATIONAL FUR ANIMAL PRODUCTION is the channel for member information.
7. IFASA is directed by a board of 5 members elected by the committee which have one elected representative from each fur producing country.
   The Scandinavian countries will cover the chairman- and secretaryship of the board. The board members from Scandinavia are those who are elected to the board of NJF's division of fur animals.

## ORGANIZATION MODEL OF IFASA:




Principally contact to the board through the national representative in the committee.