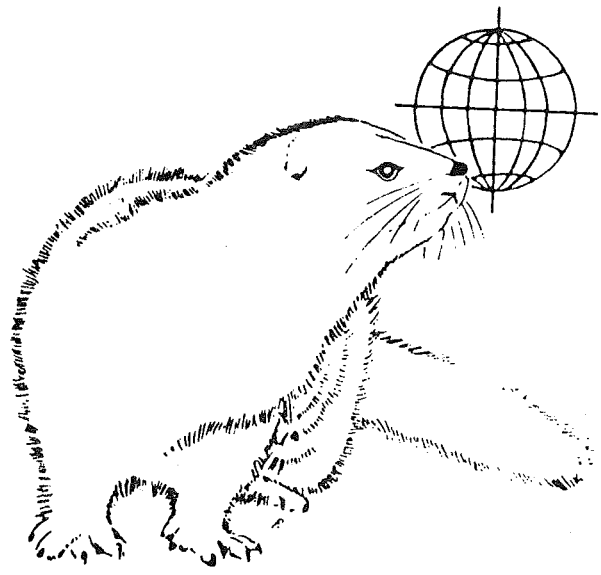

SCIENTIFUR
ISSN 0105-2403
Vol. 13, No. 2
May 1989

Published by
NJF's Fur Animal Division

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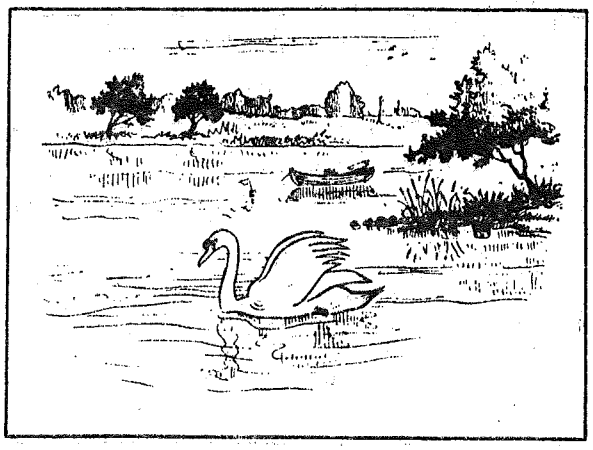
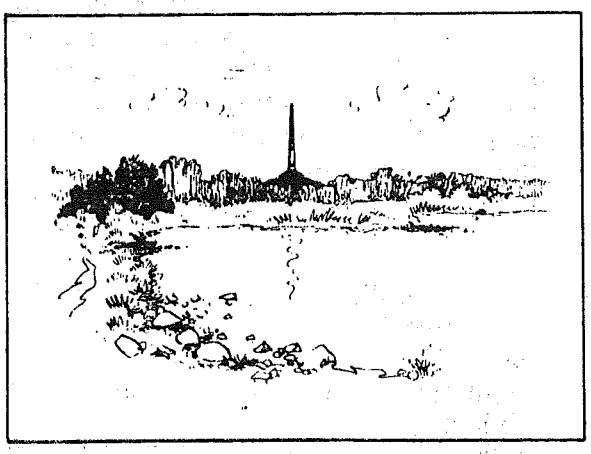




# NOTES

## SCIENTIFUR

**Vol. 13, No. 1**
**May 1989**

First of all we wish to apologize for the delay of the February issue of SCIENTIFUR, but moving the entire department, and establishing a new SCIENTIFUR office, made it impossible for us to finish it earlier.

This time we are more precise, and we can assure you that just now you have in your hand the SCIENTIFUR issue that contains the largest number of original reports, 7 in total, and the largest number of abstracts and titles.

As far as we can see, there is more than enough important information to bring in SCIENTIFUR - we have a lot in stock for the coming issues.

Therefore, it is frustrating for us that for economic reasons we have to stop production of SCIENTIFUR at the end of this year, simply because too few people are interested in all this information, and the number of subscribers and advertisers is therefore too low to ensure the economy.

We really hope that the idea of the new journal - INTERNATIONAL FUR ANIMAL PRODUCTION - which has been mentioned in detail in earlier issues of SCIENTIFUR - will become a reality.

All Fur Breeders Associations as well as relevant funds will be contacted by the INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION (IFASA) in the near future and asked for financial support for establishment of this new journal which is planned to cover both scientific reports and applied reports of actual interest to practical production as well as advertisements.

This journal, which is planned to be issued 6-12 times per year depending of the economy (number of subscribers and advertisers) will be the place for up-to-date information regarding fur animal science and fur animal production. We feel that the journal, INTERNATIONAL FUR ANIMAL PRODUCTION, should be the most effective

and cheapest way to secure the necessary supply to all the local journals existing in the fur industry. The international background of the journal, and the international panel of writers, should ensure that the information given therein is valuable to readers in all countries and at all levels.

Because of the present, poor economic situation of the entire fur industry, you may at first say that we do not have the money for such an investment, but I think you will - on second thought - realize that sponsoring the establishment of such a journal will be the best money you can spend - it often happens that a small investment in bad times proves to be the best investment for the future.

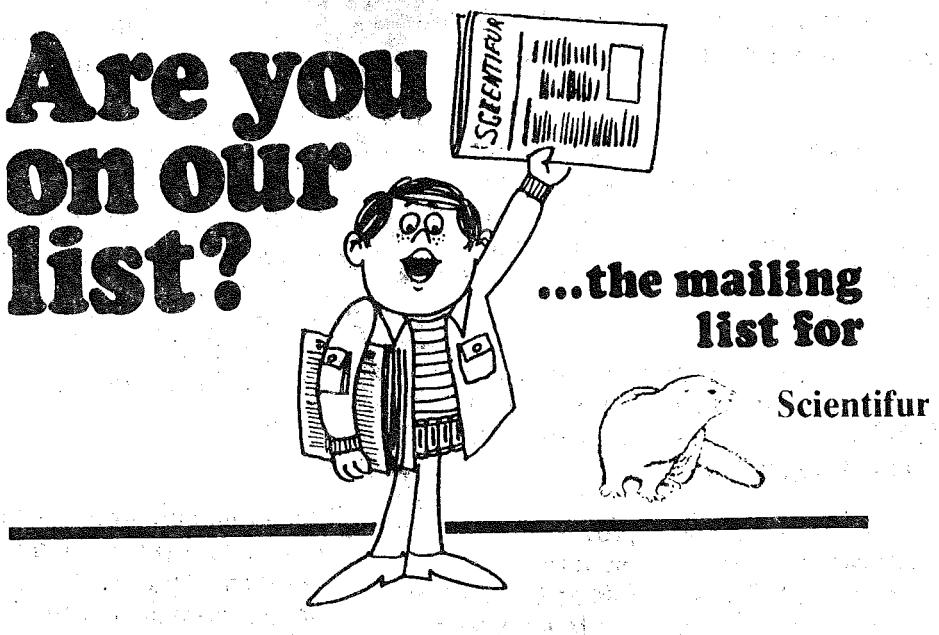
Looking at the poultry production, where besides the local journals there are 3 international journals, it is hard to beleive that the fur animal industry cannot benefit from at least one international journal.

We need your suggestions, and the board in your countries need your suggestions. Please write to us and to them, if you want to benefit from international co-operation in your field in the future.

Have a nice summer - and don't forget the future.

Best regards,

Gunnar Jørgensen
your editor



*Original Report*

# Activity of non-specific alpha-naphthylacetatesterase in the fur-bearing animal blood leukocytes.

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**Abstract**

Non-specific esterase (NAE) activity can be revealed in the leukocytes of mink and polar fox peripheral blood by cytochemical method with combination of α-napthylacetat and fast blue BB at pH 7.8-8.0. Reaction product is observed in various cell elements of peripheral blood such as lymphocyte, thrombocyte, eosinophil, monocyte and segmentnuclear leukocyte. The azodye distribution character indicates that the lymphocyte population is non-uniform. On one hand a part of lymphocytes does not stain at NAE, on the other - enzyme containing lymphocytes differ in the localization of reaction product produced. In the NAE-positive leukocytes granularity of various types is observed: the dotted one throughout the cytoplasme and above the nucleus as a sharply outlined areas of different size and powdered one - very fine dye deposits around the nucleus. Reaction, carried out at NAE can be significant for studying some characteristics of fur-bearing animal intracellular metabolism in various physiological and pathological states.

**Introduction**

At the present the cytochemical analysis has a principle value in hematology. However, this method is not used in clinico-experimental studies, carried out on the fur-bearing animals.

In our opinion, it is necessary to find some accordance between the changes in the cell population metabolism status and the organism state. Gradual cytochemical characteristic, including the most informative tests, can be used for the differential diagnosis in fur-bearing animals, for the appearance of preclinical and asymptomatic disease stages and states between physiological and pathological ones, i.e. measures, which are carried out in medicine for a long time.

The study of enzymatic cell profile plays a first role in the practice of cytochemical investigations. A great number of enzymes rather fully characterizing the different sides of intracellular metabolism can be identified cytochemically. In the cyto-enzymology wide attention is payed on the definition of the non-specific esterases as enzymes hydrolizing carboxylic acid ethers. The esterase role in cellular metabolism is not clear enough. One of the reasons is the use of synthetic and non-physiological substrates in the histochemical and biochemical studies (*Loida et al., 1982*). The most unanimous is the opinion about the esterase effect on the level regulation of acetylcholine in the organism. The relation of these enzymes to phagocytosis and processes connected with it is also determined. Participation of these enzymes in the protein exchange

is not excluded *(Berston, 1965)*.

Recently, great success has been achieved in histochemical studies of esterases at the tissue, cell and ultrastructural levels.

Quantitative esterase content in the organism tissues is extremely uneven *(Leites, 1977)*. In human being liver, excretory glands, chief cells of the stomach mucosa, kidney tubule epithelium and bronchus mucosa have the greatest esterase activity *(Berston, 1965)*.

Esterase biochemistry is very complex, as for nomenclature it is confused *(Loida, 1982)*. The group of non-specific esterases consists of carboxylesterase (ali-esterase, B esterase, carboxylesterhydrolase, 3.1.1.1.), aril-esterase (A esterase, aromesterase, arilesterhydrolase, 3.1.1.2) and acetyl-esterase (C esterase, hydrolase of acetic acid ethers, 3.1.1.6). Most of the cytochemical studies prefer the method of simultaneous diazo reaction. Interesting result are also obtained with some derivatives of napthol AS *(Korovina, 1978; Tzvetkova, Atanasov, 1985)*.

**Materials and methods**

Cytochemical analysis was carried out in mink and polar foxes leukocytes three times during the autumn-winter period (November-January-February).

Well-known cytochemical scheme of α-naphthylacetatesterase determination by Löffler method with use of α-naphthylacetat as a substrate and diazonium salts determination with fast blue BB have been tested.

Fixation was carried out in the formalin vapours during 4 minutes. The incubation medium content consists of 10 mg α-naphthylacetate, dissolved in 0.2 ml acetone, 40 ml 0.1 M phosphatic buffer with pH 7.8-8.0. A half-hour incubation of preparations was carried out in the dark at room temperature. For the nucleus staining methyl green and sometimes hematoxylin were used by I. Mc Manus and R. Mowri method.

The quantitative NAE level was determined only in lymphocytes, ensuring as we know immunological functions of the organism and subdivding on various subpopulations in dependence on their functional characteristics features. The percentage of esterase-positive cells with the separation of lymphocytes of I (+) and II (++) and III (+++) degrees of activity from the total population was determined.

**Results and discussion**

According to visual observation, the presence of NAE in mink and polar fox was noted in monocytes, thrombocytes, segment-nuclear leukocytes and lymphocytes. Only weak granularity is observed in neutrophils. It is larger in mink than in polar foxes. As for polar fox thrombocytes, they on the contrary, have more pronounced staining on NAE. Rather high NAE level is characteristic of moncytes. In mink and polar fox lymphocytes NAE is revealed as a brownish-black granules of different size and also as dotted staining of all cell and above the nucleus and sometimes as a fine, powdered granularity around the nucleus. These observations are very interesting from the point of view of cytochemical testing of some lymphocyte subpopulations *(Venglinskaya et al., 1985)*. Three lymphocyte types showing esterase activity in acidic pH zone are also revealed in human beings and small laboratory animals (rats, mice, rabbits). In this case one or two little areas are staining in the cytoplasme of the most T-cells. The lymphocytes without enzyme or with low activity of the latter are in their turn identified as B-type cells. According to our investigations, there are lymphocytes with both positive and negative NAE reaction in mink and polar fox periphery blood. Among the active cells it is possible to distinguish weak-, moderate- and strongly reacting types (Table 1).

Value of enzymatic activity varies during the autumn-winter period, it is likely the results of functional changes taking place in animal organisms at such an important stage of onthogenesis as rut preparation.

So, NAE is present in most of mink lymphocytes. During our investigations the highest indices of esterase activity were revealed in November and February. In January some lowering in the esterase-positive cell percentage was marked.

Table 1. NAE activity in the lymphocytes of mink and polar fox peripheral blood.

| Date of observation | Percentage of enzymopositive lymphocytes : X | : ± σ | : ± m | : C |
|---|---|---|---|---|
| | Mink | | | |
| November | 82.8 | 12.5 | 5.1 | 15.1 |
| January | 65.4 | 11.7 | 3.5 | 17.9 |
| February | 84.5 | 5.1 | 1.7 | 6.0 |
| | Polar fox | | | |
| November | 49.7 | 16.5 | 5.5 | 33.1 |
| February | 73.9 | 18.4 | 6.1 | 24.9 |

In polar fox the character of lymphocyte distribution according to the reaction intensity is nearly the same as in mink. I.e. the prevalence of cells, belonging to the weak or moderate activity is revealed. The largest content lymphocytes reacting on α-naphthylacetate was observed in polar fox in February.

Taking into consideration the role of NAE in the cell metabolism, its investigation for the evaluation of lymphoid population functional state in the fur-bearing animals organism is regarded perspective.

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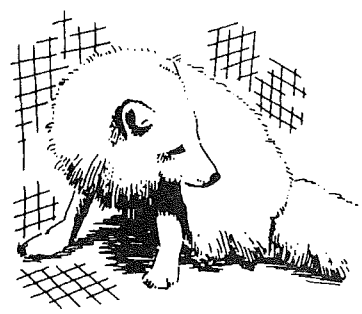

*Original Report.*

# Leukocyte ratios of mink kits from birth to 10 weeks of age. 1)

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## Introduction

Numerous accounts of normal hematologic values for mink have been reported in the literature (*Kennedy, 1925; Kubin and Mason, 1948; Jorgensen and Christensen, 1966; Skrede, 1970; Rotenberg and Jorgensen, 1971; Asher et al., 1976*). Many of these reports describe seasonal and age varation in blood parameters of juvenile (>6 wks) and adult mink but little information is available on normal values for neonatal mink. Hemoglobin concentrations have been reported for kits from birth through weaning (*Skrede, 1970; Aulerich et al., 1985*) and *Kennedy* (1935) and *Asher et al.*(1976) have published some hematologic values for kits less than two months of age and six weeks old, respectively. However, normal blood cytology values for kits at specific ages between birth and weaning are lacking. Since such information could be useful in diagnosing disease or assessing stress conditions in mink, leukocyte ratios of "normal" kits from birth to 10 weeks of age were determined.

## Methods

The adult pastel females that produced kits used in this study were bred and cared for according to standard commercial mink farm procedures. The females whelped and raised their litters until weaning (six to seven weeks of age) in suspended wire cages (76 cm L x 61 cm W x 46 cm H) with attached wooden nest boxes (38 cm L x 28 cm W x 27 cm H). From weaning through 10 weeks of age, kit littermates were housed in pairs (1 male and 1 female per cage) in suspended wire cages (60 cm L x 40 cm W x 40 cm H) with "penthouse" type nest boxes (30 cm L x 25.5 cm W x 25.5 cm H).

The mink were fed a diet consisting of commercial mink cereal, ocean fish trimmings, poultry by-products, beef trimmings, beef liver, and water. The diet "as fed" contained 13.8% protein, 8.4% fat, 10.3% carbohydrates, 3.7% ash. 1.7% crude fiber, and 62.1% moisture. Feed was placed in pans on the floor of the cages for the kits beginning at three weeks of age.

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1) *Supported in part by the Mink Farmers' Research Foundation and published with the approval of the Michigan Agricultural Experiment Station as Journal Article No. 12969.*

During the whelping and early kit growth periods, blood samples were collected from 110 pastel kits varying in age from one day to 10 weeks. One male and one female "normal" appearing kit, selected at random from each of five litters, were sampled on the day of birth and weekly through 10 weeks of age. Blood samples were collected from the newborn and one-week-old kits by tail clip, while toe clip was used to obtain samples from the older animals. A drop of free-flowing blood was collected on a pre-cleaned glass microscope slide and a blood smear made according to routine hematologic procedures. Each smear was identified according to the age and sex of the kit and stained with Camco Quick stain (American Scientific Products, McGaw Park, IL). Duplicate differential leukocyte counts (number of band and mature neutrophils, lymphocytes, monocytes, eosinophils, and basophils per 100 leukocytes) were made on each slide with a microscope at 1000X. Values for each leukocyte type were analyzed for sex differences over time using a two factorial analysis of variance. Statements of significance are based on a p value equal to or less than 0.05.

**Results and discussion**

The mean number of eosinophils, basophils, monocytes, lymphocytes, and band and mature neutrophils per 100 leukocytes for kits in each age group are shown in Figures 1-6. There were no significant differences between sexes over time in the ratios of eosinophils, basophils, monocytes, lymphocytes and mature neutrophils. Therefore, the values for the males and females for these leukocyte types were combined. However, a significant sex difference was observed in the band neutrophils. Values

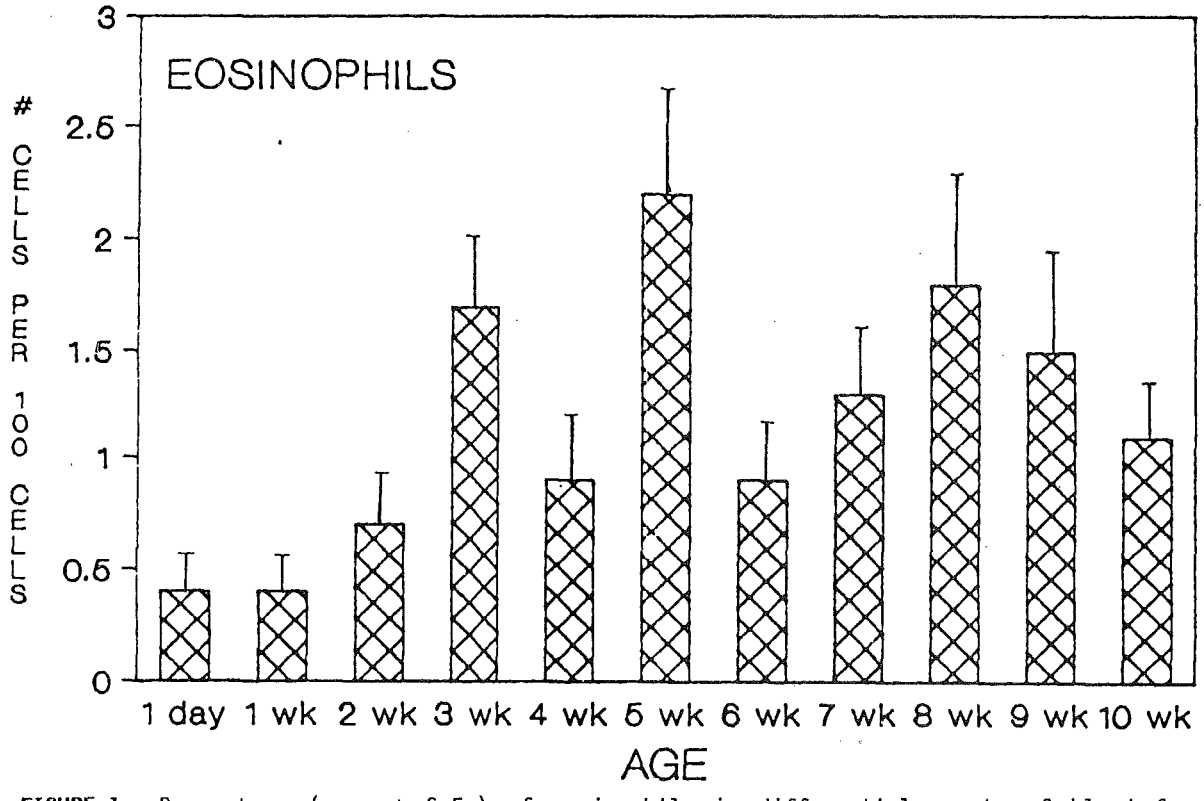


FIGURE 1. Percentage (mean + S.E.) of eosinophils in differential counts of blood from mink kits from one day to 10 weeks of age.

for the band neutrophils for both sexes are given in Figure 6.

As shown in Figures 1 and 2, the percentage of eosinophils and basophils was lowest at birth (0.5). The percentage of eosinophils fluctuated throughout the sampling period, while the percentage of

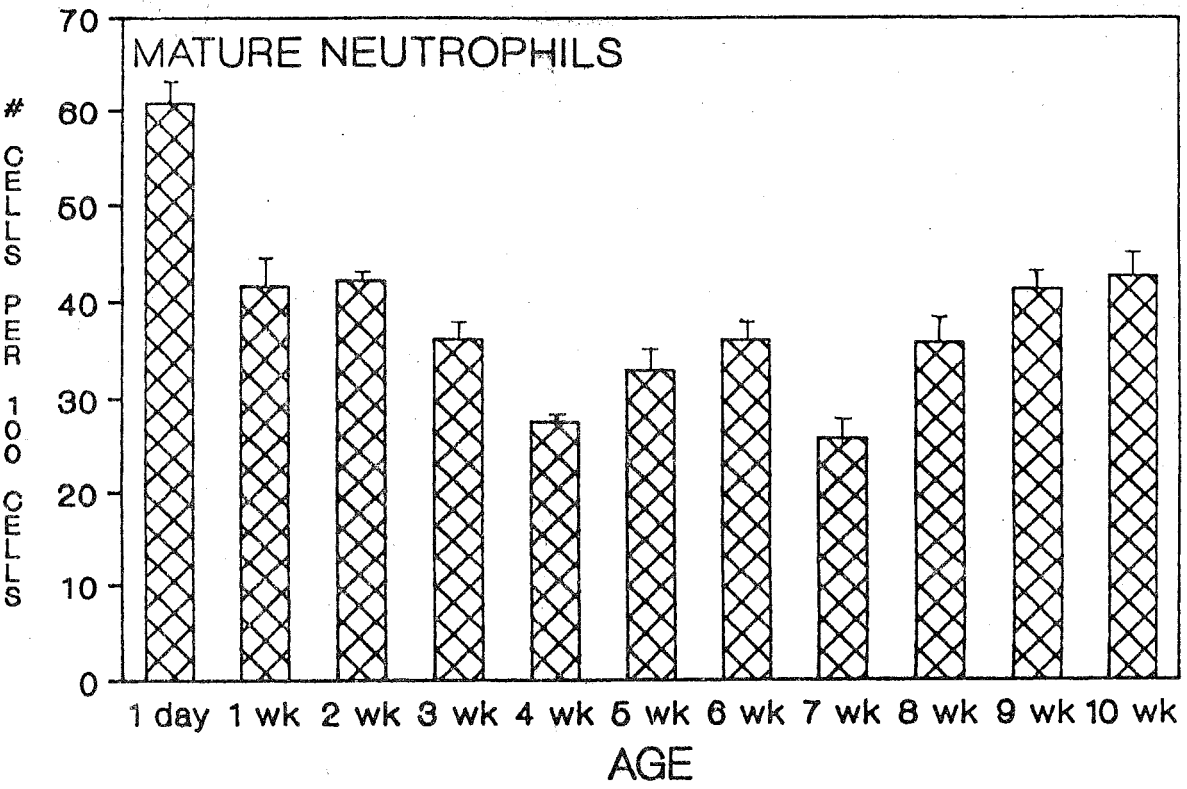


**FIGURE 5.** Percentage (mean + S.E.) of mature neutrophils in differential counts of blood from mink kits from one day to 10 weeks of age.

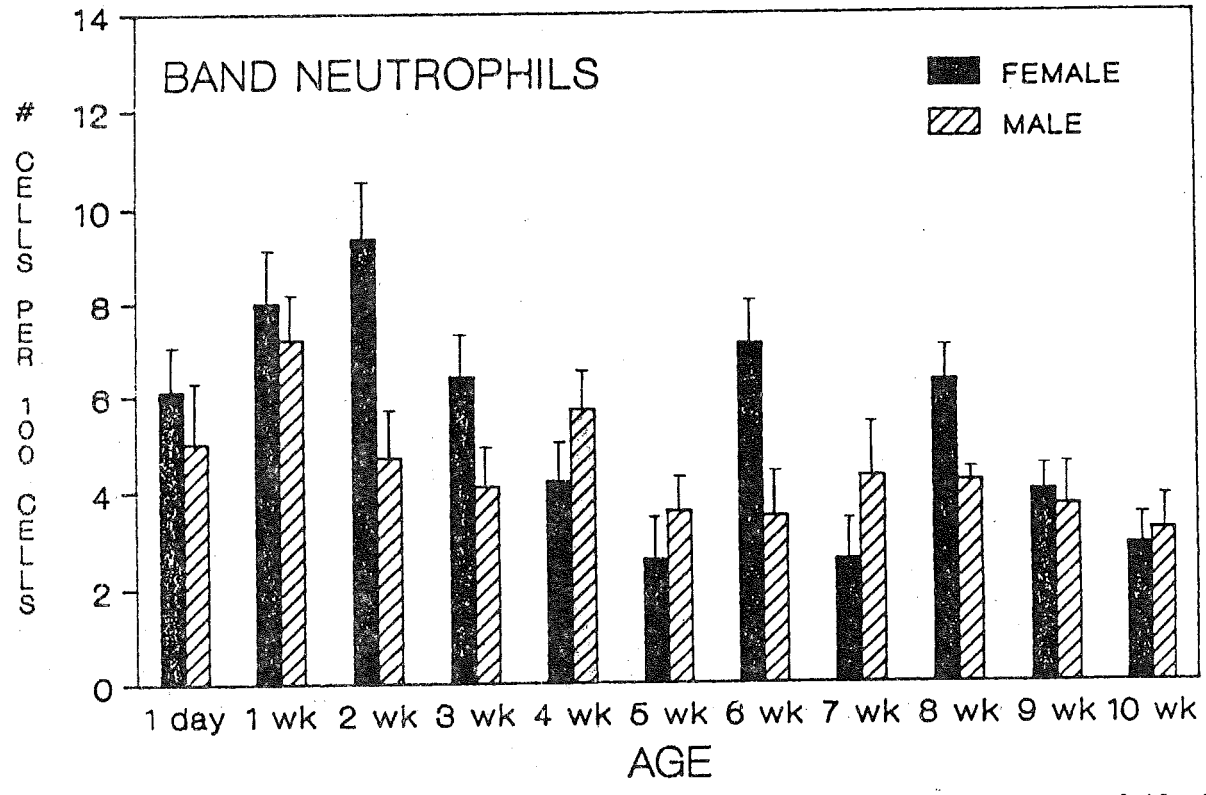


**FIGURE 6.** Percentage (mean + S.E.) of band neutrophils in differential counts of blood from mink kits from one day to 10 weeks of age.

of band neutrophils tended to increase slightly from birth to one to two weeks of age and then decreased gradually with age to below day one levels (Figure 6). The percentage of band neutrophils was significantly greater, over time, in the females kits than in the male kits.

As shown by the data presented in Table 1, leukocyte values reported by *Kennedy* (1935) for kit mink less than two months of age and *Asher et al.* (1976) for kits six weeks old are similar to the ratios determined in this study for kit mink six weeks of age.

Table 1. Leukocyte ratios of mink kits reported by Kennedy (1935) and Asher et al. (1976) and determined in this study. (a)

| Leukocyte type | Kennedy (a) (Values for kits less than 2 mo. old) | Asher et al. (Values for kits 6 weeks old) | This study (Values for kits 6 weeks old) |
|---|---|---|---|
| Eosinophils | 0.8 | 2.3 | 0.9 |
| Basophils | 0.4 | 0.3 | 0.5 |
| Lymphocytes | 66.5 | 47.5 | 49.4 |
| Monocytes | 1.1 | 7.9 | 7.5 |
| Neutrophils | 31.2 (b) | -- | -- |
| Band | -- | 3.6 | 5.3 |
| Mature | -- | 38.4 | 36.1 |

(a) Mean values for males and females combined.
(b) Values for band and mature neutrophils not differentiated.

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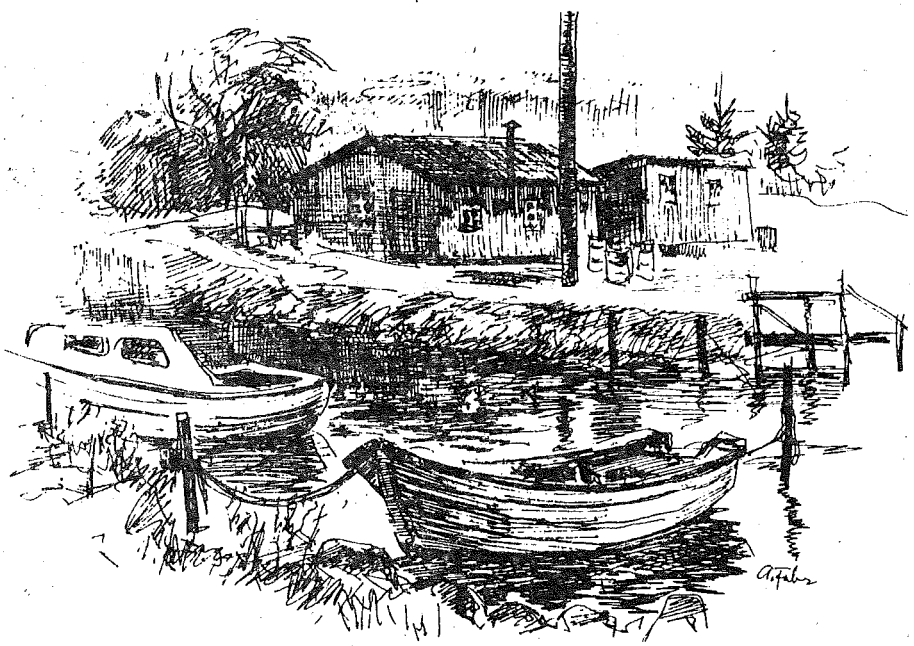

*Original Review.*

# The effect of acupuncture on the immune system of animal organism. Part I. Basic techniques used in acupuncture.

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**Introduction.**
Recently, international journals report more and more about basic clinical research concerning acupuncture in animals. The general use and mechanisms of acupuncture action have been discussed by *Hu* (1974), *Liao* (1978), *O'Connor Bensky* (1975), *Rogers, Ottaway* 1974), *Rogers et al.,* (1977), and *Wei* (1979). The best known actions of acupuncture are the effects of controlling pain, its application in the treatment of drug addiction, alcoholism and in induced narcosis in human beings and animals.

However, the effects of acupuncture on the main physiological systems are less known. Acupuncture shows a significant therapeutic action in a large spectrum of human and animal diseases. These effects have already been noted.

The present paper discusses in short the acupuncture technique. Technical methods of acupuncture application can be found in specialistic papers and text books (*Anon, 1973; 1975a; Anon ab; Klide, Kung, 1977; Westermayer 1978 ab; Kothbauer, Meng, 1983*). They present the effects of acupuncture on the immune system of animal organism. Most of the mentioned papers are not known among the western research workers because they were published in Chinese, Japanese specialistic journals. I hope, that this paper will stimulate further investigations of acupuncture and reflexotherapy.

**Acupuncture points**
In the East, they are called by their given names which describe their localization, function or action.

*Zusanli (ST-36)* - it is a point which is located at the distance of three units from the foot. It is three inches below the patella on the anterior tibial muscle.
*Lan Wei point* - the point of the cecum (Appendix point). It is used in cases of typhlitis.
*Wei Shu point* is connected with the stomach. It is used in the stomach diseases.

This system is used in Japan and Vietnam but because of different pronunciations

and independent development systems the points can be named differently depending on the region of the country from which the text originates.

Only the Anglicizing of the Chinese, Japanese and Vietnamese languages introduced some order as the names of the points were concerned. The points may be described in one country and not recognized in the other.

The Western authors accepted other system of naming the points based on the, so called, alphabetic and numeral code, a system which allows the computerization of the data and which helps in learning the points. The code LU, LI, ST, SP, VG, etc. relates to the lung meridian (LU), colon (LI), stomach (ST), spleen (SP). Point LI-4 is the fourth point of the meridian of the colon.

The points described in the present work affecting the immune system are described in the standard text books of the Chinese acupuncture. The points in animals are located in the same places as in man. They are: VG-14 (Dazhui), VG-26 (Renzhong), LI-4 (Hegu), LI-11 (Quichi), GB-39 (Xuanzhong), SP-6 (Sanyinjiao), ST-36 (Zusanli), BL-41 (Chi Shih). Baihui (GV-20), Shenshu (UB-23) are discussed as an example of traditional veterinary acupuncture in Al Ken text book (Chinese).

**Basic acupuncture techniques**
The localization and function of the acupuncture points and the technique of their activation are presented in the mentioned text books. For the clinical and research purposes these points can be found similarly as in man.

Two basic stimuli used in acupuncture are:
a) needling
b) moxibution.

Lately, some other stimuli have been applied at the acupuncture points, namely:

a) point needling
b) ultrasounds
c) cooling
d) laser stimulation.

All these methods are effective (*Rogers et al. 1977*).

**Needling**
9 types of needles were originally used in acupuncture. Now only two of them are still in use - "prismatic needles" with sharp end and triangular cross-section and the thin needles, regular needles of 18-36° of thickness, 1-15 cm long, depending on their type and use. The classic needle is made of solid stainless steel although needles which are empty inside can also be used. The basic precautionary measures should be ensured to keep the needles sterile.

The chosen points are clean shaven and disinfected with alcohol or other antiseptic.

The needles are inserted up to the proper depth described in books and after their insertion they should be turned round a few times or the point should be stimulated by connecting the needles to the electric stimulators.

Local infections, perforations of the body cavities or large vessels should not happen. Sometimes, in clinical use the needle can perforate a blood vessel. It causes the complication in the form of a hematome. Some points should not be needled during pregnancy. There are some contraindications for acupuncture used but an experienced acupuncture practitioner is well aware of them.

Many main points happen to be located over the peripheral nerves and those nerves are purposefully needled. There are no data proving that a nerve can be damaged by acupuncture if the person performing it is well trained. In the proper hands acupuncture is totally safe and if it does not help, it certainly will not do any harm.

*Moxibution.*
Moxibutrion is a form of a point cautarization. A plant, Artemisia vulgaris, is collected in wild plantations. It is dried and cut, the final product looking like tobacco - it is the moxa punk. Moxa punk is lit and it burns slowly on the point or close to the point. The methods of using the moxa punk are described in the book (*Anon 1975a; Anon 1977 ab; Klide and Kung 1977*). In the states of acute infection or high fever the moxi-

bution is not often used. Instead needles are used as the immunostimulators. The moxibution is often used in causes of chronic diseases, "cold" diseases and also when the patient is weak, etc.

In the standard books of veterinary acupuncture there are different names used to describe the same point in animals. Up till now, there are no unified standardization of the acupuncture points used in veterinary medicine. There are proofs that acupuncture causes immunostimulation in animals. It is used with success in the treatment of some infections, inflammations and allergies in animals (*Klide and Kung, 1977; Rogers et al. 1977; Westermayer 1978 ab*).

Among the diseases which are treated with success are metritis and pyometria (*Brunner 1976; Klide and Kung 1977; Milin 1973; Westermayer 1978 ab*), mastitis in cattle (*Shinohara 1976,; Westermayer 1978 ab*), gingivitis and stomatitis (*Klide and Kung 1973; Anon 1973; Breamer 1968; Brunner 1976*), gastritis and enteritis (*Demontay and Demontay-Bomsel 1978*), clinical fevers (*Anon 1975a); O'Connor and Bensky 1975; Westermayer 1978 ab*), lick (crawling), granuloma in dogs (*Stevens 1978*), laminitis in horses (*Klide and Kung 1977; Brunner 1976, 1980; Anon 1973*) and many other pathological states.

Good results of the using of acupuncture in the treatment of some animal diseases have already been proved (*Rogers et al. 1977*). The paper discusses the mechanisms of activation of the immune system with the help of acupuncture. The effect of acupuncture on the reaction of the immune system in animals was investigated in a number of problems:

a) the difference in the production of antibodies and immunoglobulins,
b) the reactions in the form of leucocytosis and phagocytosis,
c) the reactions to the experimentally induced fever,
d) the reactions in animals exposed to irradiation,
e) the antimicrobiological reaction,
f) the reactions in the lymphatic nodes (the effect on the lymphatic nodes).
g) the anti-inflammatory reactions.

**ad a) Antibodies and immunoglobulins.** Acupuncture increases the production of antibodies when administered with a special antigen (*Anon 1977 a, O'Connor and Bensky 1975; Wei 1979*).

In the experiments in which different antigens were administered to rats and guinea pigs, the immunological response was investigated *Chan et al. 1977; Chen et al. 1977; Hau et al. 1975; Lin et al. 1976*). The animals were subjected to acupuncture in the points LI-4, GB-39 and SP-6 shortly after the administration of antigen. The animals which were subjected to the acupuncture treatment produced the antibodies more quickly and of higher titre than the control animals. *Chu and Affronti* (1975) obtained similar results in rabbits subjected to acupuncture in the point Zusanli (ST-36). *Wu and Han* (1975) used acupuncture in rabbits while investigating the immunological response to the administered typhoid vaccine. In the experimental group which was subjected also to acupuncture the titre of antibodies was higher than in the control group which was subjected only to vaccination.

Other Japanese authors administered cattle plasma albumins to rats and rabbits. In the experimental group acupuncture caused greater response in the form of antibody production than in the control animals which received only plasma albumins (*Hatai et al. 1977*).

In the further research carried out on Taiwan, *Chan et al.* (1977) showed that the antibody production in rats was intensified after the administration of adrenaline and atropin and was significantly decreased after the administration of reserpine and neostigmine. It points to the fact that stimulation of the sympathetic centres or inhibition of the parasympathetic centres increases normal production of antibodies while the inhibition of the sympathetic system or the stimulation of the parasympathetic system decreases the normal response in the form of antibody production.

Electroacupuncture in Hegu (LI-4) and Xuanzhong (GB-39) and Janyinjiao (SP-6) highly increases the production of antibodies in rats even after the administration

of reserpine and neostigmine. It points to the fact that one of the mechanisms of the acupuncture effects on the immunological response can be the stimulation of the symphatetic centres and the inhibition on the parasymphatetic ones.

*Chen et al.* (1984) investigated the level of leucocytes and immunoglobulin IgG in rats. After the stimulation of the points GV-20 and UB-23, there was observed an increase in the leucocyte level and IgG and the highest increase was observed on the 7th day. In one of the series of experiments carried out on rats, a local anesthesia was applied in the acupuncture points (prior to the needling) LI-4, GB-39 and SP-6, and action which inhibited the increase of the antibody production. The stimulation of these points without the anesthesia causes an increase in the production of antibodies (*Lin et al. 1976 b*). This author also showed that the general anesthesia causes a decrease of the immunological response in rats after the injection of an antigen independently from the fact whether they were subjected to acupuncture. It suggests that the control centre is located on a higher level of the brain than the hypothalamus and that the pituitary gland takes part in the activation and immunological response or that the anesthesia has a toxic effect on the place producing antibodies.

The present data can suggest that the mechanisms must exist that cause the appearance of the immunological reaction in the form of an increased production of antibodies after the administration of acupuncture treatment:

1. Centres of immunostimulation and immunoinhibition exist in the brain mainly in the hypothalamus. Higher, specific centers can be stimulated from the particular points on the periphery, these impulses are passed to the higher centres through the peripheral sensory nerves and through the fibres of the spinal cord which are connected with the specific acupuncture points in the hypothalamus. The centres controlling the immune system are stimulated by the peripheral and central stimuli reaching these centers.

2. Sympathetic activation - parasymphatetic inhibition (blockade) can increase the production of antibodies. Similar effects are observed after the inhibition of the CR-H secretion and the inhibition of adrenal glycocorticoid. The decrease of the antibody production can be caused by the reverse effects. In allergic or autoimmunological disease when there are large amounts of antigen, its diagnosis or the effects of the reaction antibody-antigen on the cells can be modified by the peripheral stimulation (acupuncture).

The mechanism through which the acupuncture causes the antiallergic effect is not known but it may include the secretion of the endogenic ACTH, corticosteroids, antihistamines, antiprostaglandins. At present such suggestions are mainly based on the mental speculations but not only because in 1984 *Quiwen et al.* observed an antihistamine effect of acupuncture in the points Zusanli (ST-36) and Zhangmen (LIV-13). The part of neurotransmitter which takes part in the activation of the centers of immunostimulation and immunoinhibition and the transmitters or neurohormonal agents which are secreted by these centers call for further detailed studies.

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*Original Review.*

# The effect of acupuncture on the immune system of animal organism. Part II. The reaction of the immune system.

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**Leucocytosis and phagocytosis.**
Other fields in which the response of the immune system after the application of acupuncture was examined was *(ad b*)* the increase of phagocytosis and leucocytosis *(Anon et al. 1975; Klide and Kung 1977; O'Connor and Bensky 1975; Wei 1979).* If 10 ml of rabbit serum is injected intravenously to other rabbits, it causes a quick leucopenia which lasts 2-4 h and then the signs of a secondary leucopenia are observed up to 20 h and then the number of leucocytes comes back to normal (*Wu et al. 1978*). The serum of rabbits subjected to 20 min acupuncture in the LI-11 (Quchi) point reacts differently. After introducing 10 ml of serum from the acupunctured animals the recipients did not develop normal leucopenia, instead the leucocytosis could be observed up to 48 h. Similar results were obtained after injecting 0.75 ml of the serum of acupunctured rabbits as comparing to the control rabbits which had also been needled but not in the acupuncture points. The control rabbits were needled on their buttocks in the places which are not connected with immunological response. The result confirmed that the point LI-11 is responsible for immunostimulation. The existence of leucocytic factors has been suggested by other scientists since 1960. *Wu et al.* (1978) concluded that acupuncture in the LI-11 (Quchi) point caused the secretion of the leucocytic factors to the serum. This leucocyte effect of acupuncture has been confirmed in man and animals by other scientific workers. *Craciun and Toms* (1973) and *Craciun et al.* (1973) reported in their papers that also the needling of the Dazhui (VG-14) point caused the increase of the leucocyte number in man by 44-59%. *Hwang and Edwards* (1977) confirmed that the "real" acupuncture performed in the specific points increased the number of neutrophils and lymphocytes in dogs while "siple" needling did not produce any effect. *Wu et al.* (1977) needled the point LI-11 in rabbits and man and the needles were also inserted and stimulated in the placebo points in both species. The third group received local anesthesia of the points prior to acupuncture. The results showed that acupuncture caused significant leucocytosis both in rabbits and man. Acupuncture performed in the placebo point

* This letters refer to the list present in Part I of this paper.

did not produce any effect and the local anesthesia cancel the leucocyte effect. The obtained results allow the conclusion that the leucocyte effect of acupuncture requires undamaged peripheral nervous system and also some points show specific leucocyte effects. The results are similar to those obtained by *Lin et al.* (1976) in relation to the effects after local anesthesia on the antibody response after acupuncture.

*Omura* (1974) investigated the response of leucocytes after the acupuncture in man. In 24 h, neutrophilia (the increase up to 60%) and lymphocytopenia (the decrease to 50%) were observed. The papers by *O'Connor and Bensky* (1975) and *Wei* (1979) bring further data concering the leucocyte effect of acupuncture in animals. They base their opinion on earlier Chinese papers originating from the period 1955-1978. Those papers also show the stimulation of phagocytosis after the acupuncture (through the reticulo-endothelial system and white blood cells) in cases of natural infections and the investigations "in vitro". *Sciesinski et al.* (1987) observed leucocytosis in rabbits after inserting the needles in the points LI-4 (Hegu) and LI-11 (Quchi). Already in 3 h after the electrostimulation of the points there was observed an increase of the leucocyte level up to 35%, in 6 h the increase amounted to 72% and in 42 days is still continued at 35%.
*Sciesinski* (1988) observed a significant leucocytosis in young and adult polar foxes after the electrostimulation of the points LI-4 (Hegu) and LI-11 (Quchi). There was observed an increase of the level of neutrophils and then their slow decrease and the increase of lymphocytes. *Sciesinski et al.*(1988) noted a significant leucocytosis in the cubs of polar foxes after the electropuncture performed on the skin in the point Quchi (LI-11) and changes in the per cent composition of leucocytes. These changes lasted up to 42 days after the treatment.

The proofs presented in this part of the paper suggest that acupuncture in the specific places causes leucocytosis and phagocytosis. It is not a placebo effect and is caused only in some points namely LI-4 (Hegu), LI-11 (Quchi), ST-36 (Zusanli), VG-14 (Dazhui), GV-20 (Baihui), UB-20 (Renzhong), VG-26 and SP-6 (Sanyinjiao). In order to produce the effect, the peripheral sensory nervous system must be undamaged and probably a humoral leucocyte factor is a mediator in the process.

So far, there are no irrefutable proofs that acupuncture releases the humoral factor increasing phagocytosis although the presence of such a factor is highly probable.

**Reactions to experimentally induced fever. (ad c*).**
The influcence of acupuncture on the antipyretic effect. *Anon* 1975a, 1977 ab). *Klide and Kung* (1977), *Wu and Houng* (1977), *Westermayer* (1978 ab), *O'Connor and Bensky* (1975) quote early Chinese works concering the fever either natural or experimentally induced.

Acupuncture in the points VG-14 and ST-36 causes a drop in temperature in animals. Moxabution causes similar effect although the reaction is not so strong. *Wu and Houng* (1977) injected intravenously the typhoid vaccine to rabbits. Such an experimentally induced fever was treated by the stimulation of the point VG-14 for 20 min. The temperature dropped 0.5 °C immediately after the treatment and increased after 40 min. Some of the animals were subjected to acupuncture for the second time and a secondary temperature drop was observed. The treated animals showed less severe course of the fever than the control ones. The authors suggests that the antipyretic stimulus is transmitted to the centre of thermoregulation which is located in the hypothalamus.

**Reactions in animals exposed to irradiation. (ad d*)**
Acupuncture helps the recovery after the X-radiation. Anemia and leucopenia are observed in rats exposed to X-radiation. *Hau* (1978) showed that rats acupunctured in the points LI-4, GB-39, SP-6 recovered more quickly and the number of their erythrocytes (RBC), hemoglobin (HB) and leucocytes (WBC) returned to normal more quickly than in the control animals. It is known, that acupuncture was administered clinically as an adjunct procedure in the treatment of man after nuclear exposure (*Shey 1957, Chung and Wei 1977*). Apart from hematologic effects, X-radiation

inhibits immunological response in man and animals. The immunostimulating effects of acupuncture allow the possibility of effective therapy of patients who were exposed to nuclear radiation and in those who underwent an anticarcinogenic treatment.

**Antimicrobiological reaction. (ad e*)**
Acupuncture possesses antibacterial and anti-inflammatory properties (*Anon 1975a, 1977ab; Klide and Kung 1977*). Mice were experimentally infected with Trypanosons evansi *(Lin et al. 1976a)* or neoplastic cells of the Ehrlich ascites (*Leo and Lin 1975).* Some of the infected mice underwent acupuncture in the points VG-14, ST-36, and Ai Ken (a point behind the second joint of the second finger on the inside surface of the finger pulp). Other mice were infected and not treated comprising the control group. Acupuncture significantly prolonged the survival rate of the infected mice. In the neoplastic experiment all the animals died. In the T. evansi experiment all the acupunctured animals survived while the control animals died. The trials of applying acupuncture in cases of the infection with E. coli causing colibacillosis in weaners were carried out on Taiwan *(Chan et al. 1977a)*. Acupuncture was used in cases of clinical treatment of colibacillosis (E. coli enteritis) in 120 weaners in total. Some of the piglets were treated with spiramycin, other animals made up the control group. Acupuncture applied once a day caused a highly effective clinical (immunological) response on 2-5 day of the treatment. The response was the same or better than in the case of the spiramycin treatment. In the control group the diarrhoea was still observed in 10-40% of animals on the 4th day of the experiment while in the treated group only in 0-10% of the animals.

*O'Connor and Bensky* (1975) quote other Chinese experiments of antibacterial effects of acupuncture in animals. These effects were maximal already in 3-6 h after the electroacupuncture and they lasted up to 48 h. The antibacterial mechanisms of acupuncture are not fully understood or known but it seems that an important part in them is played by leucocytosis and reticulo-endothelial phagocytosis.

**Effect on the lymphatic nodes. (ad f*)**
Acupuncture causes immunological response in the lymphatic nodes. Japanese administered cattle plasma albumin to rats and rabbits. Acupuncture was applied in the point Zusanli ST-36. Some of the animals comprised the control group. Histological changes took place in the lymphatic nodes of the limb subjected to acupuncture (increase of sinuses, lymphatic nodes, bleeding, the growth of the mast cells and degranulation). A quick growth of plasma cells was observed in 48 h. One can say that the changes were of inflammatory and not immunological character. However, the obtained results showed that there was also an unmistakable stimulation of the immune system, the increase of antibodies and lymphocytopenia (*Hatai et al., 1977).*

**Anti inflammatory reactions. (ad g*).**
Acupuncture possesses anti-inflammatory properties. Acupuncture is widely used in the clinical practice in the treatment of inflammatory wounds (*Anon 1975a, 1977 ab; Klide and Kung, 1977; Westermayer 1978 ab*).

When the acupuncture anesthesia is used in surgical procedures in man and animals, the frequency of postoperative complications is lower than in the cases with general anesthesia. The postoperative bleeding and pain are smaller, the danger of infection is also smaller and the healing of wounds is quicker than after the general anesthesia (*Patterson, 1975; Niboyet et al. 1973*).

*O'Connor and Bensky* (1975) quote Chinese experiments carried out on rats with inflammatory granuloma on their backs. After 8 days of acupuncture treatment and moxibution in the point ST-36, the treated rats produced 3.5 ml of transudate from the wounds as compared to 7 ml in the control animals. The inhibitory effect of acupuncture on the inflammatory filtrate was also demonstrated by the chinese scientists with the help of the experimentally induced bacterial peritonitis in rabbits. The treated rabbits showed less peritoneal exudate and the cultures of the transudate were aseptic quicker than in the control rabbits. Similar anti-inflammatory effects were observed in other experiments (*Anon.* 1975b).

**Probable mechanisms of acupuncture in the defensive system.**
The mentioned investigations have shown that acupuncture possesses certain influence on the defensive system of the organism. The stimulation of the points LI-4 (Hegu), LI-11 (Quchi), ST-36 (Zusanli), VG-14 (Dazhui), GB-39 (Xuanzhong), SP-6 (Sanyinjiao) significantly increases the immunological response in the form of leucocytosis and phagocytosis, the production of antibodies and immunoglobulins. Most of other acupuncture points show neutral effect on the general defensive system. Some of the points such as VG-14 (Dazhui) and ST-36 (Zusanli) show antipyretic action as well as they can prevent or limit the response of the tissues to the inflammatory changes after the radiation. In the literature one can also find some papers on the effect of acupuncture against the experimental infestation with Protozoa. The activation of the defensive forces can explain the therapeutic effect of acupuncture in case of inflammations, infections and allergies in man and animals.

*Hopkin and Laplane* (1978) revised the works by James Reilly which show his great contribution to understanding the role of the autonomic nervous system in the disease processes. Reilly has showed that the autonomic nervous system plays the basic part in the response to many stimulating factors such as bacterial endotoxines and general septicemias. Most of the symptoms and changes caused by a number of inflammatory, toxic, infectious and allergic factors need the mediation of the vegetative system and the inhibition of the transmission in the autonomic system can prevent the development of the changes.

He has showed in his investigations that the phagocytosis of the reticulo-endothelial system depends on the activity induced in the autonomic nervous system starting as a reflex effect of the damaged tissues.

One could conclude that the techniques which activate the function of the autonomic nervous system could play an important role in infectious, inflammatory and allergic conditions. The mechanisms with which the acupuncture activates the defensive system of the organism are not known yet, but it seems that the peripheral and central nervous systems together with the autonomic and endocrine systems participate in the process.

**Acupuncture activates the following mechanisms which affect the immune system:**

1) *Signals from particular acupuncture points are transmitted through the specific peripheral sensory nerves and ascending pathways of the vertebral nerves to the specific integrative centres in the brain and mainly in the hypothalamus. This region contains control centres for thermoregulation and autonomic functions. It can also contain centres controlling the immunological response. Also the neuroendocrine control centres are located there. Among them there are the centres regulating the neurosecretion of endorphins and ACTH.*

2) *The activation of specific regions of the hypothalamus can release neurotransmitters and neurohormonal factors which in turn would activate the local endings of the controlling descending nerves.*

   *These neurohormonal factors are not known at present, but it seems that some of them can pass into the blood circulation and stimulate antibodies and tissue immunological response (as factors increasing immunity).*

   *Other factors stimulate leucocytosis as leucocyte factors and phagocytosis as phagocyte factors.*

   *Immunosuppression (immuno-inhibition) can be caused by the activation of the CRH-ACTH centers and glucocorticoids. It is possible that these mechanisms which helps acupuncture to block or inhibit the tissue reaction in the form of antigen-antibody reaction include in this activation the CRH-ACTH centres and glucocorticoids.*

3) *Sympathetic activation-parasympathetic inhibition of the central level and locally reflexive in the form of angiectasia in the places of needle insertion and in the region reflex connected can explain many therapeutic effects of acupuncture.*

**Acknowledgements**
The author wants to express his gratitude to Dr. Philips A.M. Rogers from Ireland whose help and encouragement gave assumpt to undertake the investigations.

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*Original Report*

# Influence of the age of weaning upon growth of raccoon dogs (Nyctereutes procyonoides).

*Andrzej Zon, Pawel Bielanski, Stanislaw Niedzwiadek.*
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**Summary**
This experiment included 128 litters - altogether 850 young raccoon dogs divided into 4 groups, which were weaned at 5,6,7 and 8 weeks after birth. The results show that the optimum age for weaning the young pups from their mothers should be considered as lying between 6 and 7 weeks. At this time, stress resulting from weaning is not great, and their growth rate is not inhibited.

**Introduction**
The first attempts at caged breeding were carried out already before the 2nd World War (*Niedzwiadek, 1981*). Towards the end of the 1950's the breeding of *N. Procyonoides* was resumed in Poland. However, because of a lack of interest in their fur, breeding was discontinued. Then in 1979 *N. Procyonoides* was introduced in Poland as a new type of fur-bearing animal for caged breeding.

One of the most important considerations in raising these raccoon dogs is determining the optimum time for weaning the young from the mother. It must be considered that the optimum date of weaning has important influence not only on the growth and health of the young, but also on the condition of the mother. In practice, the time of weaning the pups is between 35 and 63 days after birth (*Herman, 1985; Akkuratov et al., 1980; Ilina, 1978; Lorek, 1980*). The young animals are independent at the age of 35 days (*Herman, 1974*); however, the ability of the mother to produce milk extends to 49 days or even longer (*Ilina, 1978*). Thus if the pups are weaned too early the female can experience inflammation of the mammary glands, and when weaned too late, it can lead to excessive exploitation of the mother.

The purpose of the research carried out at the Institute of Zoology was to establish the influence of weaning dates upon *N. procyonoides* in respect to further growth and quality of fur.

**Materials and methods**
Research was carried out at the farm for carnivorous furbearing animals in ZZD Chorzelow, Poland. The research material included 128 litters, numbering 850 young raccoon dogs. The total number of animals was divided into four groups, each consisting of 32 liters:
Group I - weaned 5 weeks after birth
Group II - weaned 6 weeks after birth
Group III- weaned 7 weeks after birth
Group IV- weaned 8 weeks after birth.

All the young animals, both those with their mothers and those which had been weaned, were fed exactly alike, and in

accordance with the given norms for this type of animal (according to *Akkuratov, 1978*).

The young animals were weighed individually at 35, 42, 49, and 56 days after birth, and after that monthly, until slaughtering at the end of October. Complete records were kept on deaths, both for nursing and weaned pups. The young animals' eating habits were observed immediately after weaning. In order to verify the condition of the mothers, they were weighed at the time of weaning and also at 56 days after littering. The data were subjected to statistical analysis and the essential differences between groups were described by an analysis of variance (*Ruszczyc, 1970*).

**Results**

Beginning at 5 weeks of age the pups were weighed each week to the age of 8 weeks (see Table 1). At 35 days the average body weight of the pups was compared. It varied between 921 g in Group II and 936 g in group IV. Within one week the weights of the young began to show differentiation. The pups in Group I had the lowest weight - 1192 g, and the remaining groups weighed more (from 1225 to 1276 g). The differences appearing between Group I and Groups III and IV were statistically evaluated. The pups in Groups I and II had a similar body weight (1475-1484 g) at 7 weeks of age. The relationship between the weights of Group I compared to Groups III and IV, and

Table 1. Body weight of raccoon dogs (g).

| Age weeks | 5 | | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|
| Group | X | v | X | v | X | v | X | v |
| I | 926 | 14.6 | 1193AB | 11.4 | 1484CD | 10.8 | 1881 | 12.1 |
| II | 931 | 12.1 | 1225 | 12.3 | 1475EF | 11.2 | 1847 | 13.4 |
| III | 921 | 13.7 | 1257B | 10.8 | 1648CE | 12.4 | 1878 | 11.8 |
| IV | 936 | 13.6 | 1276A | 12.6 | 1628DF | 11.3 | 1907 | 12.8 |

Group I - weaning in 5 weeks
Group II - weaning in 6 weeks
Group III - weaning in 7 weeks
Group IV - weaning in 8 weeks

Means denoted with the same letters A ....F are significantly different at P<0.01.

also between Groups II, III and IV were statistically highly significant. At 8 weeks there were no large differences in body weights, and all of the groups were approximately the same (1847-1907 g). The small differences between groups were not statistically significant. The changes recorded for the weight of the pups at the age of 5, 6, 7, and 8 weeks was at a similar level (v = 10.8-14.6%).

The body weight of the mothers at the time of weaning and 56 days after giving birth was differentiated as seen in Table 2. In Groups I and II the weights of the mothers at the time of weaning were similar, about 820 to 1040 g less than the weights of the females in Groups III and IV. The observed differences between these groups were statistically highly significant. 56 days after littering, the females of Groups III and IV weighed about 340-430 g more than the ones in Groups I and II. This difference was also highly significant. The weight changes of the females were similar, both within their

Table 2. Body weight of mothers at weaning and at 56 days after littering (g).

| Groups* | at weaning | | at 56 days after littering | |
|---|---|---|---|---|
| | X | v | X | v |
| I | 6862AB | 12.1 | 7464EF | 14.3 |
| II | 6965CD | 13.8 | 7480GH | 13.7 |
| III | 7740BD | 14.2 | 7918FG | 12.8 |
| IV | 7825AC | 13.7 | 7825EH | 13.6 |

* - groups designation - see table 1.
Means denoted with the same letters A.....H are significantly different at P<0.01.

groups as well as in the time intervals between weighings (v=12.1-14.3%). The weight of the pups in August varied between 5472 g in Group IV and 5585 g in Group III. Thus the differences between groups were not great and were not statistically confirmed.

During the following months the weight differences between groups were small and not statistically significant. In October the average weight of the young varied between 8887 g in Group III and 8930 g in Group II. Weight changes in August and September were at a similar level (v=12.3-15.1%). In October on the other hand, the similarity between groups was even greater (v=10.2-12.3%).

Table 3. Body weight of young raccoon dogs in months (g).

| Groups* | Month | | | | | |
|---|---|---|---|---|---|---|
| | August | | September | | October | |
| | X | v | X | v | X | v |
| I | 5527 | 14.8 | 7285 | 13.9 | 8920 | 10.2 |
| II | 5543 | 12.3 | 7232 | 12.5 | 8930 | 11.3 |
| III | 5485 | 15.1 | 7198 | 14.3 | 8887 | 12.3 |
| IV | 5472 | 14.7 | 7180 | 13.5 | 8910 | 11.8 |

* - groups designation - see table 1.

Analyzing the losses among the young in the 5-8 week period during which the experimental factor was in effect, a differentiation was observed between the groups, as follows: Group I - 0%, Group II - 0.8%, Group III - 1.8%, and Group IV - 4.2%.

**Discussion**

Young raccoon dogs weaned at an age of 5 weeks showed a significantly lesser body weight in comparison to animals remaining with their mothers for 7 weeks. An effect of earlier weaning was considerably lower weight gains. The pups

weaned at this age were extremely stressed. Sometimes for a whole week they were lethargic and lay in the corner of the cage, eating practically nothing.

During the 8th week, the young pups weaned in the 5th, 6th and 7th weeks had very similar body weights. Thus there was a period of compensating growth, which resulted in a weight equal to that of the pups remaing with their mothers up to 8 weeks of age. *Akkuratov et al. (1980)* obtained similar results, and *Jarosz (1967)* writes also of compensatory growth. It can be said that weaning the pups at an age of 5 weeks has a negative influence on the growth of the animal, which is a result of undue stress and insufficient ability to feed themselves.

The body weight of the females at the time of weaning varied. In spite of longer nursing time before weaning during the 7th and 8th weeks, the females of those groups attained a distinctly higher body weight. Females from which the young were taken in the 5th weeks showed a definite nervousness and restlessness. They were sometimes seen pacing the cage and emitting sounds, which may be described as whining. The mammary glands became inflamed in about one-third of the females from Group I. In spite of earlier weaning, the females of Group I at 56 days after giving birth weighed 400-500 g less than those who nursed their young for 7 and 8 weeks. These results suggest that weaning the pups at 5 weeks of age is too soon, and has a negative effect on the mothers. This statement is determined by the weights of the mothers and also by their behaviour. *Akkuratov et al., (1980)* claim that the body weight of females which weaned their young after 56 days is about 7200 g.

According to our results, the females of all the groups weighed more than that. This could be explained by the possibly different conditions of rearing the animals. and also by some difference in the strains of animals being raised.

Analyses of weight increases for the young animals up to the time of slaughter show that the time of weaning did not have any effect upon their final weight. The raccoon dogs reached an average weight of a little less than 9 kg by October. *Ilina (1978) and Akkuratov (1978)* describe young animals at that age as weighing about 550 g less. *Lorek (1980)* writes that in Finland young *N. procyonoides* weigh about 9 kg in October.

The main reason for losses among the pups in the period between 5 and 8 weeks was being smothered or bitten by their mothers. This period of time was particularly observed, because it was the time when the experimental variant was the most significant. From an analysis of the losses being broken down into respective groups we see that the young weaned at 7 weeks, and especially at 8 weeks, suffered the greatest losses. This suggests that weaning at 8 weeks is too late. The grown pups with their mother would bite her, and at the same time she did not have much milk for them. The mother would drive her young off and sometimes in the process would bite them. This, accompanied by the accidental losses of smothering the young, had a definite influence on the number of young lost.

Based on these observations, no other grounds were seen for losses among nursing pups during the time of analysis. This testifies of resistance and health in this type of animal, which has also been asserted by others, such as *Barabasz and Szeleszczuk, 1982; Lykkeberg, 1978.*

Summarizing the findings of this research, it may be concluded that weaning raccoon dog pups at 5 weeks of age is too early. Stress and related symptoms are too severe, which is evidenced by slower weight gain. Furthermore, the mothers show a great desire to nurse their young during this period, which can be related to the tendency of inflammation of the mammary glands. Weaning at 8 weeks is too late. Long confinement with the mother results in unnecessary losses of pups.

The optimum time for weaning the young pups from their mothers was proven to be between the 6th and 7th weeks. During this period the stress resulting from weaning is not great, and the growth rate is not hindered in the least. The females

whose pups were weaned at this age showed no signs of mammary gland inflammation and the losses among the young were minimal.

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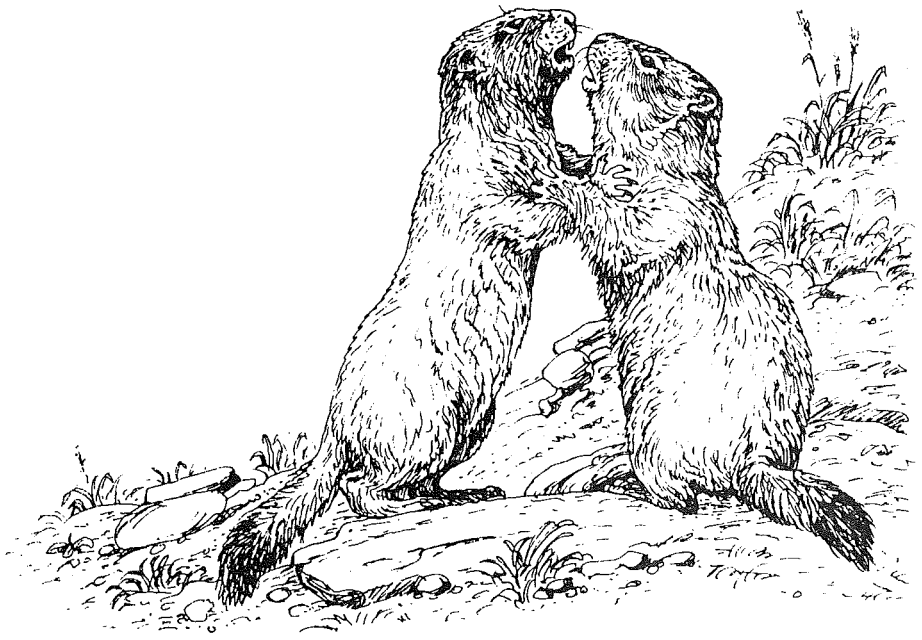


**Social influences on productive performance in farmed raccoon dogs.**

*Hannu Korhonen, Mikko Harri.*

At weaning raccoon dogs were divided into two experimental groups: (1) Group 2, animals kept in pairs in standard cages, and (2) Group 4, four animals kept in each cage measuring four times larger than standard cages. At the same time the animals in each cage were ranked into different social classes according to their weaning body weight (social status 1 = heaviest, 2 = lightest). The parameters measured during the experiments were body weight, feed intake, character (tameness score), organ scaling and fur quality characteristics. The aim of the regime was to elucidate to which extent the productive performance of the animals could be predicted from the factors such as group size, litter, sex, social status and tameness score. The results showed that both experimental groups gained weight at the same mean rate, and no statistical differences existed between the mean weights of social groups either. Within each cage group, however, significant weight differences were found from mid-August onwards. Feed consumption, fur quality and tameness score were of the same order of magnitude in both groups. The differences in organ sizes were minimal and mainly non-significant. Tameness was weakly associated with the social status (body weight) of the animals with the most dominant animals having the least tameness score. Social status, tameness score, litter, sex and group together accounted for 53% of the total variation in final body weight. Social status was the only single factor having significant importance to the variation in body weight whereas the group size and cage condition emerged to be the least important factors.

Acta Agric. Scand., 38, 433-439, 1988.
4 tables, 15 references. Authors summary.

**Selection for behaviour and genetic variability in adrenal cortex function in silver foxes.**

*I.N. Os'kina.*

Corticoids in the peripheral blood were determined in foxes selected for tameness, and in unselected foxes, under conditions of stress and no stress. Selection for tameness increased additive genetic varation in stress-free corticoid concentrations as a proportion of the total variation. Tame foxes had high genetic variation in corticoid concentrations under stress.

*Referativnyi Zhurnal, 3, 58, 778, 1988.*
*In RUSS. CAB abstract.*

**Relationship between behaviour and reproductive performance in foxes.**

*Bjarne O. Braastad.*

An account is given of some recent research in Norway on the behaviour of silver fox females at the time of whelping, the effect of housing on reproductive performance and the effects of taming females on mothering characters. In a trial attempting to identify potential cub killers, 562 young silver fox females were tested for their reaction to exposure to a pencil for 10 s in the autumn, which was scored on a 6-point scale (1-3 being aggressive and 4-6 defensive). For 138 females mated in the spring, the number of cubs weaned per mated female averaged 2.90. Of females showing flattened ears when exposed to the pencil test (aggressive females), 95% produced liveborn litters vs. 77% of females with upright ears (defensive females).

*Våra Pälsdjur, 59, 5, 180-184, 1988.*
*1 table, 1 fig. In SWED. CAB-abstract.*

**Effect of social status on mothering characters in silver foxes.**

*Morten Bakken.*

22 silver fox females with a good reproductive record were housed with 22 females with a poor record (failing to exhibit oestrus or to conceive or killing their young). 17 of the 22 females with a good reproductive record were dominant vs. 5 of those with a poor record. The behaviour of 115 females of which 102 had produced a litter, was tested after an attempt to

frighten them, when their reactions were scored on a 6-point scale. Females with a score of 1-3 were deemed defensive and those with a score of 4-6 aggressive. It was found that aggressive females had shown a better reproductive performance than defensive females. The percentage of defensive females decreased with increasing age from 48 for young females to 28 for adults, and 60% of young defensive females killed their young vs. 9% of adult defensive females.

*Våra Pälsdjur, 59, 5, 178-179, 1988. In SWED. CAB-abstract.*

**The role of genotype in stress reaction on restricted feeding in American mink.**

*V.A. Shul'ga.*

The effects of genotype (Standard, Wild and Saphire), sex and lack of food (restricted diet or starvation) on the concentration by the adrenal cortex were studied. Starvation prior to the breeding season increased oxycorticosteroid concentration in Sapphire males but not in Standard males. Chronic underfeeding did not affect oxycorticosteroid concentration in male mink of either colour variety. In vitro production of oxycorticosteroids after the breeding season was decreased only in Sapphire males due to starvation and the associated stress. In Sapphire females, chronic underfeeding resulted in a stress-conditioned increase in oxycorticosteroid concentration in blood. Standard and crossbred females were resistant to stress-induced effects on oxycorticosteroid concentration.

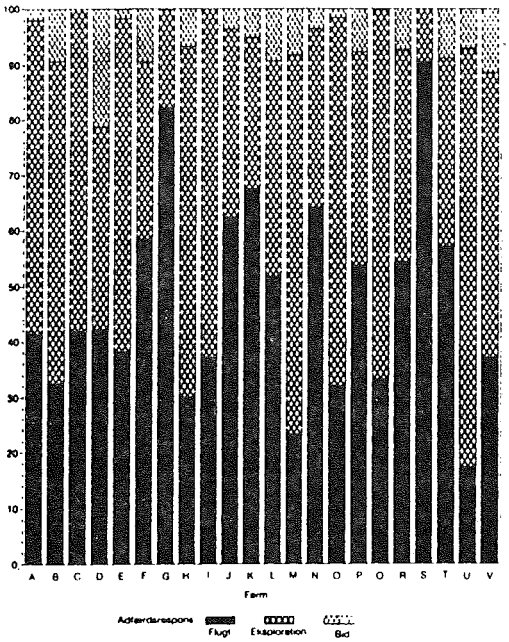
*Referativnyi Zhurnal, 4.58.452, 1988. In RUSS. CAB-abstract.*

**Correlation between behavioral response and the level of eosinophils in female minks.**

*Steffen W. Hansen, Steen Møller.*

The correlation between behavioural response and the number of circulating eosinophil leukocytes was tested on 428 scanblack mink females distributed on 22 farms.

*Figur 2. Procentvis fordeling af adfærdsrespons.*




No correlation was found between the two tests, but both tests showed significant differences between the farms.

This seems to indicate that behavioural response of pin tests is to a higher degree a result of the acquired experience of the female mink in relation to human contact, whereas the eosinophil level expresses the total environmental pressure on the farm in question.

Meddelelse, Statens Husdyrbrugsforsøg, Denmark, 721, 1988. 3 tables, 2 figs., 8 references. In DANH. Authors' summary translated by Hanne Artved.

**Genetics and phenogenetics of hormonal characteristics of animals.**

**VIII. Analysis of corticosteroid adrenal function variation in silver foxes under selection for domestication.**

*D.K. Belyaev, I.N. Oskina, L.N. Trut, N.M. Bazhan.*

The contribution of genetic and environmental components in phenotype variety of corticosteroid adrenal function was studied in undomesticated and domesticated

silver foxes during postnatal ontogenesis. The variation of basal and stress plasma corticosteroid level in animals aged 2, 4, 6, 8 months and in vitro secretion of the adrenal gland at the age 8 months was analysed.

Significant genotype-depended variability was only demonstrated in undomesticated foxes under stress stimulation conditions. This phenomenon is manifested from the fourth month of life. However, significant genotype-depended variability was already revealed under basal conditions in domesticated foxes, on initial steps of postnatal ontogenesis. The peculiarities of genetic variability of adrenocortical function in foxes selected for domestication are discussed.

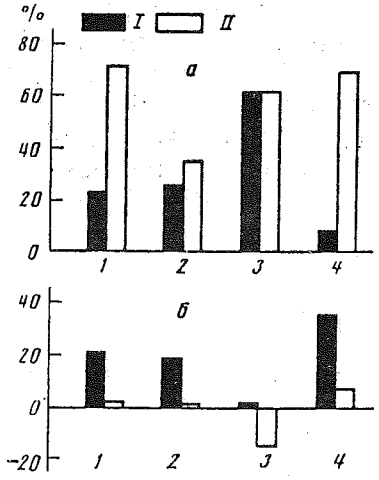



Рис. 2. Изменчивость продукции 11-ОКС надпочечниками in vitro и балла поведения у серебристо-черных лисиц: *а* – аддитивная вариансa, *б* – варианса за счет среды, общей для помета; *1* – продукция 11-ОКС при действии эндогенной стимуляции, *2* – контрольная продукция 11-ОКС, *3* – продукция 11-ОКС при действии экзогенного АКТГ. *4* – балл поведения; I – недоместицируемые, II – доместицируемые лисицы

*Genetika, USSR, 24,4, 715-722, 1988. 2 figs., 26 references. In RUSS, su. ENGL. Authors' summary.*

**Drinking behaviour and weight gain in mink with a drip watering system.**

*Steen Møller, Outi Lohi.*

A drinking system, where water is constantly dripping to the lib of the drinking valve, has been tested during the lactation period. The system was first tested in 1987 when cold and humid weather conditions probably were the reason why no effect could be seen in the development of weight, even though some positive differences in behaviour were observed. The fairly warm and dry weather, characteristic of the lactation period in 1988, was more stressing for the animals. Therefore an effect of an improved watering system could be expected to show up.

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

Fifteen females with litters of 4 to 8 kits, born between the 30th of April and the 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 23th of June. The water temperature in the two systems was measured during the test period.

The drip watering system significantly reduced the females' loss of weight during the lactation period. The weight gain of the kits was significantly increased. There was a small but significant decrease in water temperature in the drip watering system.

The drip watering system had a positive effect on the drinking behaviour of the kits. Less problems in finding the drinking valve were detected, and water intake was seen more often and from an earlier age in the experimental group than in the control group. Saliva licking was seen more often and for a longer period in the control group. All these differences were significant at 5% level.

By improving the accessibility of drinking water during the lactation period, a positive effect on the weight change of the animals

can be achieved. The improved performance of the females in the experimental group can be due to reduce saliva licking of the kits. The faster weight gain of the kits can be explained by the improved water intake.

*Faglig Årsberetning, 1988, pp 41-52.*
*3 tables, 6 figs., 2 references.*
*In DANH. Authors abstract.*

**Environmental enrichment of captive primates and foxes.**

*S.M. Dow.*

There is a growing awareness of the importance of an animal's behaviour in assessing its welfare. Captive animals have many decisions about their environment made for them. A number of projects have been set up at London Zoo to encourage a wider range of natural activities and to give the animals more control over their environment, concentrating on the primates and social carnivores. Behavior was recorded before and after any changes were introduced.

Viscous food-stuffs could be obtained by the chimpanzees by probing with a stick in the manner of "fishing" for termites in the wild. This behaviour became a significant part of their behavioural repetoire and was generalised to other areas of the enclosure. Their skills have been refined and fishing" remains an important behaviour.

A number of artifacts have been introduced to the orangutans, such as pictures of foods and telephone directories. The animals spent a great deal of time manipulating such objects. Some have the opportunity to press keys which produce different audible tones and preliminary results indicate that tones can act as reinforcers for key pressing.

Fennic foxes were given different insect prey which required finding and/or pursuit before being consumed, in addition to their usual ration. Stereotyped pacing was reduced in one pair while a second, very inactive pair, who did not pace, increased their activity when given insects to hunt.

*Appl. Anim. Behaviour Science, 18, 3/4, 383-390, 1987. Author's abstract.*
*Only abstract received.*

**Effect of cage size on growth, feed intake, fur quality and activity pattern of farmed raccoon dogs.**

*Hannu Korhonen, Mikko Harri.*

Body weight gain, feed consumption, fur quality and behavioural activity patterns were studied in juvenile and adult farm-raised raccoon dogs reared in cages of normal and large sizes. Body weights gain was normal and of the same order of magnitude in both cage groups. No marked differences in feed intake of the groups were observed. The effects of cage size on fur quality characteristics of the animals were minimal and non-significant. Behavioural activity was similar for animals in small and large cages. Only the sitting patterns was higher in animals reared in small cages.

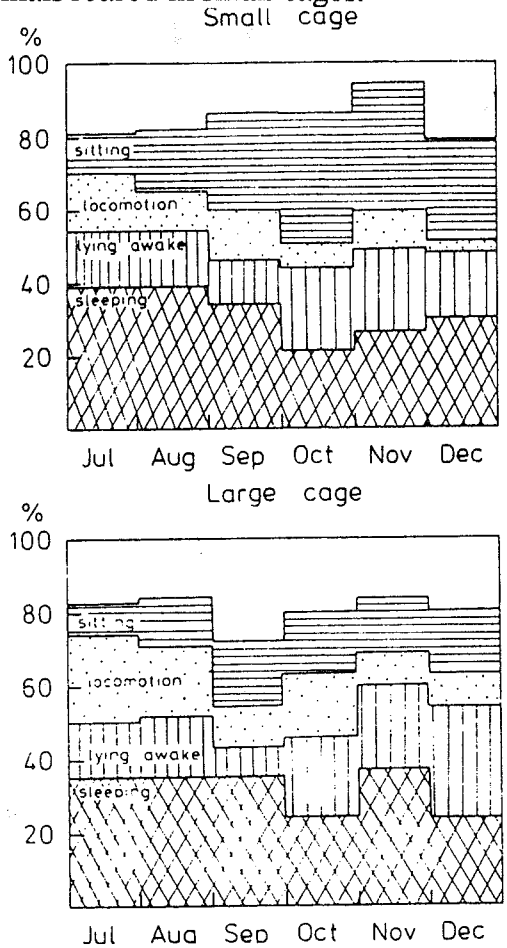



Fig. 2. Cumulative percentage of behavioural patterns in juvenile raccoon dogs housed in small and large cages.

*Z. Versuchstierkd., 31, 49-54, 1988.*
*2 figs., 2 tables, 14 references.*
*Authors' summary.*

**A cage for the ferret.**

*W. Scharmann, D. Wolff.*

A cage for ferrets is described that consists of a plastic box with a metal sliding-grill top and metal front lattice. It contains a new feeding system using dishes that can be removed without opening the cage. The cages are kept in mobile racks and are commercially available.

*Laboratory Animals, 21, 43-47, 1987.*
*6 figs., 5 references. Authors' summary.*

**Problems of animal welfare in fur farming.**

*H. Kraft.*

Fur farms frequently have a high stocking density resulting in problems associated with management, nutrition and environment factors. Also, they usually lack qualified personel and the provision of expertise in general management.

Special attention is required for the successful breeding of foxes, mink and polecat. The South American beaver, kept in water enclosures, requires particular attention to maintain a hygienic environment. Climatic and nutrition are particularly important in the farming of chinchillas.

Euthanasia must be carried out painlessly and must take account of specific animal welfare aspects.

*Tierarztliche Umschau,43, 3, 168-170, 1988.*
*7 references. In GERM, Su. ENGL.*
*Author's abstract.*

**Drinking water supply and Pseudomonas aeruginosa findings from pharyngeal swabbing of minks.**

*H. Zimmermann, Lisa Hering.*

Pseudomonas aeruginosa was recorded by pharyngeal swabbing from three per cent of all minks investigated, Saprophytic dissemination was found to be widespread, as could be seen from positive findings from 37 per cent of all mink stocks checked. The Pseudomonas bacteria were located in the pharyngeal cavity and were probably transmitted through continuous drinking grooves. Hence, such grooves should be rejected for reasons of good farm hygiene.

*Mh. Vet.-Med., 44, 21-22, 1989.*
*2 tables, 1 fig., 19 references.*
*In GERM, Su. RUSS, ENGL. Authors' summary.*

**Effect of melatonin implantation of the seasonal variation of FSH secretion in the male blue fox (Alopex lagopus).**

*M. Mondain-Monval, A.J. Smith, P. Simon, O.M. Møller, R. Scholler, A.S. McNeilly.*

A heterologous radioimmunoassay system developed for the sheep was shown to measure FSH in the plasma of the blue fox. FSH concentrations throughout the year showed a circannual rhythm with the highest values 61.6 +/- 14.8 ng/ml) occurring shortly before or at the onset of the mating season, a pattern similar to that of LH. The concentration of FSH then declined when androgen concentrations

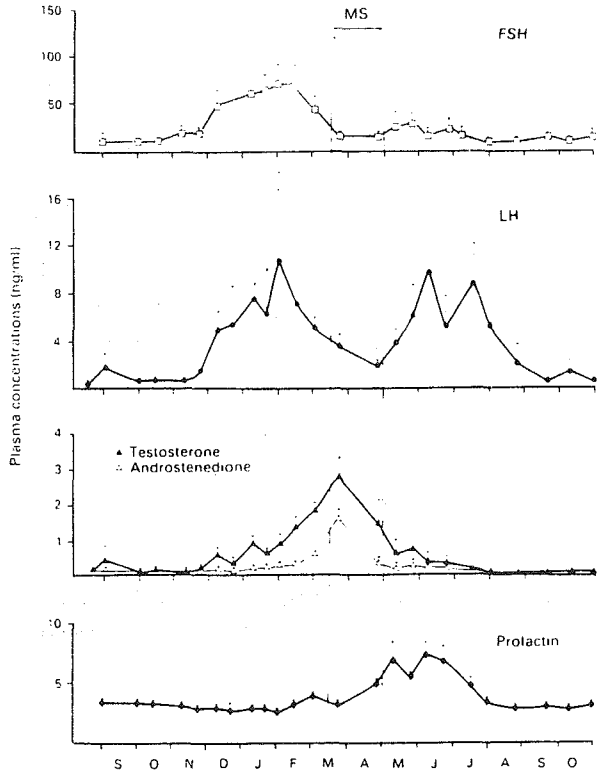



Fig. 3. Mean (±s.e.m.) plasma concentrations of FSH, LH, androgens and prolactin in 6 untreated male blue foxes during the annual cycle. MS = mating season.

and testicular development were maximal at the time of the mating season (March to May). Thereafter, concentrations remained low (25.2 +/- 4.1 ng/ml) in contrast to those of LH. Implantation of melatonin in August and in February maintained high plasma values of FSH after the mating season (142.3 +/- 16.5 ng/ml) in association with a maintenance of testicular development and of the winter coat. The spring rise of prolactin was suppressed by melanonin treatment. The release of FSH after LHRH injection was also increased during this post-mating period in melatonin-treated animals, in contrast to the response of the control animals which remained low or undetectable.

These results suggest that changes both in the secretions of FSH and prolactin may be involved in the prolongation of testicular activity and in the suppression of the spring moult after melatonin administration.

*J. Reprod. Fert., 83, 345-354, 1988.*
*5 figs., 31 references. Authors' summary.*

**Hair types in Scanblack mink.**

*Palle V. Rasmussen.*

100 Scanblack mink pelts from 20 farms in Denmark were examined. There were significant differences between farms in hair length and fibre type. Length of guard hairs was positively correlated with length of underfur and pelt quality score, and fur density was positively correlated with fur thickness score and pelt quality score. Data are presented in 5 graphs and 1 table.

*Faglig Årsberetning, Denmark, 1988, 155-164. 5 figs., 2 tables, 2 references.*
*In DANH. CAB-abstract.*

**Histological determination of different stages of pelage development fur growth of mink.**

*Leena Blomstedt.*

A histological study on pelage development was carried out in a young female mink. Skin biopsies were taken during the growth period of the animal. Auber's SACPIC method was modified and used for staining of skin sections 8-10 μm in thickness. The mean numbers of growing and mature hairs in three types of follicular bundles were counted. Local differences in maturation and shedding of the fur coat were found between bundles containing only underfur hairs and those containing one guard hair in addition to underfur hairs. It is concluded that the method counting separately the number of mature and growing hairs gives means for judging the fur during the maturation process.

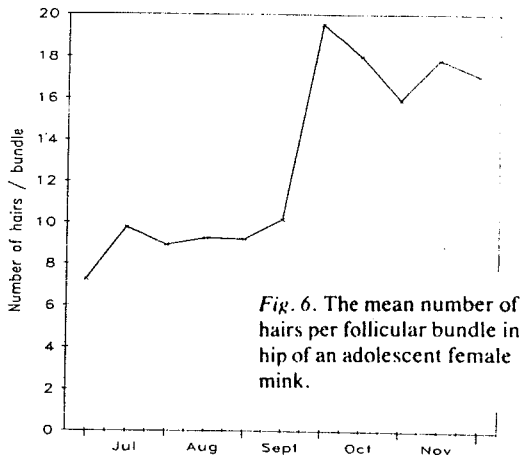



*Fig. 6.* The mean number of hairs per follicular bundle in the hip of an adolescent female mink.

*Acta Agric. Scand., 39, 91-99, 1989.*
*6 figs., 5 references. Author's abstract.*

**Hair defects in silver foxes.**

*Ulla Joutsenlahti.*

An illustrated account is given of the "parting" and "curly hair" pelt defects in silver foxes; both defects are inherited.

*Våra Pälsdjur, 59, 8, 292-293, 1988.*
*2 figs., 3 references. In SWED. CAB-abstract.*

**Early weighing of mink provides information on pelt length.**

*Niels Therkildsen.*

79 mink were weighed on 1 Sep. and again at pelting in Nov.-Dec. Body weight in

Sep. averaged 1851, 998, 1992 and 1014 g resp. for Standard males and females and Pastel males and females vs. 2305, 1079, 2181 an 1192 g in Nov.-Dec, and pelt length averaged 77.5, 62.8, 77.2 and 64.2 cm. The correlation of body weight in Sep. with pelt length was 0.47, 0.86, 0.72 and 0.87 resp. in the 4 groups, and the correlation of body weight at pelting with pelt length was 0.79, 0.87, 0.93 and 0.91.

*Deutsche Pelztierzuchter, 62, 8, 117-119, 1988. 3 tables. In GERM. CAB-abstract.*

**Changes in skeletal structure in sable and mink kept in cages on fur farms.**

*N.A. Slesarenko.*

Lack of exercise weakened bone structure in caged furbearing animals resulting, by 5-9 years of age, in osteoporosis and osteosclerosis. (The same publication also contains other papers on the adverse effects of cage husbandry).

Sbornik Nauchn. Trudov, Moskovskaya Vet. Akademiya, 10-13, 1987. In RUSS. CAB-abstract.

**Morphofunctional condition of adrenal cortex in silver fox females and influence of domestication and photoperiodic conditions on it.**

*N.D. Lutsenko, L.N. Trut.*

It was shown during investigation of seven-day-old and eight-month-old silver fox females that additional photostimulation influences the morphological condition of the adrenal cortex differently in animals selected and not selected for domesticated type of behaviour. In relatively wild foxes it exerted a stimulating effect on function of the reticular zone, while in tame animals additional illumination caused increase in functional activity of the fascicular zone. It is suggested that selection of silver foxes for domesticated properties of behavior leads to change in sensitivity of the adrenals to conditions of external illumination

*J. Evolutionary Biochemistry and Physiology, 23, 6, 542-546, 1988. 1 table, 2 figs., 12 references. Authors' abstract.*

**Onuf's nucleus in the spinal cord of the Alopex lagopus.**

*Zbigniew Milart, Stefan Herec.*

The lumbosacral parts of the spinal cord of the *Alopex lagopus* were cut in the transverse plane into sections 15 μm thick. Sections were stained with methylene blue by a simplification of Nissl's method and with luxol and cresyl violet by the method of Klüver and Barrera. In the ventral horn of grey matter of the secral part of spinal cord in the *Alopex lagopus*, in segments SI and SII, there was described Onuf's nucleus. It is formed mainly of medium multipolar cells and is divided into two parts: the ventro-lateral and dorso-medial part.

*Ann. Univ. Mariae Curie-Sklodowska, DD, 39, 1-7, 1984. 6 photos, 17 references. In POLH. Su. ENGL. RUSS. Authors' summary.*

**Topography and cytostructure of nucl. motorius n. accessorii, nucl. parasympathicus n. glossopharyngei et vagi and nucl. ambiguus in Arctic foxes, Alopex lagopus.**

*Zbigniew Milart, Irena Ziolo, Stefan Herec, Anna Bujak.*

Investigations were carried out on sections of the five *medulla oblongatae* of sexually mature *Alopex lagopus*. The histological slices were stained by the modified method of Klüver-Barrera. Detailed studies showed that the motoric nuclei of *Alopex lagopus* demonstrate some specific characteristics of the topography in comparison with analogous nuclei of other animal species mentioned in the paper. The motoric nucleus of the accessory and the *ambiguus nucleus* lie more rostrally. The parasympathic nucleus of the glossopharyngeal nerve and vagus shows a homogenous structure and is not distinctly divided into secondary groups. Differences in the cytostructure of the nuclei described occur in relation to the particular part of the nucleus.

*Ann. Univ. Mariae Curie-Sklodowska, DD, 39, 9.17, 1984. 11 photos, 22 references. In POLH. Su. ENGL, RUSS. Authors summary.*

**The nuclei of the cerebellum of Alopex lagopus.**

*Anna Bujak, Marek Jastrzebski, Zbigniew Milart, Irena Ziolo.*

Studies were carried out on cerebelli of 3 sexually mature *Alopex lagopus* males. They were imbedded in paraffin and sections were cut in the frontal and horizontal plane and stained by the method of Nissl or Klüver-Barrera.

After studying the topography and cytoarchitecture, the internal grey matter of the cerebellum was divided into 4 nuclei: *nucl. fastigii, nucl. interpositus lateralis cerebelli, nucl. interpositus medialis cerebelli, nucl. lateralis cerebelli.* In *Alopex lagopus* these nuclei are separated from each other by a layer of nervous fibres of different thickness, except their medial segments, in which numerous cell "bridges" connect the neighbouring nuclei and cause blurring of the border between them. In *Alopex lagopus* no subdivision of the particular nuclei was observed. The cerebellum nuclei of *Alopex lagopus* are built of large, medium and small cells.

Ann. Univ. Mariae Curie-Sklodowska, DD, 39, 19-27, 1984. 12 photos, 22 references. In POLH. Su. ENGL, RUSS. Authors summary.

Changes in physiologic and clinicopathologic values in domestic ferrets from 12 to 47 weeks of age.

*John P. Hoover, Charles A. Baldwin.*

The values of 25 blood constituents are tabulated for 5 male and 4 female ferrets (Mustela putorius furo) examined at 12, 18 and 47 weeks of age. The results provide normal values that should be of use in veterinary practice.

*Comp. Animal Practice, 2, 1,40-44, 1988. 3 tables, 12 references. CAB-abstract.*

**Control of fly pests on fur farms.**

*G.A. Veselkin, G.K. Sergeeva.*

85 species of Diptera, capable of breeding on fur farms, occur in the Yamalo-Nenetskii region of the USSR, among them Protophormia terraenovae (Phormia terraenovae), Fannia canicularis, Musca domestica, Calliphora uralensis, C. vicina, Lucilia illustris, L. caesar, Morellia hortorum, Piophila vulgaris (Parapiophila vulgaris), Piophila casei, Hydrotaea dentipes and H. meteorica. Various insecticides were recommended to kill the larvae, to be applied at intervals of 10-20 days during the fly breeding season. Surfaces could be sprayed with etaphos, dichlorvos, crotoxyphos, diazinon, sulfidophos (fenthion) or trichlorfon to kill adult flies, repeated whenever necessary. Different insecticides should be used against larvae and adults, to prevent the emergence of resistant flies.

*Veterinariya, Moscow, 6, 23-25, 1988. In RUSS. CAB-abstract.*

**World production in 1987-88.**

*Anonymous.*

In 1987, the world production of mink pelts totalled 35,726,000, of which 16,496,000 were produced in Scandinavia, 4,500,000 in the USSR, 4,400,000 in USA, 3,300,000 in China, 1,650,000 in the Netherlands and 750,000 in Japan. The production of blue fox pelts totalled 2,379,000 (1,819,000 in Scandinavia and 390,000 in Poland), that of Shadow + White fox pelts 584,000 (507,000 in Scandinavia and 50,000 in Poland), that of Silver fox pelts 869,000 (604,500 in Scandinavia, 75,000 in the USSR, 70,000 in Canada and 60,000 in Poland) and that of Blue Frost fox pelts 812,000 (777,000 in Scandinavia). Results are compared with those in 1986. (Figures given apply only to the principal producers).

*Våra Pälsdjur, 59, 6, 236, 1988. In SWED. CAB-abstract.*

**Breeding of fur bearers in Norway in 1987.**

*Anonymous.*

In 1987, in Norway, the performance was recorded of 24,000 mink, 21,800 silver fox and 24,000 blue fox breeding females at 630 farms. The number of young produced per mated female averaged 4.3 for mink females, 5.8 for blue x blue fox matings, 4.2 for blue x silver fox matings and 3.0 for silver x silver fox matings, the corresponding figures in 1986, being 4.2, 5.4, 3.8 and 2.9. Approximately 72,000 blue fox females were inseminated at 1660 farms, of which 45% were inseminated twice; 40,000 of the females were inseminated with silver fox semen. Of the 2287 females which were inseminated by the most successful inseminator, 85% conceived, and litter size averaged 4.5, 4.6 and 3.0 resp. for blue x blue, blue x silver and silver x silver fox matings. Details are given of health and feeding.

*Våra Pälsdjur, 59, 6, 232-233, 1988. In SWED. CAB-abstract.*

**A survey of nutria housing used in the German Federal Republic. Part 1 and 2.**

*Günther Aatz, Rose-Marie von Wegner, Johannes Petersen.*

Of nutria at 136 farms in the German Federal Republic investigated in 1984-85, 22.8% were housed with access to water, 67.6% in pens on the ground with no access to water, and 25.7% in cages. Details are given on the construction of the 3 types of housing, and the effects of housing on production are discussed.

*Deutch. Pelztierzuchter, 62, 7, 104-105, 1988, and 8, 120-121, 1988. 1 table. In GERM. CAB-abstract.*

**Statistics on nutria breeding in the German Federal Republic.**

**Günther Aatz, Rose-Marie Wegner, Johannes Petersen.**

In 1985 there were 152 nutria farms in the German Federal Republic and 2 in Austria. Of 136 farms investigated, 29.4, 24.3, 17.7, 10.3 and 11.8% resp. had 20, 30-40, 40-60, 60-100 and 100 animals. The majority of farms (84.6%) produced Greenland nutria, and 50.0, 28.7, 27.9, 26.5 and 25.0% resp. produced Silver, Black, Beige, Gold and standard nutria. Details are given of carcass evaluation, and economic aspects are considered.

*Deutsch. Pelztierzuchter, 62,4, 56-58, 1988. 7 tables. In GERM. CAB-abstract.*

**Annual Report 1987.**

*Niels Glem-Hansen.*

Recent work carried out in Denmark on breeding, selection, reproduction, pelt development, growth, nutrition and diseases in mink is reported. Papers abstracted appear in the appropriate section of the journal, and can be traced via the subject index, under the heading Reports.

*Faglig Årsberetning, 1988, 292 pp. In DANH. CAB-abstract.*

**A report from the Department of Fur Bearers at the National Institute of Animal Science.**

*Gunnar Jørgensen.*

An account is given of some recent experiments in Denmark, including selection of Scanblack mink kits for colour intensity, selection of mink for fur density, genetically conditioned hairlessness in mink, lighting experiments to accelerate pelt maturity, the effect of light on blood prolactin concentration in lactating mink, the effect of cage size on social behaviour in mink and the evaluation of stress in fox females.

*Faglig Årsberetning, 1987, 118-122, 1988. 35 references. In DANH. CAB-abstract.*

The breeding work will only give results if the differences between the animals are not caused exclusively by environmental influences and diseases. Progress can only be created, if the breeding work is carried out in a good environment free of diseases. If this is not the case, the breeding work may not be rewarded with progress but with a stagnation or a regression.

Litter sizes are only found for the kits selected for breeding which should be born in mind when evaluating the results. The crucial point is, however, what the difference would be between animals selected for breeding and animals pelted - which will never be proved.

*Dansk Pelsdyravl, 51, 8, 551-553, 1988. 1 fig., 1 tables. In DANH. Author's summary translated by Hanne Artved.*

**Selection for pelt quality in mink.**

*Gabrielle Lagerkvist.*

Recent work in Sweden on the selection of mink for fur density, quality of guard hairs, pelt colour and pelt size, factors affecting the above traits, and their heritabilities is summarised. The bibliography is not printed in the journal, but may be obtained from the author.

*Våra Pälsdjur, 59, 8, 289-290, 1988. in SWED. CAB-abstract.*

**Chromosomal polymorphism of polar fox (Alopex lagopus) in relation to livability of youngs.**

*V. Parkanyi, J. Rafay, I. Jakubicka, M. Barta.*

Eighty foxes - 62 females and 18 males were examinated cytogenetically and the distribution of genotypes was determined. It was evident from the obtained data that the three chromosomal types 2n = 50 (42.50%), 2m = 49 (38.75%) and 2n = 48 (18.75%) were represented in females and males.

In one of four experimental farms 28 female breeders were analysed in relation to cytogenetical findings, number of youngs in the litter at birth and number of youngs at weaning. Litter size at birth was not significantly influenced by chromosomal type. The highest number of dead youngs before weaning was recorded in genotype 2n = 50 (cytogenetical homozygotes). Number of youngs at birth x = 9.47 was reduced even to x = 4.32. Besides only in genotypes with 2n = 50 destruction of the whole litter was observed. The highest livability was observed at weaning of litters from females with 2n = 49, i.e. cytogenetical heterozygotes x = 7.21.

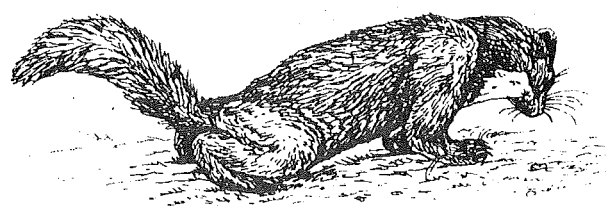
*RIAP, Nitra, XXIII, 123-131, 1988. 5 tables, 1 fig., 20 references. In CZEC. Su ENGL, RUSS. Authors' summary.*

**Report of the committee on comparative mapping.**

*P.A. Lalley, S.J. O'Brien, N. Créau-Goldberg, M.T. Davisson, T.H. Roderick, G. Echard, J.E. Womack, J.M. Graves, D.P. Doolittle, J.N. Guidi.*

This report summarises the available information on gene maps of 11 primate spp., mice, 10 other eutherian mammals, marsupials and monotremes and lower vertebrates such as fish. The number of known linkage and syntenic groups and mapped genes are tabulated for farm livestock species, horses, mink, mice, rats, cats, dogs and rabbits. 258 loci and linkages that are homologous for humans and mice are tabulated, giving the locus symbol and name, chromosome number and approximate chromosomal location (proximal, distal, etc.) for the loci in mice.

*Cytogenetics and Cell Genetics, 46 1-4, 367-389, 1988. 5 tables, 367 references, CAB-abstract.*



*Original Report*

# Study on the system of mating the raccoon dog (Nyctereutes procyonoides).

*Andrzej Zon, Pavel Bielanski, Stanislaw Niedzwiadek.*
*National Institute of Animal Husbandry, Dept. of Fur Animal Breeding, 32-083 Balice, Krakow, Poland.*

**Summary**
Experimental material consisted of 152 females and 73 males, as well as all of their offspring, divided into two groups: in Group I the females were mated three times in three days, and in Group II they were mated twice in two days. The experiment showed that when they were mated three times, there were fewer barren females and a greater number of pups, both at birth and at time of weaning.

**Introduction**
*N. procyonoides* was introduced to Poland in 1979 and distributed among several of the leading carnivore fur farms. The mild temperament of this animal and its great ability to adapt to new conditions allowed much to be learned in a very short time about its biology and breeding care. In spite of years of raising the raccoon dog, production technology is still not generally known, especially in the areas of reproduction, feeding at various stages of development, and general care.

Reproduction is an important factor influencing the economics of raising *N. procyonoides* in captivity. The frequency of mating of carnivorous fur-bearing animals has a large influence on the efficacy of matings and the fertility of the females. Polish fur farms have used various systems for mating these animals, with differing degrees of success. In Finland the preferred method is to mate the females three times (*Lorek, 1989*). Russian Breeders, on the other hand, mate them twice (*Ilina, 1978*). Thus the aim of the research at the National Institute of Animal Husbandry was to describe the influence of various mating systems on the fertility indices of the females.

**Materials and methods**

Research was carried out at the farm for carnivorous fur-bearing animals in ZZD Chorzelow, Poland during the years from 1983 to 1987. The research material consisted of 152 females and 73 males, as well as all of their offspring. Approximately 20% of the females were bred for their first time in each of the mating seasons. They were divided into two groups, each consisting of 76 females:

Group I: mated three times on three consecutive days;
Group II: mated two times on two consecutive days.

The animals in each group were fed identical rations, which were provided with consideration to age and length of time in confinement, according to feeding norms established by *Akkuratov (1978)*. The

original group of animals was kept in cages of the type used for foxes, and the newly-weaned young were kept three in a cage, stacked in pavilion style.

The females were weighed individually before the beginning of the mating season, as well as at the time of weaning. Records were kept of the dates when each began her estrus cycle, and when she was mated. At pre-determined times the dens were checked to determine the number of pups. The number of losses were registered during the time the pups were with their mothers, in an attempt to determine their causes. The young animals were weighed at the time of weaning and at the time of slaughter.

**Results**

The weight of the females were recorded at the beginning of each breeding season. The females were then divided into groups so that the average weight in each group varied within a range of 6047-6748 g (Table 1). At the time of weaning, the females weighed from 6107 g (Group II) to 7310 (Group I).

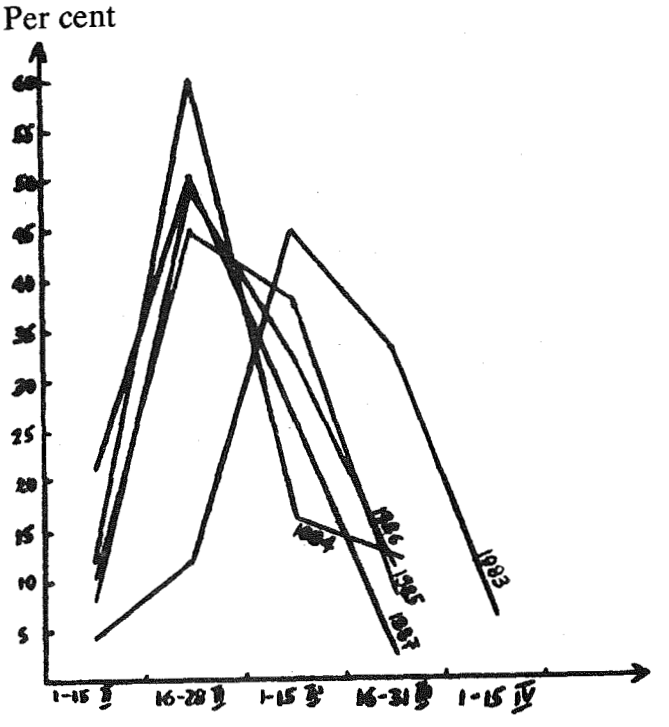
Table 1. Body weights of females.

| Years | Group I * | | | | Group II ** | | | |
|---|---|---|---|---|---|---|---|---|
| | Beginning | | At weaning | | Beginning | | At weaning | |
| | X | v | X | v | X | v | X | v |
| 1983 | 6040 | 14.1 | 7000 | 7.4 | 6180 | 10.8 | 6107 | 6.5 |
| 1984 | 6047 | 11.8 | 7088 | 8.1 | 6440 | 12.4 | 7187 | 6.5 |
| 1985 | 6240 | 9.9 | 7310 | 6.7 | 6100 | 13.2 | 7220 | 8.1 |
| 1986 | 6652 | 13.1 | 7310 | 6.4 | 6704 | 11.3 | 7154 | 7.8 |
| 1987 | 6720 | 10.9 | 7155 | 6.9 | 6748 | 10.2 | 7030 | 7.7 |

* - females mated 3-times.
** - females mated twice.

The mating season for both groups began at the beginning of February and ended at the end of March (Graph 1). The greatest number of matings occurred during the last 10 days of February.

All of the females were mated in each breeding season (see Table 2). The percentage of females which gave birth was similar for both groups, but varied according to the year. In Group I this variation was from 65% to 100%, and in Group II from 58.4% to 85%. The gestation period varied from 59.5-61.0 days, averaging 60.4 days for Group I and 60.2 days for Group II. The number of pups born in each group differed according to year. In 1986 the number of young in both groups was the same, but in the following years, the number of pups born to Group I was considerably higher. The over-all average for Group I (8.1 pups) was higher than for Group II (7.1 pups), and the significance




Mating dates

Fig. 1. Percentage of female mated.

Table 2. Results of reproductive performance of raccoon dog females.

| Item | Groups* I | | | | | Groups* II | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1983 | 1984 | 1985 | 1986 | 1987 | 1983 | 1984 | 1985 | 1986 | 1987 |
| Females mated (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Females barren (%) | 16.6 | 0 | 3.2 | 35 | 5 | 41.6 | 33.3 | 18.4 | 20 | 15 |
| Fem. delivered (%) | 83.4 | 100 | 96.8 | 65 | 95 | 58.4 | 66.7 | 81.6 | 80 | 85 |
| Length of pregnancy (days) | 60 | 61 | 60.5 | 60 | 60.5 | 60 | 61 | 59.9 | 59.5 | 60.5 |
| Litter size (pcs): | | | | | | | | | | |
| alive | 9.1a | 8.9A | 7.6b | 7.8 | 7.6B | 8.1a | 6.1A | 6.6b | 7.8 | 6.5B |
| dead | 0.2 | 0.3 | 0.9 | 0.8 | 0.7 | 0.5 | 0.7 | 0.9 | 0.3 | 0.6 |
| Young weaned per a female: | | | | | | | | | | |
| delivered (pcs) | 5.9 | 6.2 | 6.2 | 6.4 | 6.3 | 5.3 | 4.4 | 4.5 | 6.2 | 5.1 |
| Pups died and bitten: | | | | | | | | | | |
| to death (%) | 35.1 | 30.3 | 18.4 | 18.0 | 17.1 | 35.0 | 32.1 | 27.9 | 20.5 | 19.0 |

*) - for explanations - see table 1.

Means followed by same letters significantly different (A, B, $p<0.01$; a, b $p< 0.05$)

of this difference was statistically determined (Table 3).

The percentage of young which died before weaning was from 17.1-35.1% for Group I and from 19.0-35.0% for Group II. The calculated fertility indicators demonstrated a relationship to the number of matings. The females mated three times showed a higher fertility rate. In each group 100% of the females were mated, while 13.6% of them were barren in Group I and 24.3% in Group II. The average size of litters varied from 7.1-8.1 pups per litter, the higher value appearing in the group of females mated three times. This difference was statistically confirmed. There were also significant differences in the size of litters at the time of weaning, to the advantage of the group of females mated three times.

## Discussion

The females were in good condition at

Table 3. Reproductive performance of raccoon dog females of all times of experiment.

| Items | Groups* I | Groups* II |
|---|---|---|
| Females mated (%) | 100 | 100 |
| Females barren (%) | 13.6 | 24.3 |
| Females delivered (%) | 86.4 | 75.7 |
| Length of pregnancy (days) | 60.4 | 60.2 |
| Litter size (pcs): | | |
| alive | 8.1a | 7.1a |
| dead | 0.6 | 0.6 |
| Young weaned per a female: | | |
| delivered (pcs) | 6.2A | 5.1A |

*) - for explanations - see table 1.

the beginning of the mating season, somewhat better than those which *Akkuratov et al.* mentioned (1980). In each individual year the weight of the females from each group was compared. The differences in weight between the years analyzed is likely attributable to weather conditions. The first indications of estrus were observed in early February, which is somewhat later than the date given by *Lorek (1980)* or *Akkuratov (1980)* and *Zon et al. (1987)*. In 1983 the mating season for *N. procyonoides* was about two weeks longer as compared to the years 1984-1987. The reason for this was likely the introduction for one-year-old females, newly purchased from other farms.

Analyzing the fertility indicators of the females, it can be said that they are quite different, being higher for the group that was mated three times. 1986 was an exception in which the indicators were similar for both groups. During that season the appearance of estrus took place over a very short time as compared to other years. This had an unfavourable influence on the mating of the females bred three times, because it led to an excessive exploitation of the males. *Ilina (1978)* asserts that males used too frequently may experience a decrease in their fertility parameters.

The percentage of females from both groups which littered during the years 1985-1987, as well as the ones bred three times in 1983 and 1984 correspond to and often exceed the results given by *Gawarecki and Barabasz (1982)* and *Lorek (1980)*. According to *Akkuratov et al., 1980)* the number of females which littered is given as 10-20% lower. On Finnish farms, where the females were initially mated twice, the number of productive matings were at a level of 64% according to *Valtonen and Mäkelä (1979)*, thus similar to the group of females mated twice in 1984 and 6% higher than in the year 1983.

The average number of pups in both groups in the years 1983-1987 was not significantly higher than results from farms in the U.S.S.R., as reported by *Akkuratov (1978)*. The increased number of pups obtained from the females bred three times shows the influence of breeding frequency on their fertility indicators.

In conclusion it may be said that triple mating of *N. procyonoides* provides the following advantages:

- greater efficiency in servicing the females and a lower percentage of barren matings;
- greater number of pups born and surviving to the time of weaning, as compared to females bred twice.

Thus the introduction of a general practice of servicing the females three times will provide an increase in the parameters of fertility of the raccoon dog females.

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**Differential effects of testosterone, 5 alpha-dihydrotestosterone and oestradiol-17 beta on plasma concentrations of LH in castrated ferrets.**

*Y.P. Tang, C.L. Sisk.*

The biological activity of testosterone often depends on the conversion of testosterone within the target cell to an androgenic or oestrogenic metabolite. The purpose to this study was to compare the relative ability of testosterone and two of its metabolites, dihydrotestosterone (DHT) and oestradiol, to suppress LH secretion in castrated male ferrets. Castrated ferrets were treated with five different doses of steroid by implanting various numbers of s.c. silicone elastomer capsules packed with either testosterone, DHT or oestradiol. The lowest dose of oestradiol (0.1 mm capsule length/100 g body weight, mean estimated total release rate of 25 ng/day) significantly supressed plasma concentrations of LH in castrated ferrets. Higher amounts of DHT (2.5 mm capsule length/100 g body weight, mean estimated total release rate of 88 ng/day) were required for a significant reduction in plasma concentrations of LH. Concentrations of LH were also significantly lowered by testosterone when administered at a 2.5 mm capsule length/100 g body weight; however, estimated total release rate was 312 ng/day from these capsules. The fact that oestradiol was more effective than DHT, and that DHT was more effective than testosterone in inhibiting LH secretion in castrated ferrets, suggests that in gonadally intact ferrets, testosterone may be converted to DHT or oestradiol within target cells that mediate steroid negative feedback on LH secretion.

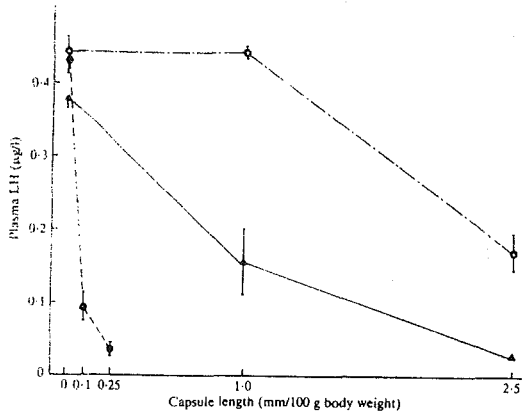


FIGURE 2. Mean ± S.E.M. plasma LH concentrations (μg/l) in castrated ferrets before and after treatment with two doses of testosterone (○), 5α-dihydrotestosterone (▲) or oestradiol-17β (●). Doses of steroid are expressed in terms of mm of capsule length implanted/100 g body weight. The sample at 0 mm was obtained 3 weeks after steroid capsules were removed at the end of experiment 1.

*J. Endocr. 117, 461-466, 1988.*
*1 table, 2 figs., 22 references. Authors abstract.*

**Partial characterization of a luteal factor that induces implantation in the ferret.**

*Rodney A. Mead, M.M. Joseph, Sandra Neirinckx, Matthew Berria.*

This study was designed to test the hypothesis that ferret corpora lutea (CL) secrete a compound that acts in conjunction with progesterone to induce blastocysts implantation and to identify the chemical nature of this compound. CL and the residual ovarian tissue, obtained predominantly on the ninth day of pseudopregnancy, were extracted with 0.05 M phosphate-buffered saline. The extracts were injected into pregnant ferrets that had been ovariectomized on Day 6 of pregnancy and had received Silastic implants containing progesterone. Aqueous luteal extracts, but not those of the residual ovarian tissue, induced implantation in test animals. Fractionation of the luteal extracts by passage through a series of filters with molecular weight (MW) cutoffs ranging from 500 to 50,000 consistently revealed that the biologically active fraction was retained on the filter with the highest MW cutoff employed. Moreover, blastocyst implantation failed to occur in ovariectomized, progesterone-treated ferrets after one-half of a luteal preparation (MW > 50,000) was incubated with a broad-spectrum protease. These data are consistent with the hypothesis that CL of the ferret secrete a protein during the preimplantation period that is essential for blastocyst implantation.

*Biol. Reproduction, 38, 798-803, 1988.*
*4 tables, 1 fig., 16 references.*
*Authors' abstract.*

**Sexual maturation in the female ferret: Circumventing the gonadostat.**

*K.D. Ryan, S.L. Robinson, S.H. Tritt, A.J. Zeleznik.*

The purpose of this study was to examine the role of circulating 17β-estradiol in the regulation of pituitary gonadotropin secretion and, hence, ovarian maturation in immature female ferrets. The hypersensitive negative feedback relationship between the ovaries and the hyothalamo-pituitary axis in developing ferrets was disrupted by infusion of a specific antiserum to 17β-estradiol. The effect of this treatment on gonadotropin secretion and ovarian morphology was contrasted with that observed in intact age-matched control females treated with a nonimmune γ-globulin preparation. Infusion of the antibody into intact immature ferrets caused, within 48 h, an increase in pulsatile secretion of LH to 0.67 +/- 0.06 pulses/h over that observed in intact females treated with control γ-globulin (0.13 +/- 0.06 pulses/h). This increase in pulse frequency was similar to that observed 48 h after ovariectomy of young animals (0.70 +/- 0.12 pulses/h). Furthermore, this level of gonadotropin secretion in antibody-treated animals resulted in stimulation of antral follicle growth in ovaries of these females. Ferrets treated with specific antiserum to 17β-estradiol showed a significant increase in numbers of ovarian follicles greater than 0.3 mm in diameter compared to those in ovaries of females treated with control γ-globulin. These data strongly suggest that the limiting event at puberty in the ferret is the rise in gonadotropin secretion which is allowed by the pubertal decrease in efficacy of 17β-estradiol to inhibit gonadotropin secretion.

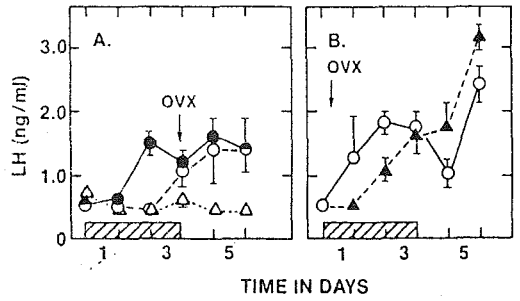


FIG. 1. Plasma LH concentrations (mean ± SEM) in blood samples collected daily. All females were intact during the infusion period (▨). Treatment groups were as follows: ●—●, estradiol antiserum; ○—○, control γ-globulin; Δ- -Δ estradiol antiserum with DES capsule (see text). Ovariectomies (OVX) were performed on day 4 after infusions were stopped. B, Plasma LH concentrations in blood samples collected daily from females ovariectomized on day 1. ○, Females that received an infusion of control γ-globulin. ▲, Data from females that received no infusion. ▨, Infusion period. In both panels, the absence of SEM indicates a value smaller than the symbol.

*Endocrinology, 122, 4, 1201-1207, 1988.*
*1 table, 5 figs., 21 references. Authors' abstract.*

**Changes in ovarian steroidogenesis during embryonic diapause and at the time of implantation in mink (Mustela vison) Study in vivo and in vitro.**

*Isabelle Stoufflet.*

The gestation of mink is characterized by a postponed implantation of variable length (5 to 37 days) caused by a failure to function by corpus luteum.

In the ovary only corpus luteum seems to be indispensable for the implantation, and apart from progesterone it may excrete a factor which is necessary for the induction for the implantation: we have therefore made tests in vivo and in vitro of the development of sexual steroids during the diapause and at the moment of implantation in order to try to find the answer to the question: Is the unknown lutein factor a steroid?

The increase in the plasma concentations of progesterone starting 10 days before implantation corresponds the increase in the growth of blastocytes and the decrease in the concentrations of circulating androgens.

The lutein cells excrete mainly progesterone, the excretion of which increases until implantation. The stimulation by a substrate is, however, weaker at the moment of implantation. The lutein cells are equally capable of excreting androgens and oestrogens and of transforming androgens into oestrogens. The excretion of androgens increases when the excretion of oestrogens is reduced at the moment of implantation. The lutein-making hormone stimulates the excretion of androgens heavily.

The implantation is characterized by a temporary increase in the number of large cells in the middle of corpus luteum.

The existence of an embryo signal of minor importance can not be excluded, as the steroid levels are weaker in pseudo-pregnant females than in pregnant females.

*Thesis, Universite de Paris-6, France.*
*18 tables, 35 figs., 121 referendes, 94 pp.*
*In FREN. Author's abstract translated by Hanne Artved.*

**Investigation of blood progesterone concentration in pregnant and non-pregnant mink.**

*Tove Nørgård Clausen.*

20 Standard mink females, aged 1 yr, were (1) isolated from other mink, (2) mated with a vasectomised male in Mar. or (3) mated twice with normal males in Mar., with an interval of 9 days between matings. Blood samples were collected at weekly intervals from 5 Mar. to 14 May. Blood progesterone values increased sharply in Apr. in all females in groups 2 and 3, whether pregnant and non-pregnant, but only 1 of the 5 females in group 1 showed a very slight increase.

*Faglig Årsberetning, Dansk Pelsdyravlerforening, 101-105, 1988. 2 tables, 1 fig. In DANH. CAB-abstract.*

**Functional state of the adrenals in different phases of the estrous cycle in the domesticated silver fox, Vulpes fulvus.**

*N.M. Bazhan, N.D. Lutsenko.*

The study was carried out on silver foxes of populations selected over the course of 10-15 generations for domesticated behaviour, and on animals from a control, non-selected population. In females of both populations the blood plasma level of 11-OHCS, in vitro 11-OHCS production, the width of the fascicular zone of the adrenal cortex, the volumes of cell nuclei and nucleoli, and the in vitro reaction of the adrenals to two doses of ACTH (2 and 5 units/g of adrenal) at anestrus, proestrus, and estrus, were investigated. In the females from the control population all the investigated parameters increased significantly from anestrus to proestrus. In the females selected for behaviour, no changes were found in the in vitro 11-OHCS production, nor in the morphological parameters of the fascicular zone in the course of the estrous cycle. Moreover, in the proestrus the adrenals of the selected females were incapable of reliably increasing the production of 11-OHCS in vitro with the introduction of ACTH. Decrease in the reactivity of the adrenals to ACTH is apparently the basic reason that the adrenals of the behaviour-selected

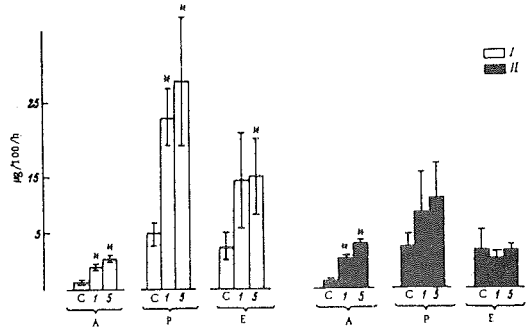


Fig. 3. Change over the course of the estrous cycle in the in vitro production of 11-OHCS in non-selected (I) and behavior-selected (II) silver fox females. C, production of hormones in the control without additions of ACTH. Introduction of doses of ACTH to 1 g of adrenal (units): 1) 1; 5) 5. Asterisks, reliable differences by comparison with the control at each phase of the cycle, ($p < 0.05$).

females do not activate in proestrus. Thus, in the course of the selection of silver foxes to the domesticated type of behaviour, the dynamics characteristic for the species of the activation of the adrenal in the course of the estrous cycle are lost.

*Translated from Zhurnal Evolyutsionnoi Biokhimii i Fiziologii, 23, 5, 652-657, 1987. Plenum Publish. Corp., 1988, 0022-0930/-87/2305-0472. 3 figs., 15 references. Authors' summary.*

**On some female-age related features of reproductive performance in Standard and Grenland races of coypu.**

*Stanislawa Labecka.*

The aim of the paper was to follow certain female-age related features of reproductive performance in Standard and Grenland races of coypu. The highest number of born and weaned offspring was obtained from 3-yr-old females of both races, the lowest number being obtained from 1-yr-old females. Female age has a decisive effect on the litter size and number of weaned offspring. Highly significant differences between 3-yr-old and 1-yr-old females were found; significant differences were found between 2-yr-old and 1-yr-old females of both races.

Among the weaned offspring, the highest number of males was obtained from 3-yr-old females, the lowest number being recorded in the 1-yr-old ones. The relationship was confirmed statistically in the Grenland females only, no significant

female age effect on the weaned offspring sex ratio being found.

*Zeszyty Naukowe Akademii Rolniczej w Szczecinie, 120 (Zootechnika 22), 37-49, 1986. 5 tables. In POLH, Su: ENGL, RUSS. Author's summary.*

**Mating systems and reproduction in mink.**

*Lars Elofson, Gabrielle Lagerkvist, Hans Gustafsson, Stig Einarsson.*

The effects of different mating systems on some reproductive traits were studied in 1515 mink females. Most females were of standard type, a few of pastel type, and the investigation comprised yearlings and older females. The systems evaluated were mating once (1), mating on two consecutive days (1+1) and mating twice with a 9 day interval between matings (1+9). The matings were stated on various fixed dates between March 7 and March 25. The project was extended to include histological studies of ovaries from unmated mink sacrificed at different dates during the breeding season. Furthermore, eggs, embryos and foetuses were recovered and counted after various periods of gestation. The readiness to mate increased steadily during the mating season. Overall acceptance rates on the first test day were 86% for older females and 80% for yearlings. These high rates indicate that the unmated female does not undergo cyclic heat periods; but when she has come into heat she is ready to mate at any time during the sexual period. Large, mature follicles were found in all ovaries studied, and no waves of follicular development were apparent. For females in the 1+1 mating system, the gestation period was shortened by 0.4-0.5 days for every day that mating was delayed. In this system, the gestation period was 1.5 days shorter for older females than for yearlings. In the 1+9 system the gestation period was not significantly influenced by date of first mating. In this system, both age categories showed about the same reproductive performance: 6.0 (yearlings) and 6.3 (older females) kits born per litter. In the 1+1 sytem, litter size was 5.5 for yearlings and 6.7 for older females. For older females mated 1+1, there was a positive linear relationship between litter size and mating date (0.16 kit per day).

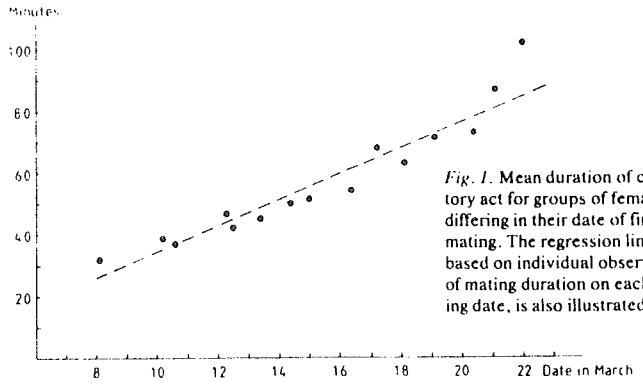


*Fig. 1.* Mean duration of copulatory act for groups of females differing in their date of first mating. The regression line, based on individual observations of mating duration on each mating date, is also illustrated.

*Acta Agric. Scand., 39, 23-41, 1989. 15 tables, 1 fig., 24 references. Authors' summary.*

**Timing and systems of mating mink.**

*B.D. Babak.*

Female mink at 3 farms were mated on days 1 and 8; 1, 8 and 9; 1, 2, 7 and 8; 1, 7 and 8; or 1, 7 and 14 of the breeding season. There were 113-262 females in each group. The largest litters per female mated (5.73) were obtained for females mated on days 1, 7 and 8; for females mated on days 1 and 8 the litter sizes were 5.60-5.70 vs. 4-17-5.47 for other systems of mating. Increasing the number of matings per female from 2.5 to 4.8 did not result in a greater number of females conceiving or larger litters. The number of matings per male increased from 11.1 at 2 days of exposure to 17.1 at 4 days.

*Sbornik Nauchnykh Trudov, Moskovskaya Vet. Akademiya, 147, 150-156, 1986. 6 tables. In RUSS. CAB-abstract.*

**A study on factors influencing gestation length, litter size and sex ratio in mink.**

*K.D. Seo, C.K. Kim, Y.C. Chung, K.S. Lee.*

This study was conducted to determine the effect of breed, dam age, date of

mating, mating system and month of whelping on gestation length, litter size and sex ratio in the female mink. A total of 454 litters during 1981 and 1982, of which 211 were Standard Dark, 19 were Black Cross, 49 were Pastel, 82 were Sapphire, 79 were Jet Black and 14 were Violet breed, were used for the least-squares analysis. All females were raised at the experimental farm of Yonam Junior College, Chungnam, Korea. The gestation length for the 454 litters averaged 47.35 days. The difference in the gestation length among the 6 different breeds, 3 dates of mating, 9 mating systems and 2 whelping months were highly significant ($p < 0.01$) and also the effect of dam age were significant ($p < 0.05$). The gestation length of Sapphire and Violet breed, 1-year-old dam, mating between the 3rd and 10th of March, 1-mating system and whelping in May had the longest gestation length, respectively. The mean litters was 5.70 kits, 2-year-old dam weaned 0.71 more kits per litter than 1-year-old dam ($p < 0.01$). However, although there was a tendency towards smaller litter sizes in Violet breed, mating from 18th of March onwards, 2-mating system with an interval of 6-10 days after the 1st mating, and whelping in May, there were no significant differences among the different breed, date of mating, mating system and whelping month. The mean sex ratio after weaning was 46.94% for the 454 litters. No significant differences in sex ratio could be found among the ages of dam, dates of mating systems and whelping months except among the breeds ($p < 0.05$).

*Japanese Society of Zootechnical Science, Tokyo Japan, 1983. (Fifth World Conference on Animal Production, August 1982, 3667-368). 1 table, 10 references.*
*Authors' summary.*

**Effect of different sperm number on fertility after artificial insemination of foxes.**

*Jan A. Fougner, Mats Forsberg.*

A total of 324 blue fox vixens were inseminated with fresh semen from 50 silver fox males. Each ejaculate was divided into 4 portions and diluted so as to contain 100, 60, 40, and 20 million sperm/ml. Vixens in groups 1, 2, 3 and 4 had been randomly assigned to their group at the time of insemination. The animals were inseminated once with either 100, 60, 40, or 20 million sperm. Vixens in groups 5 and 6 were selected by the technician after detecting signs of estrus during a physical examination. Animals judget to be at their optimal time for conception were assigned to group 5 and inseminated once with 20 million sperm. Animals considered to be early in their heat were assigned to group 6 and inseminated twice within 24 to 36 h with 20 million sperm per insemination dose. All inseminations were performed within 3 h of semen collection. A 1-ml total volume of extended semen was used for intrauterine deposition. In the random group inseminated once with 20 million sperm (group 4), both pregnancy rate and litter size were lower compared to the other random groups (groups 1, 2, and 3), although the difference was not statistically significant. Among the vixens inseminated with 20 million sperm (group 4, 5, and 6) there was a significant difference in fertility between animals randomly selected and inseminated once and those selected by the technician and inseminated twice (group 6). Our results suggest that for the cross-breeding of foxes 20 million sperm is the minimum insemination dose required for acceptable fertility with the present technique for sperm preservation and estrous determination.

*Acta Vet. Scand., 28, 403-407, 1987.*
*1 table, 8 references. In ENGL. Su: NORG.*
*Authors' summary.*

**Insemination of foxes.**

*Liisa Jalkanen.*

In 1988, in Finland, 188,433 fox females were inseminated, representing 25% of the total population. Of blue fox females, 58% were inseminated with silver fox semen and 10% with blue fox semen, and of silver fox females, 21% were inseminated with silver fox semen and 1% with blue fox semen. For silver x blue, blue x blue and silver x silver matings, the CR was 81.9, 80.4 and 75.4% resp., and litter size

averaged 4.20, 5.32 and 2.41 cubs. Results are compared with those in previous years.

*Finsk Pälstidskrift, 22, 11, 458-459, 1988. 3 tables, 4 figs. In SWED. CAB-abstract.*

**Whelping results of mink in 1988.**

*Anonymous.*

For 676,000 mink females at 1157 farms in Finland, litter size averaged 3.77 kits per mated female in 1988 vs. 3.83 in 1987, and the percentage of infertile females plus females which lost their kits was 23.20. Litter size of Scan Black females averaged 3.52 kits per mated female.

*Finsk Pälstidskrift, 22, 7-8, 269, 1988. In SWED. CAB-abstract.*

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NUTRITION

**Effects of dietary supplement of methionine and lysine on blood parameters and fur quality in blue fox during low-protein feeding.**

*Jouko Työppönen, Hans Berg, Maija Valtonen.*

Four groups of blue fox (*Alopex Lagopus*) were fed from weaning to pelting with feed of two different protein levels. The metabolizable energy (ME) from protein amounted to 35/30% in the control group and 22/18% in three low-protein groups during the early and late growth period, respectively. One of the low-protein groups received an unsupplemented diet. The second low-protein diet was fortified with methionine, and the third with methionine and lysine to the same level as in the control diet. Hematological values, urea and creatinine were lower in all low-protein groups as compared to the control group. The activities of amino acid metabolizing enzymes ASAT, ALAT and GGT in plasma were lower in the low-protein groups although the relative sizes of the liver and kidneys were greater. The lowered protein content in the feed was sufficient for growth, and only a slight negative effect on fur characteristics was observed. The dietary supplementation of methionine and lysine yielded no improvement in the fur quality or other parameters as compared to the unsupplemented low-protein feed, indicating that there was no deficiency of these amino acids in these low-protein feeds.

*J. Agric. Sci., Finland, 59, 355-360, 1987.*
*7 tables, 18 references. Authors summary.*

**Flushing of mink. Effect of plasma progesterone, plasma estradiol, implantation rate and reproductive performance.**

*Anne-Helene Tauson, H. Gustafsson, I. Jones.*

Flushing by ad libitum feeding following a period of restriction has resulted in improved litter size in mink. In this investigation effects of 4 different flushing models on plasma estradiol-17$\beta$, plasma progesterone, number of corpora lutea, implantation sites and litter size were studied. Flushing from March 4, preceded by moderate restriction, resulted in superior estimated number of corpora lutea and a tendency for increased number of implantation sites and litter size. Plasma estradiol-17$\beta$ tended to increase from February 25 to March 8 but was not affected by the experimental treatment. Plasma progesterone levels started to increase 4.0-7.7 days before the estimated day of implantation (34.0-37.7 days before parturition). The interval between day of increase in plasma progesterone and recorded day of peak plasma progesterone was shorter in three of the flushed groups compared with the control group. The level of plasma progesterone was not affected by the experimental treatment, estimated number of corpora lutea, number of implantation sites or litter size.

*Acta Agric. Scand. 38, 421-432, 1988.*
*4 tables, 6 figs., 17 references.*
*Authors' abstract.*

**The effect of dietetic Vantosil, copper and zinc in young minks.**

*Heddie Mejborn, Asbjørn Brandt.*

In a factorial experiment with mink kits, the effect of the content of Vantosil IB, copper and zinc in the feed was investigated. In the present experiment it has not been possible to show any significant effect of various levels of Vantosil IB, copper and zinc in the feed on the development and priming of pastel mink kits. However, animals with a high intake of Vantosil IB (corresponding to conservation of the feed with 3% "Biensil") tended to have a lower zinc content in tissue and hair, and the copper content in tissue and hair and the iron content in tissue from these animals were influenced negatively. This seems to indicate that Vantosil

IB has restrained the mineral intake of the animals. At the same time animals with a low copper intake tended to have grey underfur and a lower fur quality. The haematological status of the animals was not significantly influenced by the experimental treatment, but the amount of transferin bound iron in the blood plasma has been influenced negatively, stressing the potent chelating effect of Vantosil. Vantosil IB had no effect on the iron, zinc and copper balances of the animals, and the digestibility of crude protein, crude fat and crude carbohydrate was no influenced either.

*Statens Husdyrbrugsforsøg, Meddelelse 714, 1988. 8 tables, 1 reference. In DANH. Authors' summary translated by Hanne Artved.*

**Nutrient balance in feeding carnivorous fur-bearing animals on local resources.**

*Speranta Sava, O. Sava, C. Murar, G.H. Spiridon.*

Values for DM, metabolizable energy, crude protein, crude ether extract, nitrogen-free extract, calcium and phosphorus are tabulated for 16 kinds of slaughterhouse waste used for feeding mink and fox in the Tigru Mures area of Romania.

*Rev. de Cresterea Animalelor, 36, 1, 35-39, 1986. 2 tables, 7 references. In ROMN. CAB-abstract.*

**Digestibility of different fats and fatty acids in the blue fox (Alopex lagopus).**

*Kirsti Rouvinen, Tuomi Kiiskinen, Jaakko Mäkelä.*

The influence of the level and type of fat on the digestibility of fat and different fatty acids in the blue fox was studied (experiment A). The possible synergistic effect of saturated and polyunsaturated fatty acids was also clarified (experiment B). The fats employed in experiment A were beef tallow, capelin oil and rapeseed oil and in experiment B beef tallow and soybean oil. Digestibilities were determined by the AIA-indicator method, 0.5% silicate (Celite 545) in feed served as an indicator. The animals in experiment A were adult breeding animals, two males and 2-6 females per group. In experiment B 5-month-old male-female pairs were used, 5 pairs per group. The apparent digestibilities of beef tallow, capelin oil and rapeseed oil on a 15% level of supplemental fat were 88, 96 and 95%, respectively. The corresponding values on a 25% level were 87, 97 and 96%. The digestibilities of beef tallow, soybean oil and their mixture (50:50) on a 20% level of supplemental fat were 93, 96 and 95%, respectively. In experiment A the increase in fat level had no influence on the digestibilities of fat or any other nutrients although it significantly increased metabolizable energy (ME) and its percentage of the gross energy (GE) of the diet. Fat type influenced the digestibility of fat and the utilization of GE. There was also a level x type interaction in the ME of the diet. An over 10% increase in tallow level, the proportion of ME derived from fat increasing from 37 to 50%, caused no change in the digestibility of saturated fatty acids or total fat. Although tallow is a very saturated fat source it is fairly efficiently digested in the blue fox. In experiment B a compensatory increase in the digestibility of protein and carbohydrates could be seen in the tallow containing groups compared to the soybean oil group. No synergistic effect between tallow and soybean oil could be found.

*Acta Agric. Scand., 38, 405-412, 1988. 5 tables, 16 references. Authors' summary.*

**Effect of the quality and method of storage of frozen krill on its suitability as feed.**

*K.A. Mrochkov, G.S. Shepeleva, V.K. Yudin.*

Large (43 to 54 mm) and small (33 to 42 mm) krill were stored on deck at -1 to +3 deg.C before freezing as whole krill or as a meal without or with supplements of a mixture of low-molecular fatty acids (preparation NMZhK-6) then stored at -16 to -18 deg.C for 4 or 8 months. There was a deterioration in organoleptic properties or large and small krill after storage on deck for 12 and 6 h, respectively.

Table 5. *Digestibility coefficients for different fatty acids and fatty acid groups in experiments A and B*
For further explanations see Tables 3 and 4

| | Experiment A | | | | | | Experiment B | | |
|---|---|---|---|---|---|---|---|---|---|
| Fatty acids | 1L Beef tallow | 2L Capelin oil | 3L Rape-seed oil | 1H Beef tallow | 2H Capelin oil | 3H Rape-seed oil | 1 Beef tallow | 2 Soybean oil | 3 Tallow: Soybean oil |
| C14:0 | 95.5 | 98.5 | 71.5 | 93.0 | 99.2 | 82.6 | 97.4a | – | 96.0c |
| C16:0 | 86.0 | 94.4 | 83.3 | 85.3 | 95.6 | 86.4 | 91.1c | 93.2a | 91.6b |
| C18:0 | 80.2 | 75.5 | 76.5 | 83.3 | 69.7 | 79.6 | 86.8 | 85.8 | 86.8 |
| C20:0 | 74.6 | – | 86.2 | 80.6 | – | 89.7 | 86.0 | 85.0 | 85.0 |
| Saturated | 83.8 | 93.8 | 81.2 | 84.8 | 95.2 | 84.9 | 89.1 | 90.8 | 89.6 |
| C16:1ω7 | 97.8 | 98.7 | 83.5 | 95.0 | 98.8 | 89.2 | 99.1d | 77.3a | 97.5d |
| C18:1ω9 | 95.9 | 94.6 | 97.3 | 90.7 | 96.3 | 97.5 | 98.4a | 96.5d | 97.5ac |
| C20:1ω9 | 90.3 | 98.6 | 95.7 | 83.5 | 98.3 | 95.7 | 95.8d | 86.5a | 93.0c |
| C22:1ω11 | – | 97.9 | 91.7 | – | 97.0 | 93.2 | – | – | – |
| Monounsat. | 95.8 | 97.3 | 96.9 | 90.8 | 97.3 | 97.1 | 98.4d | 95.9a | 97.4ad |
| C18:3ω3 | 96.0 | 93.8 | 98.4 | 92.1 | 96.1 | 98.6 | 96.9a | 98.4c | 98.8d |
| C18:4ω3 | 98.9 | 98.3 | – | 93.7 | 99.6 | – | 100.0 | – | – |
| C20:5ω3 | 100.0 | 98.9 | 86.4 | 93.0 | 99.0 | 90.3 | 100.0dc | 93.8a | 96.3ba |
| C22:6ω3 | 90.7 | 98.0 | 82.4 | 90.5 | 98.6 | 81.3 | 95.6d | 90.5a | 96.7d |
| ω3-series | 95.7 | 97.9 | 96.4 | 92.2 | 98.6 | 97.4 | 97.5b | 97.3c | 98.2a |
| C18:2ω6 | 91.4 | 80.0 | 95.7 | 87.5 | 87.2 | 96.5 | 95.7a | 98.1d | 98.6d |
| ω6-series | 90.8 | 79.7 | 95.1 | 86.6 | 86.5 | 96.1 | 96.3a | 97.9 | 98.5b |

| Experiment A: Significance ($p$) | Fat level | Type of fat | Level × type |
|---|---|---|---|
| Saturated | <0.01 | <0.001 | <0.001 |
| Monounsaturated | <0.001 | <0.001 | <0.001 |
| ω3-series | NS | <0.001 | <0.001 |
| ω6-series | NS | <0.001 | <0.001 |

During cold storage there was a further dulling of the colour in whole krill. Untreated and treated meal retained their bright orange and dark-claret colouring. Large fresh krill had more protein, 18.5% more amino acids and 10% more essential amino acids than had small krill. Lipid oxidation processes were similar in both sizes of krill. Lipid hydrolysis was twice as great in small krill. Large krill had 2% more polyunsaturated fatty acids, especially arachidonic and eicosapentaenoic acids. During cold storage for up to 8 months quality of large krill was maintained. That of small krill deteriorated. In treated meal proteins underwent partial acid hydrolysis during cold storage making them more easily assimilated. Growth and fur quality was studied in 6 groups of 100 pastel mink given mixed diets without or with equal amounts of the different forms of krill. Mink given small whole krill showed retarded growth and had poor-quality pelts. Best results were with treated meal.

*Rybnoe Khozyaistvo, Moscow, USSR, 11, 71-75, 1987. 6 tables. In RUSS. CAB-abstract.*

## The feeding of blue foxes.

*Anonymous.*

Suitable feedstuffs for blue foxes, energy content of diet at different stages, feeding intensity (uniform for males, seasonally variable for vixens and high in early growth period), feed refusal in autumn, feed consumption, cub weight and growth pattern are discussed, with reference to Scandinavian literature. Suitable feedstuffs of animal origin and problems in choice of fish are largely the same as for mink, but foxes are better able to digest protein from dry animal feed, especially meat meal and fish meal high in ash. Foxes also require more carcass waste, liver and blood, up to at least 25% in the breeding period. Without impairing fertility or pelt quality foxes can consume considerably more carbohydrate than mink, and also take cooked cereal up to 10 weeks old and uncooked at the adult stage.

*Deutsche Pelztierzuchter, 62, 1, 4-5, 1988. 3 tables. In GERM. CAB-abstract.*

**Results of feeding trials during the breeding period in 1988.**

*Tuula Dahlman.*

For 76 mink females at Kyrkslatt, fed a diet of offal treated with formic and lactic acid during the breeding period, the percentage of non-pregnant females was 27.6 vs. 25.7 for 70 females fed a standard diet, the number of kits per mated female on 31 May averaged 4.0 vs. 3.8 and kit weaning weight 620 and 472 g resp. for males and females vs. 537 and 436 g. For 99 female mink at Maxmo, fed a high carbohydrate diet, the percentage of non-pregnant females was 9.1 vs. 13.3 for 98 females fed a standard diet, the number of kits per mated female on 31 May averaged 5.02 vs. 4.63 and kit weaning weight of males plus females 364 g vs. 324. For blue fox females at Maxmo (34-38 females per group) fed (1) dry food + 25% offal + 1% blood, (2) a high carbohydrate diet or (3) dry food only, the percentage of non-pregnant females 3 wk after mating was 7.9, 35.3 and 43.2 vs. 28.9 for control females fed a standard diet, and the number of cubs per mated female 3 wk after parturition averaged 8.13, 5.56 and 5.70 vs. 6.53.

*Finsk Pälstidskrift, 22, 11, 443-444,1988. 4 tables. In SWED. CAB-abstract.*

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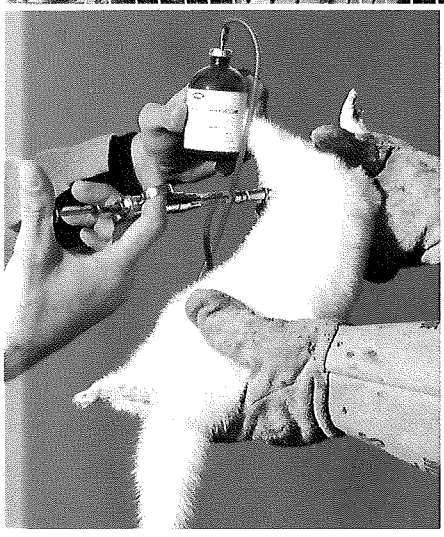

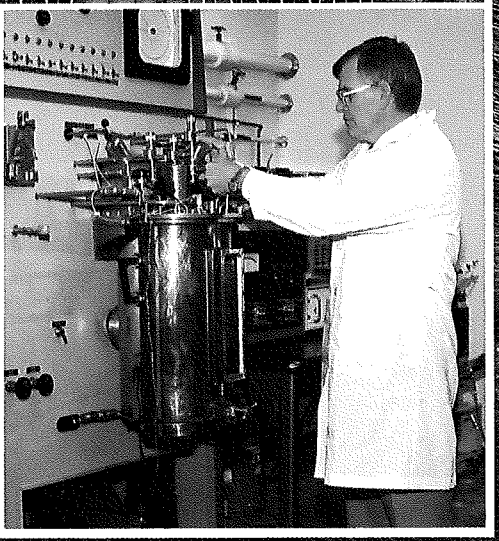

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*Original Report*

# Thymic hypoplasia in weak platinum fox pups.

*Detlef Klaus Onderka*
*Alberta Department of Agriculture, Animal Health Division, Veterinary Laboratory, 6909-116 Street, Edmonton, Alberta, Canada T6H 4P2.*

**Summary**
Four Platinum fox pups from 3 litters of Silver foxes initially grew at a normal rate but after 3-4 weeks failed to gain weight, became anoretic, lethargic and eventually died within 1-2 weeks. Some developed *E. coli* septicemia and pneumonia. Affected pups had markedly smaller thymuses weighing only 0.2 - 0.5 gm as compared to 1.7 gm in normal pups of similar age. The primary change was cortical hypoplasia with some having enlarged Hassal's corpuscles. There was poor lymphoid cell development in the spleen. The clinical signs resembled "fading" syndrome with congenital immune deficiency as the likely underlying cause.

**Introduction**
Weak offsprings and perinatal mortality are well known problems in many animal species including dogs, cats (*Fox, 1963; Hime 1963; Norseworthy, 1979*), foals (*Poppie, 1977*) mink and foxes (*Venge, 1959*). Underlying causes include viral or bacterial infections, nutritional deficiencies and toxins (*Davies and Skulski, 1956; Fox, 1963; McKiernan et al., 1981; Scott, 1979*). The role of the thymus gland in predisposing newborn animals to metabolic disturbances and infections due to immune deficiency has been documented in mice (*Good et al., 1962*), foals (*Splitter et al., 1979*) and suggested in dogs and cat (*Roth, 1987*). This report describes the gross and microscopic changes in the thymus of Platinum fox pups with "fading" syndrome.

**Case history, materials and methods.**
Four 5-week-old Platinum pups from three different litters were submitted for necropsy. They were apparently healthy at birth. Initially, they grew at the same rate as their Silver litter mates. At three weeks of age they started to eat solid food and were then injected with iron-dextran. At four weeks of age they became anoretic, listless and stopped growing despite being hand fed or given to other vixens and being treated with injectable Tetracycline and supplemented with Vitamin B complex and Calcium. Eventually they died giving the rancher the impression that they "shrank and faded away". Routine necropsies were done and tissues were fixed in 10% buffered formalin, embedded in paraffin, sectioned and stained with Hematoxylin/Eosin for microscopic examination. From two pups, intestines were submitted for direct electron microscopic examination of mucosal scrapings and for the detection of parvo-virus using a hemagglutination test on African Green monkey red blood cells. Histologic sections of thymus were quantitatively assessed using a Kontron Bildanalyse image analysis system (*Kontron, Munich, W. Germany*).

## Results

All pups were in thin body condition with resorption of all internal body fat reserves. Their eyes were sunken and the skin had lost its elasticity. In one pup, the ventral portion of the lung lobes was dark red and firm. This was due to an *E. coli* induced pneumonia, characterized by extensive alveolitis with much neutrophil invasion. Another pup had *E. coli* septicemia causing congestion of pericardium and liver and fibrinous exudate on the intestinal serosa. In all four pups the thymus was very small (Fig. 1) weighing 0.5 gm in three of the animals and 0.2 gm in the fourth. By comparison, six-week-old Silver fox pups and normally grown Platinum fox pups submitted for different reasons had an average thymus weight of 1.7 gm (Fig. 2). Microscopic

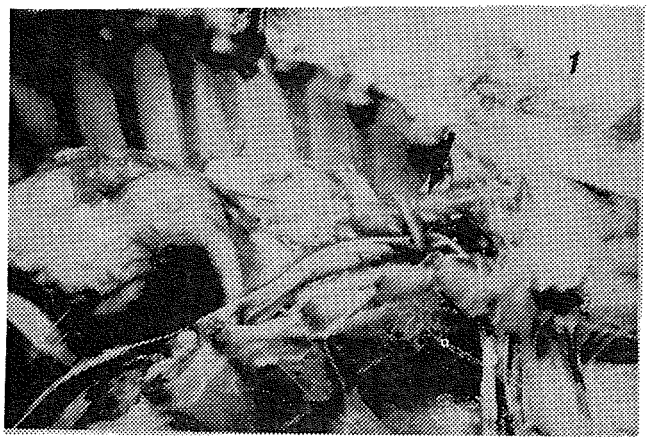



*Fig. 1.*
*Marked hypoplasia of the thymus (arrow) in a 5-week-old Platinum fox pup with "fading" syndrome.*

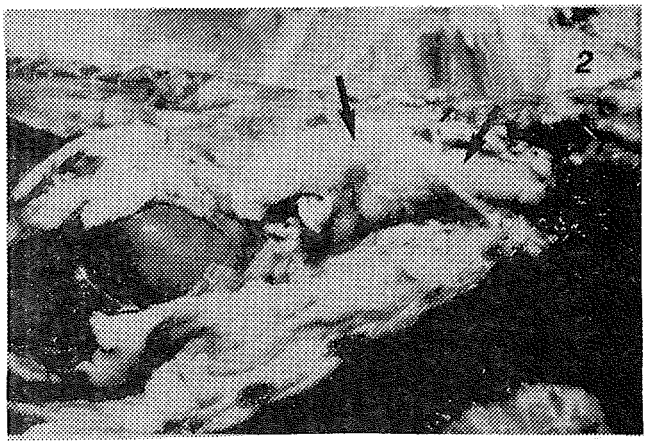
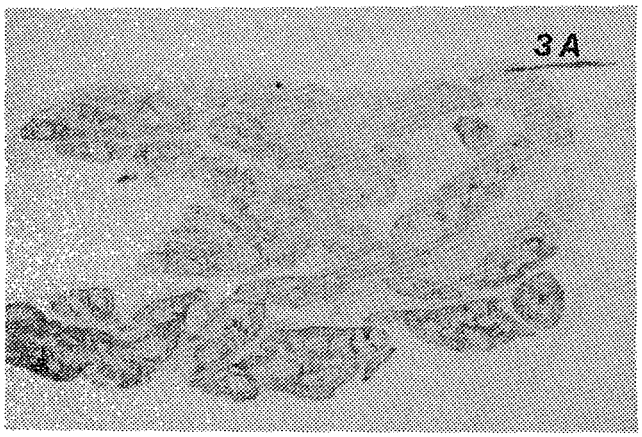



*Fig. 2.*
*Well developed thymus gland (arrows) in a normal Platinum fox pup.*

examination showed marked thymic cortical hypoplasia with lack of differentiation between cortex and medulla (Fig. 3). Hassall's corpuscles appeared somewhat enlarged (Fig. 4). The ratio of the cellular component to Hasall's corpuscles was 4.42



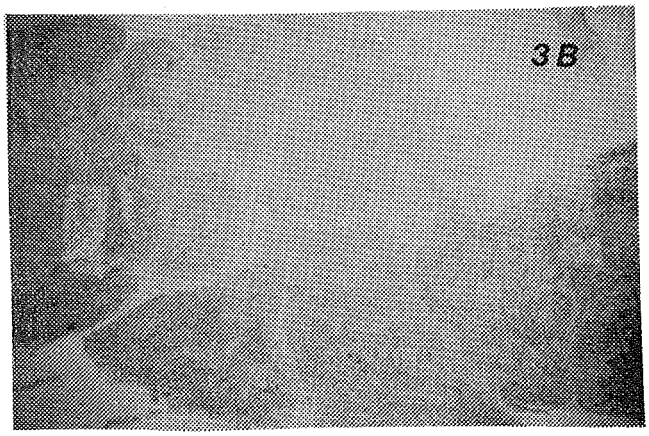




*Fig. 3.*
*A: Cortical hypoplasia and slightly enlarged Hassal's corpuscles in a Platinum fox pup with "fading" syndrome. Thymic lobes are separated by increased connective tissue.*

*B: Normal thymus from a healthy Platinum pup of similar age. H & E, X 16.*

*Fig. 4.*
*Hypoplastic thymus from a 5-week-old Platinum fox pup with "fading" syndrome. There is cortical hypoplasia with loss of differentiation between cortex and medulla. Hassal's corpuscles (arrows) are enlarged. H & E, X 80.*

compared to 11.16 for normal pups thus confirming the lymphoid hypoplasia. Average corpuscle size was 2.8 $\mu^2$ and only slightly larger than 2.3 $\mu^2$ in the normal thymus. The spleen was hypocellular with absence of follicles. Tests for viruses were negative.

**Discussion**

The problem of weak Platinum fox pups has been known for almost fifty years. It is thought to be a genetic problem, the mechanism of which is not fully understod (*O. Lohi,* Institute of Fur Animal Science, Hillerod, Denmark, personal communication, 1987). It does not occur in all Platinum offsprings but is sufficiently widespread on some ranches in Western Canada to cause problems in pup production. In this case, almost 50% of 15 Platinum pups died despite supportive therapy. These pups failed to thrive and seemed to be susceptible to infectious disease caused by common environmental bacteria. Since the thymus plays an important role in the immune function by supporting the normal development of the paracortical areas of lymph nodes and periarteriolar areas of the white pulp in the spleen (*Good, 1962; Miller, 1961*), the observations of markedly reduced thymic tissue in affected pups suggests immune deficiency as an underlying cause for their "fading" syndrome. Unfortunately, blood samples were not available for immunoglobulin measurements. However, the fact that this syndrome occurred after the pups took solid food thus reducing their passive immunity received through the vixens milk lends support to the suggestion of a congenital immune deficiency syndrome. It is recommended not to use the parents of such offsprings nor their litter mates for further Platinum production.

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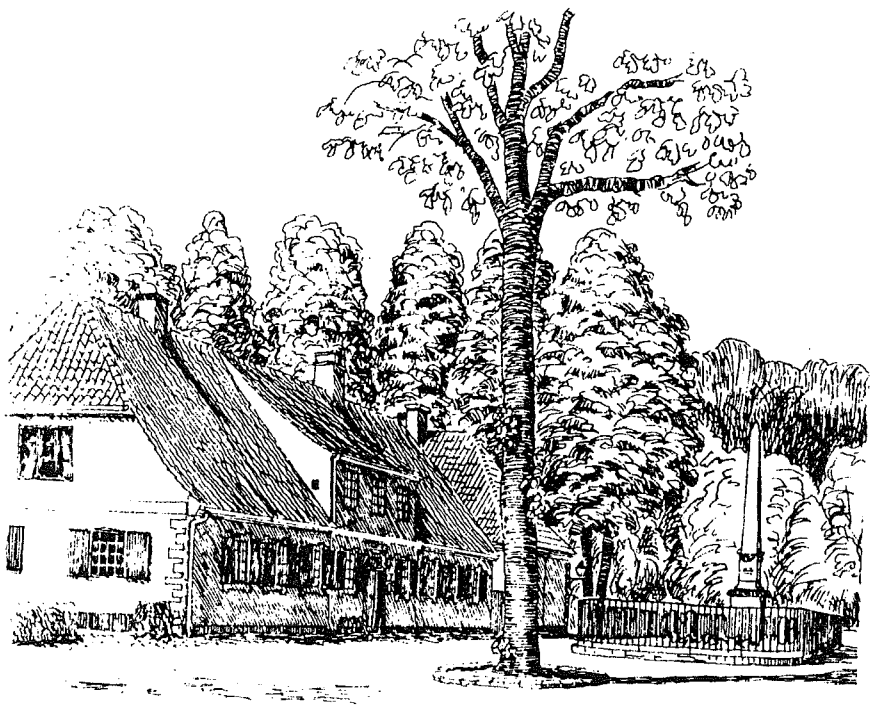


**Wet belly in mink. Diagnosis using the urine testing strip method.**

*Tove Nørgård Clausen, Asbjørn Brandt.*

Urine samples were obtained in July, Sep., and Oct. from 1800 mink males at 3 farms in Denmark and were tested by means of a urine stick; blood samples were also collected from some of the mink. The incidence of males affected by wet belly was 14, 20, 21, 10, 27 and 20% resp. for Pastel, Pearl, Sapphire, Standard, White and Violet mink, indicating genetic susceptibility of light colour types. The incidence of wet belly was significantly correlated with the concentration in urine of blood, protein and glucose, and with the concentration of urea and creatine kinase activity in blood.

*Faglig Årsberetning 1987, 106-111, 1988. 2 tables, 2 references. In DANH. CAB-abstract.*

**Fatty liver syndrome in mink females during pregnancy and lactation.**

*P.E. Martino, J.A. Villar.*

Fatty liver (hepatic lipodosis) is a common finding in mink at post-mortem investigations in females dead during pregnancy and lactation periods. We autopsied several of them in the last 2 years with this pathomorphological change. The responsibility of nutritional and stress factors are discussed.

*Vet. Argentina, 9, 39, 1987. 1 fig., 8 references. In SPAN. Su. ENGL. Authors' summary.*

**Pathological observations of nursing sickness in mink.**

*Yukio Seimiya, Fuminari Kikuchi, Shuichi Tanaka, Kan-ichi Ohshima.*

On a mink farm which kept 230 females and 60 males, seventy lactating females died in 5-7 days after showing extreme emaciation, staggering gait and cannibalism. The main PM findings were depletion of subcutaneous and visceral fat, greatly enlarged and softened yellowish greasy liver, and yellowish kidneys. Microscopically, extreme fatty accumulation was seen in liver cells and the renal cortex. Pregnancy toxaemia, bacterial toxaemia and chemical poisoning were discounted, and nursing sickness was diagnosed. It was concluded that the ration supplied had been too rich in protein (60-65.5%) and too low in fat (8.4-16%) and carbohydrate (6.4-7.1%), all on a dry weight basis.

*Japanese Journal of Vet. Science, 50, 1, 255-257, 1988. 1 table, 2 figs., 6 references. In ENGL. Su. JAPN. CAB-abstract.*

**Polycystic disease of the kidney in related mink.**

*Per Henriksen.*

Polycystic kidneys in young related mink kits were seen on a mink farm in 1983 (4 kits) and 1984 (6 kits). The kits showed retarded growth and locomotor abnormalities leading to death in the 1983 at the age of 4 months. The renal cysts involved the collecting tubules; there was vacuolization and focal hyperplasia of the epithelium. Other organs were normal. The data available for the condition in mink are insufficient as yet to explain the mode of inheritance.

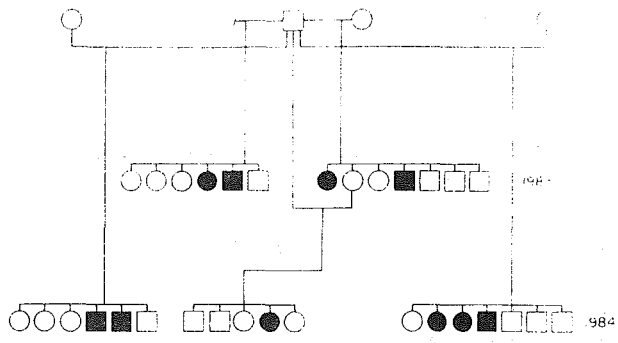



Fig. 1. Inheritance of polycystic kidney disease in mink. ● = affected female; ■ = affected male; ◐ = unaffected female; □ = unaffected male.

*J. Comp. Path., 99, 101-104, 1988. 3 figs., 11 references. Author's summary.*

**Studies into enteral influenza infection of ferret.**

*H. Glathe, A. Lebhardt, M. Hilgenfeld, B. Brandt, H.-U. Strittmatter.*

Influenza strains A/Hongkong/1/68 (H3N2) and A/Krasnodar/101/59 (H2N2) were applied to ferrets, orally through intragastric tube and through rectal catheterisation. Nasal and anal excretion of virus was established, following application of strain A/Hongkong/1/68. While none of the infected animals exhibited any clinical sign of respiratory disease, enteritis was recorded and found to last at least three days. Virus was isolated also from the lumen and lining cells of various intestinal sections, primarily from the colon. Virus antigen was detected in colonic mucosa cells by means of immunofluorescence. A few antigen-positive cells were found also in the jejunum and duodenum. The cases of virus isolation from the respiratory tract are discussed as having possibly resulted from aspiration of virus following oral application and nasal uptake of virus which had been excreted the anal route, in the first place. Neither anal excretion of virus nor any other sign of virus replication in the digestive tract was detected in the wake of oral application of strain A/Krasnodar-/101/59.

*Arch. exper. Vet.med., Leipzig, 38, 5, 771-777, 1984. 4 tables, 2 figs., 22 references. In GERM. Su: RUSS, ENGL. Authors' summary.*

**Campylobacter-like omega intracellular antigen in proliferative colitis of ferrets.**

*James G. Fox, G.H.K. Lawson.*

Proliferative colitis in the ferret consistently displays, along with marked proliferation of mucosal cells, intracytoplasmic campylobacter-like organisms within the apical portion of the epithelial cells. Fluorescent antibody to "omega" campylobacter antigen present in porcine intestinal adenomatosis and hamster proliferative ileitis was demonstrated at the site of bacterial colonization within hyperplastic epithelial cells of six colons from ferrets affected with proliferative colitis.

*Lab. Animal Science, 38, 1, 1988. 3 figs., 16 references. Authors' abstract.*

**Dermanyssus gallinae (de Geer 1778) on coypu (Myocastor coypus).**

*Wlodzimierz A. Gibasiewicz.*

In a coypu colony kept in concrete cages without swimming facilities and free access to water, a heavy infestation of Dermanyssus gallinae was diagnosed in the groins of young animals weakened by Salmonella infection. The transmission of the parasite from poultry could be attributed to wild birds and flies. D. Gallinae is the tenth ectoparasite so far found on coypu.

*Medyzyna Weterynaryjna, 43, 10, 593, 1987. 2 figs. In POLH. CAB-abstract.*

**Cryptosporidiosis in ferrets.**

*Jerold E. Rehg, Francis Gigliotti, Dennis C. Stokes.*

The diagnosis of cryptosporidiosis in two ferrets who died from unrelated causes prompted a survey to determine the prevalence and incidience of the infection in ferrets at our facility. The survey of the existing ferret population and all new arrivals indicated cryptosporidiosis occurred as a subclinical disease in a high percentage of young ferrets: 40% of the ferret population and 38 to 100% of the new arrivals had cryptosporidial oocysts in their feces. The infection was found to persist for several weeks in both immunocompetent and immunosuppressed ferrets. The interspecies transmission of *Cryptosporidium* implies that infected ferrets should be considered a potential source of infection for the general population.

*Lab. Animal Science, 38, 2, 155-158, 1988. 4 figs., 2 tables, 15 references. Authors abstract.*

**The coccidia species occurring in two mink farms in Ankara.**

*Recep Tinar.*

Since mink breeding is very new in Turkey, information about the parasites in these animals is not known yet. Therefore this parasitological surway was conducted in two mink farms around Ankara.

In this study, 22 animals were systematically studied at autopsy. In addition, intestinal tracts of 9 animals and 150 fecal samples were also examined. In 60 out of 181 intestinal contents, the only parasites found were coccidial oocysts. The number of animals infected with single, two, three or four different coccidial species were 27, 22, 10 and 1 respectively. The species of coccidia occurred in these animals were identified as Isospora laidlawi (in 36 animals), Eimeria vison (in 33 animals), E. ictidae (in 24 animals) and E. mustelae (in 11 animals).

The number of coccidial oocysts counted in per gram of feces of infected animals were found to be between 100 and 2600.

*A.Ü. Vet. Fak. Derg., 32, 3, 464-473, 1985. 1 table, 7 figs., 13 references. In TURK. Su: ENGL. Author's summary.*

**Delayed neurotoxic effects of tri-o-tolyl phosphate in the European ferret.**

*A.M. Stumpf, D. Tanaka, Jr., R.J. Aulerich, S.J. Bursian.*

The development of organophosphorus-induced delayed neurotoxicity (OPIDN) was studied in the European ferret (Mustela putorius furo). A single oral or dermal dose of 250, 500 or 1000 mg tri-o-tolyl phosphate (TOTP/kg body weight was administered to adult male ferrets. Corn oil served as the vehicle in the oral test and 95% ethanol was the vehicle in the dermal test. AT 48 h posttreatment, half the animals in each group were killed by cervical dislocation for assessment of whole-brain neuropathy target esterase (NTE) activity. The remaining 5 animals per group were observed and examined neurologically on a daily basis for a subsequent 54 d. All ferrets dosed dermally with 1000 mg TOTP/kg body weight developed clinical signs characteristic of OPIDN ranging from ataxia to partial paresis. Ferrets administered 250 and 500 mg TOTP/kg body weight via the dermal route displayed variable degrees of hind limb weakness and ataxia. Of the animals dosed orally, only those in the 1000 mg TOTP/kg body weight group showed clinical signs indicative of OPIDN. These signs did not progress beyond mild ataxia. Small amounts of axonal degeneration were noted in the dorso-lateral part of the lateral funiculus and in the fasciculus gracilis of spinal cords in ferrets receiving dermal doses of 1000 mg TOTP/kg body weight. Whole-brain neuropathy target esterase activity was also maximally inhibited (46%) in animals receiving 1000 mg TOTP/kg dermally. These results suggest that the ferret is a species that is susceptible to OPIDN.

*J. Toxicology and Environmental Health, 26, 61-73, 1989. 3 tables, 2 figs., 29 references. Authors' summary.*

**A collective outbreak and control of hemorrhagic pneumonia in mink.**

*Hiroshi Akimoto, Yuji Mikami, Hajime Satoh, Tokanobu Unuma, Kuniichi Tada.*

An enzootic of hemorrhagic pneumonia was found on a farm of 90,000 mink in Memuro-shi, Hokkaido. More than 15,000 kittens of 55,000 succumbed to the disease. The prominent clinical findings were dyspnea, hemoptysis and epistaxis. *Pseudomonas aeruginosa* was isolated from visceral organs. It was also isolated from the raw ingredients of feed. It was comparatively warm and humid in the district. Inspection revealed that cleaning and disinfection of the farm facilities were insufficient. In the following years, the disease was controlled by the use of a halogen disinfectant vaccination of kittens with *P. aeruginosa* multicomponent vaccine.

*J. Jap. Vet. Med. Ass., 40, 10, 735-738, 1987. 2 tables, 4 figs., 14 references. In JAPN. Su: ENGL. Authors' summary.*

**Controlling ectoparasites of mink.**

*A.E. Khrutskii, V. Ya. Linnik, I.T. Arzamasov, A.G. Lebetskaya, V.F. Litvinov.*

In be Belorussian Republic, young mink tended to become infested with the fleas Ceratophyllus sciurorum and Xenopsylla cheopsis, and also the mite Dermanyssus gallinae. Hygienic measures served to break the life cycle of these parasites. "Akrodex" and "Insektol" aerosols could be used.

*Veterinariya, Moscow, USSR, 5, 3839, 1988. In RUSS. CAB-abstract.*

**To an epizootic of yersiniosis in chinchilla?**

*J.M. Gueraud.*

For last year has been isolated the same strain of *Yersinia enterocolitica* from three different chinchilla breedings. Lesions, organs in which the *Yersinia* has been found and the method of isolation are described.

*Bull. Acad. Vet. de France, 61, 95-98, 1988. 14 references. In FREN. Su: ENGL. Author's abstract.*

**Determination of some markers of Aleutian virus infections in mink.**

*L. Bobak, F. Lesnik, J. Knezik, P. Balent, M. Danihel.*

Studies on Aleutian disease of minks were conducted to examine some markers of the infection. Hypergammaglobulinemia and hypogammaglobulinemia were confirmed in experimentally infected minks in relation to defined time intervals from the time of infection. Similar results were obtained in examinations of naturally infected (IAT-positive) animals. In contrast to IAT-negative animals the total blood serum protein levels were increased.

*Folia Veter., 32, 1, 114-122, 1988. 2 tables, 15 references. In ENGL. Authors' abstract.*

**Kit mortality in chinchillas - a problem.**

*Anonymous.*

An account is given of causes of stillbirths and kit mortality in chinchillas. Possibilities of lowering the rate of mortality by means of improved management and nutrition are discussed.

*Deutsche Pelztierzuchter, 62, 10, 154-155, 1988. 1 fig. In GERM. CAB-abstract.*

**Common diseases and medical management of ferrets.**

*Thomas J. Burke.*

This review covers anatomy, reproductive physiology, nutrition, immunizations, anaesthesia, diseases (ectoparasites, internal parasites, fungal diseases, bacterial diseases, viral diseases), toxicities, metabolic disorders, congenital defects, neoplasms and miscellaneous conditions.

*Exotic Animals (Ed. by E.R. Jacobson and G.V. Kollias, Jr.). 247-260, 1988. 1 table, 48 references. CAB-abstract.*

**Evidence of restricted viral replication in adult mink infected with aleutian disease of mink parvovirus.**

*Søren Alexandersen, Marshall E. Bloom, James Wolfinbarger.*

Strand-specific hybridization probes were used in in situ molecular hybridization specifically to localize cells containing replicative intermediates of Aleutian disease of mink parvovirus (ADV). When adult mink of Aleutian genotype were infected with ADV Utah I, the largest number of cells positive for viral replication (i.e., containing replicative-form DNA and RNA) were found in the mesenteric lymph nodes and spleens at 10 days after infection. The localization of positive cells in the middle of germinal centers suggested that they were B lymphoblasts. Circulating leukocytes and bone marrow cells also contained viral RNA, but the levels of replicative-form DNA were below detect-

ability. The levels of viral DNA and RNA in adult mink cells replicating ADV were decreased compared with those in permissively infected cell cultures or neonatal mink, suggesting that the replication of ADV in adult mink might be semipermissive or restricted at some early stage of viral gene expression. The low level or viral replication and transcription in lymphoid cells might provide a mechanism for the development of immune disorders and for the maintenance of persistent infection. Single-stranded virion DNA was found in other organs, but the strand-specific probes made it possible to show that this DNA represented virus sequestration. In addition, glomerular immune complexes containing virion DNA were detected, suggesting that ADV virions, or perhaps free DNA, may have a role in the development of ADV-induced glomerulonephritis.

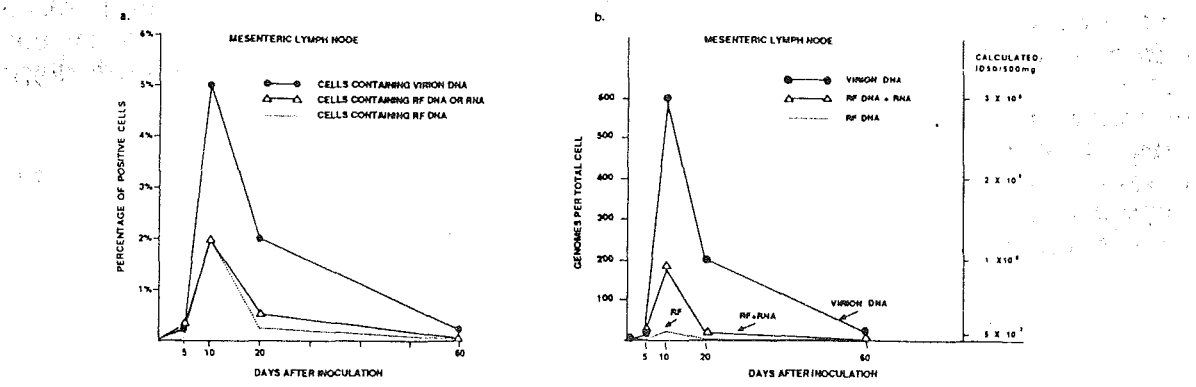



FIG. 2. Estimation of the percentage of positive cells and genomes per total cell in mesenteric lymph node by in situ hybridization. In situ hybridization was performed on PLPG-fixed paraffin-embedded tissue as described in Materials and Methods. Cells containing virion DNA were detected by using the plus-sense probe, RF DNA was detected on RNase-treated slides by using the minus-sense probe, and RF DNA plus RNA was detected by using the minus-sense probe on slides not treated with RNase. (a) Percentage of cells positive in mesenteric lymph nodes. (b) The number of genomes per total cell was calculated by multiplying the content of genomes per positive single cells by the percentage of positive cells. The $ID_{50}$ in the organs was estimated by assuming a virion-to-$ID_{50}$ ratio of 100 (16) and assuming that 500 mg of tissue corresponds to approximately $5 \times 10^8$ cells (14).

*Journ. of Virology, 62, 5, 1495-1507, 1988. 9 figs., 2 tables, 51 references. Authors' summary.*

## Characterization of biological and antigenic properties of raccoon dog and blue fox parvoviruses: A monoclonal antibody study.

*P. Veijalainen.*

Parvovirus isolates from blue foxes and raccoon dogs were characterized by studying their haemagglutination properties, host range in vitro and antigenic structure. In all 3 characters, raccoon dog parvovirus resembled canine parvovirus (CPV), while blue fox parvovirus was similar to mink enteritis virus (MEV). Monoclonal antibodies (MAbs) were prepared against both viruses. Raccoon dog parvovirus, while resembling CPV, had a unique antigenic site which could be specified by MAbs. The pattern of MAbs prepared against blue fox parvovirus indicated that it is a member of Type 2 MEV.

*Veterinary Microbiology, 16, 219-230, 1988. 4 tables, 20 references. Author's abstract.*

## Attempts to vaccinate cats, dogs, minks and foxes with attenuated vaccines containing feline panleukopenia virus or canine parvovirus.

*Barbara Arciuch, Jerzy Gorski.*

Vaccines containing live, attenuated virus of feline panleukopenia or infectious canine enteritis were applied altogether for 26 cats, 10 dogs, 93 minks and 27 foxes. No clinical symptoms of disease were found among vaccinated animals, as well as among those not vaccinated (left in cages together with the vaccinated animals). Detailed haematological studies carried out on cats have shown in some animals a decreased number of leukocytes to $<5000$ in 1 $mm^3$ of blood, a decrease in the percentage of granulocytes and the appearance of atypical giant leukocytes.

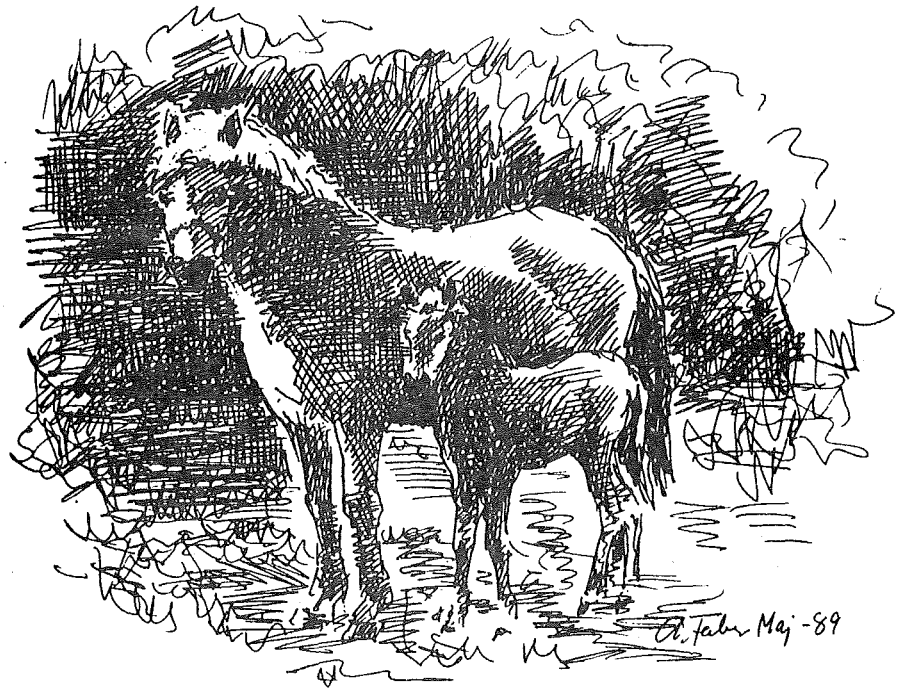
*Bull. Vet. Inst. Pulawy, 28-29, 1-4, 94-102, 1985-86. 3 figs., 1 table, 17 references. In ENGL. Authors' summary.*

**Parasitism of red fox (Vulpes vulpes) by Echinococcus multilocularis in Lorraine (France) and their consequences on human contamination.**

*M. Aubert, P. Jacquier, M. Artois, Marie-José Barrat, Anne-Marie Basile.*

The percentage of *Echinococcus multiloculari* infestation in the red fox is reported in Lorraine relying upon the examination of 513 animals. The percentage ranges from 14 to 36 per cent according to years and geographical areas. It is suggested that the distribution of the parasite could be related with frosty or snowy climate, which insures the conservation of the embryophores outside. Some points regarding the human risk are stressed on: countryside populations are under risk, as well as suburban population. Where the parasitism of the fox exists, the human risk does not seem directly related to the frequency of this parasitism. Other factors such as human behaviour (feeding habits, relations towards dogs) should be studied.

*Rec. Med. Vet., 163, 10, 839-843, 1987. 4 tables, 2 figs. In FREN. Su: ENGL, SPAN. Authors' summary.*



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