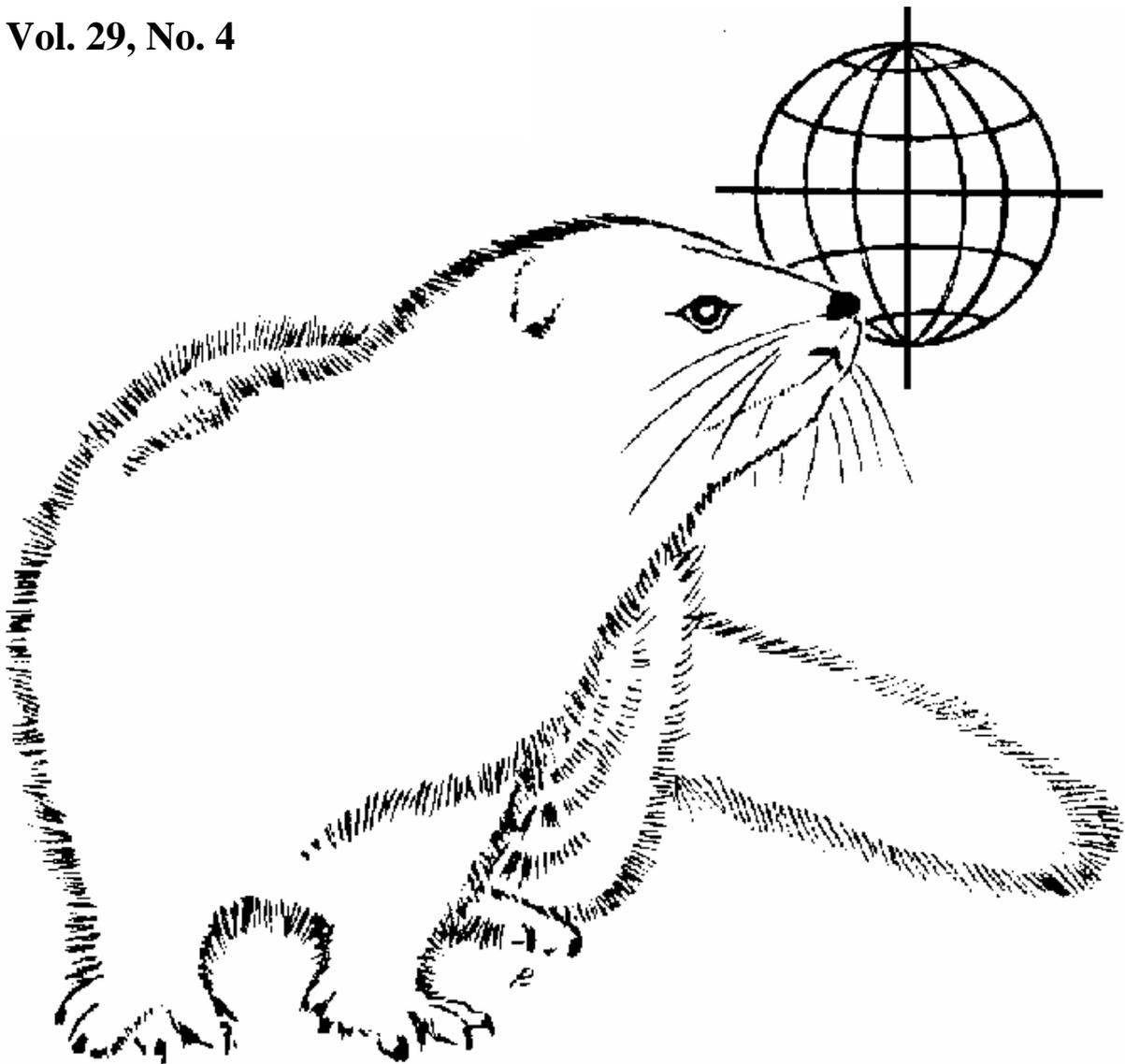


# SCIENTIFUR

SCIENTIFIC INFORMATION IN FUR ANIMAL PRODUCTION

Vol. 29, No. 4



INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

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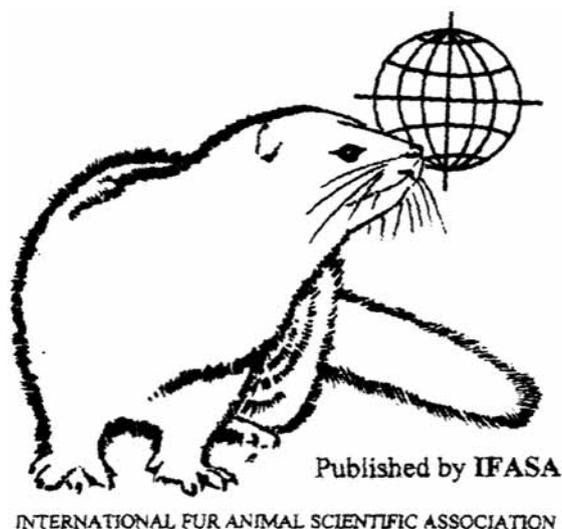
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<b>1.</b>	<b>Contents</b>	<b>107</b>
<b>2.</b>	<b>Notes</b>	<b>113</b>
<b>3.</b>	<b>Short communications</b>	<b>115</b>
	<b>Some phenotypic and genetic aspects of reproduction of wild rabbits kept in cages.</b> <i>R. Cholewa, D. Kałuziński, T. Szwaczkowski, M. Wlazelko</i>	115
<b>4.</b>	<b>Symposiums, congresses etc.</b>	<b>121</b>
	<b><u>Proceedings of the 3rd International Symposium, Petrozavodsk, 27-29 September 2005</u></b>	121
	<b>Ecological factors controlling the spread of parasitic diseases among fur animals in Karelia.</b> <i>L.V. Anikieva, V.S. Anikanova</i>	122
	<b>Breeding in Russia.</b> <i>N.A. Balakirev</i>	122
	<b>Nontraditional provenders in rations of fur animals.</b> <i>N.A. Balakirev, M.V. Wolkova</i>	122
	<b>In vitro activity of amylolytic enzymes from chinchilla's digestive tract.</b> <i>B. Barabash</i>	122
	<b>An implantation of melatonin to 2.5-month old ferrets and its influence on fur maturation terms and reproduction abilities.</b> <i>B. Barabash, D.N. Pereldik, I.I. Bagdonas</i>	124
	<b>Eperation of lymphocytes and dynamics of rosette-forming cells in polar fox of different age.</b> <i>Y.A. Berezina, I.A. Domsky</i>	125
	<b>The current state and the perspectives of spirulina use in fur breeding.</b> <i>V.A. Berestov</i>	125

<b>Effect of locomotor activity on interior indices of young animals of nutria.</b> <i>O.Y. Bespyatykh</i>	125
<b>Comparative analysis of autoxidation of mammalian haemoglobins.</b> <i>A.G. Borisova</i>	125
<b>Interrelation of intensity of processes free-radical oxidation and parameters of the immune status at the minks.</b> <i>L. Y. Boyarintsev, T.L. Boyarintseva, I.V. Mamaeva, K.U. Kostyleva, Y.A. Zyrianova, M.U. Zlobina, N.N. Tyutyunnik</i>	125
<b>Cytochemical investigation of sapphire mink blood leucocytes.</b> <i>A.G. Golubeva, L.B. Uzenbaeva, V.A. Ilukha, N.N. Tyutyunnik</i>	126
<b>Seasonal changes of antioxidant enzymes activity in organs of different color type mink.</b> <i>N.A. Gorlyakova, V.A. Ilyukha, V.V. Ostashkova</i>	126
<b>Adjusted norms and standard diets for mink.</b> <i>T.M. Demina, O.V. Rastimechina, N.A. Balakirev</i>	126
<b>The influence of antioxidant emicidin on females and young minks safety.</b> <i>T.V. Demina, I.S. Sugrobova, O.V. Rastimechina, V.I. Melnichenko</i>	126
<b>Reproductive capability of females, growth and development of mink in different conditions of housing.</b> <i>T.M. Demina, E.G. Sergeev, N.E. Kulikov, E.A. Tinaeva, N.A. Balakirev, N.I. Tinaev</i>	126
<b>The use of probiotic “zoonorm” for treatment kits polar foxes.</b> <i>E.I. Drozdova, N.N. Loenko, S.V. Xolodkov</i>	126
<b>Use of biologically active additive of 2% EPW water extract of propolis in rations for feeding slaughter young of fur-bearing animals.</b> <i>V.V. Durova</i>	127
<b>Effect of bioadditive – 10% suspension of ginseng cell culture on reproductive functions of fur-bearing animals.</b> <i>V.V. Durova</i>	127
<b>Age articular cartilage micromorphology of caged minks.</b> <i>E.S. Durtkarinov</i>	127
<b>Content of several elements in whole blood and blood serum of young raccoon dogs.</b> <i>O.E. Evenko, N.A. Suntsova, V.Z. Gazizov, N.A. Shulatyeva, I.S. Lapteva, V.M. Korotaev</i>	127
<b>Quantity of two antigenic variants of alpha-macroglobulin of American mink in normal ontogenesis.</b> <i>V.I. Ermolaev, M.A. Savina, L.A. Skripkina</i>	127
<b>Evaluation of microelements complex use efficiency and its influence on young standard minks development intensity.</b> <i>S.A. Ermolina, V.A. Sozinov</i>	127
<b>Age changes of serum iron and haemoglobin in young standard minks.</b> <i>S.A. Ermolina, V.A. Sozinov</i>	128
<b>Prospects of the unloading method as effective element of zoological crop.</b> <i>J.S. Zabolotskih</i>	128
<b>Nourishing qualities of new animal food for minks cubs.</b> <i>E.M. Zelenova, E.G. Kvartnikova</i>	128
<b>Does the feeding with mushroom shiitake increase reproductive capacity of mammals?</b> <i>T. Zorenko, I. Motmillere, N. Matjuskova</i>	128
<b>Vitamins A and E in the polar fox during postnatal ontogenesis.</b> <i>T.N. Ilyina</i>	130
<b>The morphological features of a dermal integument at fur animals.</b> <i>A.S. Istomin</i>	130

<b>Influences of some biologically active substances on polar fox antioxidant system.</b> <i>S.N. Kalinina, V.A. Ilyukha, S.S. Filimonkov</i>	130
<b>Biological role of iodine in the organism of animals.</b> <i>L.Y. Karpenko</i>	130
<b>Estimation of activity phagocytosis at chronic renal insufficiency at dogs.</b> <i>L.Y. Karpenko, A.I. Erukashvili</i>	130
<b>Biochemical estimation of a condition of antioxidant system of dogs.</b> <i>L.Y. Karpenko, A.A. Bakhta, A.B. Andreeva</i>	131
<b>Requirements for sanitary-chemical quality of food mixes for minks in represent feeding base.</b> <i>E.G. Kvartnikova, R.I. Michailova</i>	131
<b>Reproductive function, and brain catecholamines after chorionic gonadotropin stimulation of mink females selected by behaviour.</b> <i>D.V. Klochkov, T.A. Alekhina, O.V. Trapezov, O.I. Prokudina</i>	131
<b>Current state and the perspectives of fur breeding development in “pryazhinskoye” closed corporation at present-day reality.</b> <i>V.P. Koloushkin</i>	131
<b>Main biochemical indices of nutria’s blood at food deprivation.</b> <i>V.M. Korotaev, N.A. Suntsova, V.Z. Gazizov, L.E. Boyarintsev, O.E. Evenko, I.S. Lapteva</i>	131
<b>Chorionic gonadotropin stimulation effect in prepubertal period on follicle development and early embryonic development in miks, evaluation of potential fertility.</b> <i>D.V. Klochkov, G.K. Isakova, P.A. Eryuchenkova</i>	131
<b>Chorionic gonadotropin administration to prepubertal mink females. Effect on early embryonic development of their posterity and follicle development.</b> <i>D.V. Klochkov, P.A. Eryuchenkov</i>	131
<b>Effects of two phase protein feeding on performance of blue foxes during growing-furring period, a field study.</b> <i>N. Koskinen, T. Dahlman, I. Pölönen, J. Valaja, T. Rekilä</i>	132
<b>Low protein and methionine in blue fox diet during growing-furring season, a field study.</b> <i>N. Koskinen, T. Dahlman, I. Pölönen, J. Valaja, T. Rekilä</i>	132
<b>The influence of Monclavit-1 on incubatory eggs.</b> <i>A.F. Kuznetsov, S.V. Litvyakov, K.V. Salandaev</i>	133
<b>Biochemical and morphological showings of mink kept in different housing systems.</b> <i>N.E. Kulikov, N.A. Balakirev, E.A. Tinaeva, T.M. Demina, E.G. Sergeev, N.I. Tinaev</i>	133
<b>Monclavit use efficiency at cows endometritis.</b> <i>S.V. Litvyakov, A.F. Kuznetsov</i>	133
<b>Monclavit-1 effect on blood and faeces indices at treatment of calves dyspepsia.</b> <i>S.V. Litvyakov</i>	133
<b>Therapeutical efficiency of Monclavit-1 for cows mastitis treatment.</b> <i>S.V. Litvyakov</i>	133
<b>Comparative study of lactate dehydrogenase isoenzymes in tissues of mammals.</b> <i>N.V. Matsuk, V.V. Ostaschkova, V.A. Ilukha, A.R. Unzhakov, V.V. Belkin, A.V. Jakimov</i>	134
<b>Reproductive strategies in felidae reproduction.</b> <i>S.V. Naydenko, M.N. Erofeeva, K. Norbauer, F. Geritz, K. Evgenov</i>	134

<b>Effective utilization of biostimulators in fur farming.</b> <i>A.M. Nikitenko, V.V. Malina, N.N. Tyutyunnik</i>	134
<b>Stimulation of reproductive function of young females of mink.</b> <i>P.P. Orlov, N.A. Shulyatieva</i>	134
<b>Increase of litter vitality in young females of nutria.</b> <i>P.P. Orlov, N.A. Shulyatieva</i>	134
<b>Endocrine and reproductive effects of colour mutations in silver foxes (<i>Vulpes vulpes</i>) bred in captivity.</b> <i>L.V. Osadchuk</i>	134
<b>Morphofunctional state of lymphatic system of organ of vision in canidae.</b> <i>S.M. Paninsky</i>	135
<b>Some aspects to consider for improving reproduction of blue foxes (<i>Alopex lagopus</i>).</b> <i>P. Pylkkö, N. Koskinen, J. Sepponen, T. Rekilä</i>	135
<b>Development and testing of Euro-standard cages for fur-bearing animals.</b> <i>I.A. Plotnikov</i>	136
<b>Using of melatonin in zooculture.</b> <i>O.L. Rapoport, L.Y. Kiselyev, N.N. Novikova</i>	136
<b>Putative effect of light intensity to reproduction in blue foxes (<i>Alopex lagopus</i>).</b> <i>T. Rekilä, T. Korhonen, N. Koskinen, J. Sepponen, P. Pylkkö</i>	136
<b>Mercasolium and thioxine effects on liver cathepsin D activity and haematological indices of polar foxes.</b> <i>N.L. Rendakov, E.A. Gorelova</i>	137
<b>Age dynamics of thyroid hormones concentration in polar foxes.</b> <i>N.L. Rendakov, N.N. Tyutyunnik</i>	137
<b>Probable physical-chemical mechanisms of evolutionary development of regulatory reactions in protein solutions under external exposure.</b> <i>S.P. Rozhkov</i>	138
<b>One-year sable females reproductive characteristics.</b> <i>Z.S. Ruchkina, T.M. Chekalova</i>	138
<b>Spectrum of carbohydrases of mink and blue fox in ontogenesis.</b> <i>E.B. Svetchkina</i>	138
<b>The use of pathogenicity factors of micro-organism by construction immunobiological preparation.</b> <i>A.N. Semikrasova, S.S. Saveliev, N.A. Polunina, O.B. Litvinov</i>	138
<b>The influence of behavior's type on productivity of minks and foxes in different conditions of housing.</b> <i>E.G. Sergeev, T.M. Demina, N.E. Kulikov, E.A. Tinaeva, N.A. Balakirev, N.I. Tinaev</i>	138
<b>Stimulation of follicle development by 11-deoxy-analogue of prostaglandin E1.</b> <i>L.V. Sidorova</i>	139
<b>The detoxication of an organism with application of enterosorbents and local decompression.</b> <i>V.G. Skopichev, L.V. Zhichkina</i>	139
<b>Clinical substantiation of health of animals at the analysis of crystallization of saliva of dogs of nursery of the Ministry of Internal Affairs.</b> <i>V.G. Skopichev, A.A. Stekol'nikov, M.K. Kasumov, L.V. Zhichkina</i>	139
<b>The x-radiography and morphological correlations in a rating of age modifications of a bone and joint system of fur animals.</b> <i>N.A. Slesarenko, E.S. Durtkarinov, A.I. Torba</i>	139

<b>Characteristics of enteric-associated lymphoid tissue topography in polar foxes.</b> <i>N.A. Suntsova</i>	139
<b>Using recombinative antitoxical preparat pHMB for increase of minks productivity.</b> <i>N.N. Tinaev</i>	139
<b>Combinative method of fur animal killing.</b> <i>N.I. Tinaev, V.A. Skobelev, E.A. Tinaeva, C.G. Sergeev, N.E. Kulikov</i>	140
<b>The domestication of fur bearers and homological rows in variability of their coat colours (American mink as a model).</b> <i>O.V. Trapezov</i>	140
<b>The mendelian low's and fur animals breeding (140 years of the lows of heredity).</b> <i>O.V. Trapezov</i>	140
<b>The results and the perspectives of physiological and biochemical investigations of fur-bearing animals introduced in zooculture.</b> <i>N.N. Tyutyunnik</i>	140
<b>Use of the mineral component "Shungistim" in polar foxes breeding.</b> <i>N.N. Tyutyunnik, Y.K. Kalinin, A.R. Unzhakov, H.I. Meldo, E.B. Svetchkina, I.V. Baishnikova</i>	140
<b>Influence of selenium and succinic acid on physiological state, haematological and biochemical indices of young minks.</b> <i>A.R. Unzhakov, N.L. Rendakov, N.N. Tyutyunnik, H.I. Meldo</i>	141
<b>Use of the method of food deprivation for polar foxes in slaughter period.</b> <i>A.R. Unzhakov, N.N. Tyutyunnik, H.I. Meldo</i>	141
<b>Lactic dehydrogenase-C – A specific isoenzyme of testes.</b> <i>A.R. Unzhakov, N.N. Tyutyunnik, H.I. Meldo</i>	141
<b>Internal characteristics of standard dark-brown mink in the course of domestication.</b> <i>O.I. Federova</i>	141
<b>The possibility of coupling between sables and polecats.</b> <i>G.A. Fedoseeva</i>	141
<b>On the age influence on slaughter nutrias meat and carcass by-products outcome.</b> <i>S.A. Fominykh, N.A. Suntsova, V.Z. Gazizov</i>	141
<b>The structure of gonads and hormone levels in foxes and polar foxes, kept in cage.</b> <i>N. Shulgina</i>	141
<b>Different constitution type color foxes fur quality.</b> <i>N.N.Shumilina</i>	142
<b>Morphometric os penis indices and epididymis mass influence on reproductive mink qualities.</b> <i>N.N. Shumilina, T.V. Mayorova</i>	142



## Notes from the Group of Editors

This issue of *Scientifur*, which is the fourth issue of Volume 29, contains a short communication on reproduction of wild rabbits kept in captivity as well as a number of abstracts presented at the 3<sup>rd</sup> International Symposium regarding “Physiological bases for increasing the productivity of mammals introduced in zooculture”, held in Petrozavodsk, 27-29 September, 2005.

Our objective is to publish one issue per volume containing only reviewed articles, however, as non of the manuscripts recently submitted to us are ready to be published, we have decided to postpone

the publishing of an issue containing only reviewed articles until Volume 30.

The appointment of a number of local *Scientifur* representatives (their names and addresses are to be found on the inside of the front page) is expected to make it easier for us to provide you with an interesting and informative periodical. However, we also rely on our readers to submit articles for reviewing, short communications, abstracts etc. to be able to publish a quality periodical on fur animal science.

On behalf of the  
Group of Editors

Birthe Damgaard



## Some phenotypic and genetic aspects of reproduction of wild rabbits kept in cages

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### Abstract

The aim of this work was to obtain basic information about the reproduction results of wild rabbits kept in cages. As the breeding results of rabbits kept in group cages were considered to be unsatisfactory, it was decided to move the animals into cages with one female in each cage. During a 4-year-long experiment, 23 females were prepared for reproduction. On average each female produced 2.7 litters (10.4 young ones) a year. The wild rabbits reproduced in captivity during the first three quarters of the year. The most favourable reproduction system was keeping the animals in pairs in three-segment breeding houses. The results indicated a significant genetic influence on the survival of the young before weaning.

*Key words:* wild rabbits, survival, reproduction, heritability

### Introduction

The wild rabbit (*Oryctolagus cuniculus* L.) belongs to the Lagomorpha order and the Leporidae family.

In Poland it appeared in the second half of the XIX century. In the Poznań region it was found in 1870–1880 in the Koprza forest district near Kościan and in 1875 in Puszczykowo in the vicinity of Poznań. According to Pax (1925) in the Poznań region in 1885/86 21891 wild rabbits were gained.

The wild rabbit was mostly introduced in estates or forest inspectorates. Thanks to the big adaptation

abilities of this animal species to certain conditions and intensive preservation, the introduced rabbit started to reproduce very intensely expanding into new habitats.

After this dynamic increase, the number of wild rabbits in Poland during the interwar period, the war period and especially afterwards, dropped suddenly. Today the situation seems to be even worse. Residual mini populations or more numerous but dispersed populations found mainly in strongly urbanised areas are insufficient to rebuild the population of rabbits that could be of importance to the hunting industry. Nowadays, to change this unfavourable situation the release of wild rabbits has started. To this end, it is necessary to have good and common breeding material as well as training and breeding instructions. In professional literature, the information about breeding methods of wild rabbits in captivity and its results is incomplete. Organisational units of the Polish Hunting Association could use this kind of information in their plans. (Pinkowski, 1994, Szamborski, 1992)

The objective of this work was to obtain basic information on the reproduction results of wild rabbits kept in closed spaces (cages). The research focussed on an evaluation of the influence of chosen factors on the survival of the young ones before weaning. Knowledge about wild rabbit reproduction results could be useful in the future planning of reintroducing the animal into new places, firstly for hunting purposes.

## Material and methods

### Material

It was pretty hard to buy suitable animals for breeding in captivity. In 1996 purchased animals, which in people's presence avoided the rabbit run to get feed (green forage), were kept in three group cages, with one male in each. There were two group cages with two females and one with three females. In the years 1998-2000 another 8 animals were bought of which one male and one female came from a wild population. The rest came from our own breeding. In the years 1997-2000, 37 animals were used for breeding including 23 females. Wild rabbit breeding began in October 1996. In the early stage of this activity the idea was to carry out breeding in three group cages. However, the initial results caused us to move all the animals into single cages in 1997.

Ten cages were built. Each of them consisted of two basic parts: a house made of wood and a rabbit run made of metal. The rabbit run construction was made of metal rods, each measuring 12 mm, which, except for the house side, were rounded with wire mesh, measuring 1.5 x 1.5 cm. The wooden roof was covered with tar paper, and the house was divided into two parts by a wooden partition wall. From the run, the animals had access to each part of the house through a specially made hole. The roofing above the run was made of net; the aim of this was to protect the animals and to make escape difficult. An opening in the netting served to give fodder and water and to remove feed residuals.

The main fodder component for the rabbits during the period from mid-September till mid-April was hay, and during the rest of the year green forage. Hay was prepared of grass, white and red clover and different kinds of herbs and perennials, e.g. yarrow motherwort, nettle, and dandelion. The fodder was given in quantities of approximately 150 g per rabbit.

In the vegetation season each animal was given 250 g green forage reaped just before florescence. In addition to the volume feeding stuffs, the rabbits were given protein food in the form of a grain mixture consisting of mainly oats, wheat, barley and in the winter period, maize too. The highest amount of protein food was given to the rabbits in the beginning of spring (about 120 g per rabbit); the rest of the year the protein food was given in ratios of

approximately 80 g per rabbit. The rabbits ate approximately 579 g of different kinds of fodder per day. They were fed in the morning hours and just before dusk.

Often catching the animals and weighing them caused much stress and even death or made them become tame. To keep their natural fearfulness towards humans, these activities were given up.

### Methods

Calculations were based on 402 animal including 37 parent animals (classified as base animals). The recorded individuals were classified in one of two categories (1-in case of survival, 0-when subject died). Before calculation, probity data transformation was made (Lynch and Walsh, 1998). The computation was made based on single-trait threshold animal model:

$$\mathbf{y} = \mathbf{X}_1 \boldsymbol{\beta}_1 + \mathbf{X}_2 \boldsymbol{\beta}_2 + \mathbf{X}_3 \boldsymbol{\beta}_3 + \mathbf{Za} + \mathbf{e},$$

where:  $\mathbf{y}$  – observation vector,  $\boldsymbol{\beta}_1$  – vector of fixed effects of birth years,  $\boldsymbol{\beta}_2$  – vector of fixed effects of litter size,  $\boldsymbol{\beta}_3$  – vector containing number of birth year days included as linear covariable,  $\mathbf{a}$  – vector of random genetic additive effects,  $\mathbf{e}$  – vector of random errors,  $\mathbf{X}_1$  and  $\mathbf{X}_2$  – incidence matrices for these fixed effects,  $\mathbf{X}_3$  – incidence matrix for partial regression,  $\mathbf{Z}$  – incidence matrix for these genetic effects.

The following assumptions were made:

$$\text{var}(\mathbf{a}) = \mathbf{A} \sigma_a^2, \text{var}(\mathbf{e}) = \mathbf{I} \sigma_e^2 \text{ and } \text{cov}(\mathbf{a}, \mathbf{e}) = 0.$$

Then:  $E(\mathbf{y}) = \mathbf{X}_1 \boldsymbol{\beta}_1 + \mathbf{X}_2 \boldsymbol{\beta}_2 + \mathbf{X}_3 \boldsymbol{\beta}_3$  and  $\text{var}(\mathbf{y}) = \mathbf{ZAZ}' \sigma_a^2 + \mathbf{I} \sigma_e^2$  where:

$\mathbf{A}$  – matrix of additive relationship,  $\sigma_a^2$  – variance of additive genetic,  $\sigma_e^2$  – variance of random residual (in this case equal 1)

The following parameters were estimated:

- heritability coefficient defined as:  $h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_e^2}$ ,
- partial linear regression coefficient of survival – birth day (next in a year),

- birth year effects (to magnitude placed in diagrams was added 1),
- litter size effects (to magnitude placed in diagrams was added 2).

The calculation was made using the ASREML algorithm (Gilmour et al., 2001)

### Results and discussion

Breeding in group cages for a period of two months (February, March) resulted in seven females giving birth to 12 young, 4 of which died during the first days.

The reproduction results of breeding in group cages were considered to be unsatisfactory. Therefore, it was decided to use cages with one female in each cage. Thus, from April till August 1997, seven females gave birth to 46 young. The mortality of the young unweaned rabbits was on average 13 %.

In 1998, ten females were placed in cages and mated with five males (each male was put into two cages, like in 1997). These 10 females gave birth to 86 young, of which 10 died before weaning. In 1999, nine females gave birth to 112 young of which 20% died. In 2000, ten females gave birth to 129 young of which 41 (32%) died. When analysing the litter numbers of each female and the number of young, it can be stated that with time better results were obtained. In 1997 each female gave birth to 2.0 litters on average and the average size of each litter was 3.3 young. In 1998 the average litter number was 2.3 with 3.7 young in each litter. In 1999, the females used for reproduction gave birth to 3.3 litters on average and the average size of each litter was 3.8 young. During the whole period of the experiment the best year of reproduction was 2000. In 2000 each females gave birth to 3.1 litters with 4.2 young in each. To summarise the 4-year-long experiment, 36 females were prepared for reproduction of which each gave birth to 2.7 litters on average a year and the average size of each litter was 3.8 young.

The heritability estimate for survival was 0.3239 ( $\pm$  0.1605). To our knowledge, no heritability estimates of survival for wild rabbits are currently available, so discussion is unavoidably restricted to general considerations concerning mainly analysis of some livestock populations. The estimate is higher than that obtained in farm animal populations. For example, Haley et al. (1988) found that the

heritability estimates of piglet survival ranged between 0.03-0.18. Van Arendonk et al. (1996) obtained higher estimates (0.25). These differences can be attributed to specificity of population. The high heritability estimated in the present study resulted from an unselected population. Long term intensive selection lead to reduce the genetic variability, and in consequence to lower heritability (with environmental condition stabilisation). A relatively large standard deviation of estimate  $h^2$  was obtained. It probably connected with the number of individuals recorded.

Blasco et al. (1993) showed a big mother role in the survival variability, especially in free living mammal species. This statement corresponds to the research results on bison (aurochs) reported by Olech (2003).

The aim of this research was also to evaluate the influence of the chosen factors on rabbit survival. The coefficient of partial regression survival – the day of year was positive and amounted to 0.0036 (for transformed data) and was important. It means that together with day extension and rising temperatures the chance of litter survival increased. Unfortunately, the relatively small number of observations could make the regression analysis during the years unreliable. It was shown that during the first three years survival was equalised, the lowest in the fourth year. When analysing the effect of litter size on survival, it was demonstrated that the highest survival was characteristic for twins and the lowest for single-born rabbits. This can be connected with the very rarely occurring single rabbit pregnancy. When we accept the hypothesis of maternal influence on litter survival (in the prenatal period too), we suppose that single-born rabbits were the result of pathological pregnancy determined by for example chromosome aberration, mother habitat, or so called differentiation (see diagram 2)

Nowadays, hunters are looking for solutions that can increase the number of small animals. One of the ways to realise this aim is release. Usually there is lack of information about how to prepare and choose a place of introduction, what animals to buy, how to organise their keeping and how to protect them.

This work can be an instruction to follow to make the breeding of wild rabbit in captivity effective.

It appears that the conviction about the huge reproduction ability of wild rabbits is a myth. It is well known that we cannot refer the wild rabbit's reproduction ability to the domestic rabbit's reproduction results. It appeared that one wild rabbit female kept in captivity for a period of 4 years gave birth to only 7 young ones a year that could be used as game. An important reduction factor should be taken into account – the carnivores and their natural conditions. The wild rabbit's reproduction success is mainly limited by little number of suckling, high birth mortality and loss during the lactation and growing period in consequence of serious rabbit diseases. The results obtained in this work confirmed earlier published information about kitting periods and the number of wild rabbit litters (Boback 1970). They indicated that low temperatures had an effect on the mortality of young and adult rabbits (Caboń -Raczyńska and others, 1983). The failure of breeding rabbits in group cages was connected with high mortality rates. When a human or another danger appeared nearby the enclosure, the adults rapidly were looking for a hiding place and they hid by the new-born rabbits. Critical factors for rabbit survival were catching, vaccination and removal of young animals from cages into group cages. It is hard to state which factor was the most important in relation to increased mortality before weaning. Another reason for high mortality rates before weaning was decreasing temperatures in January and February at the start of kitting. Furthermore, mortality could be caused by unsuitable fodder (bad quality hay, frozen root plants, overheated green forage) and diseases like myxomatosis, pest and coccydiosis. Big damage in wild rabbit breeding can be made by loafing dogs, foxes and cats. The net on the bottom of the cages should be welded not plaited (with mesh 1.5 x 1.5 cm).

Considering wild rabbit reproduction abilities, the mortality should be minimised in the first period of the young rabbit's life. At that time we should ensure a quiet environment and eliminate dangers caused by rats, weasels, carnivores, dogs and cats. During the coldest months the nests with young should be warm and in the summer period they should be protected from overheating. Thus the cages should be placed in the shade, for example under deciduous tree. To obtain good breeding material for release, the human-animal relation should be limited. The fodder provided should be of

the best quality, keeping in mind that green forage should be reaped just before feeding.

Animals to be used for reproduction should be from December, be kept in pairs, or the male should stay with the female for 2–3 days a week during the whole reproduction period.

### Conclusions

1. Keeping two females with one male in a large cage or a cage measuring 9m<sup>2</sup> does not guarantee good reproduction results.
2. The most favourable breeding form can be keeping the animals in pairs in three-segment breeding houses.
3. When in captivity, the wild rabbits reproduced during the first three-quarters of a year, giving approximately 4 litters per female.
4. The results indicated significant genetic effects on the survival of the young before weaning.
5. Further experiments including these animals are needed to work out practical instructions on wild rabbit reproduction in captivity.

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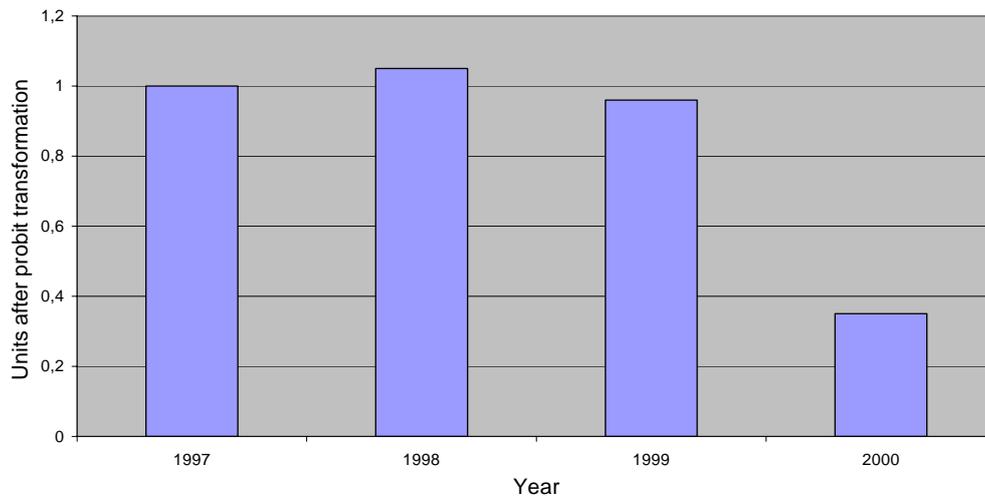
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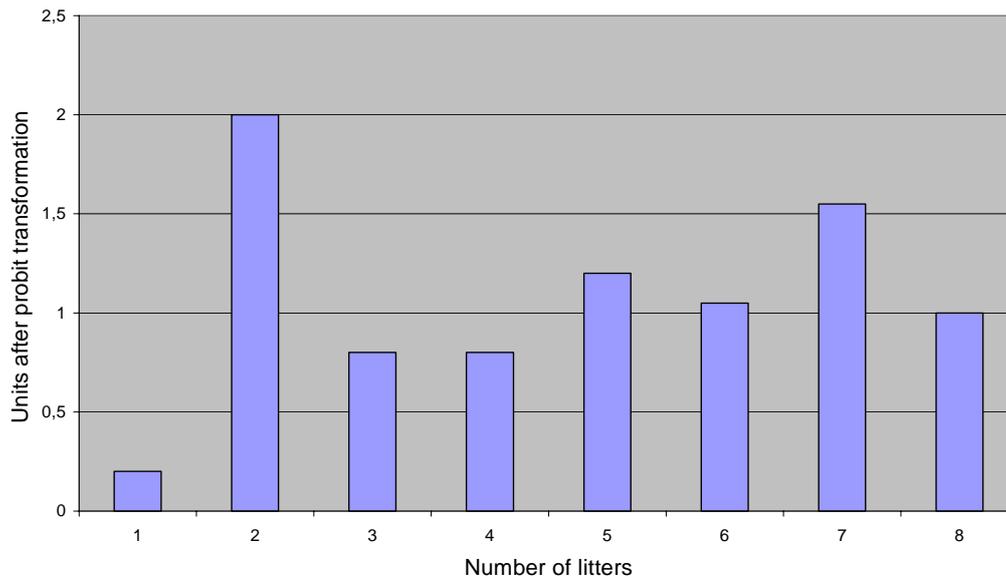
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**Figure 1.** Estimation of the effects of summer births



**Figure 2.** Estimation of the number of litters

**Table 1.** Reproduction of wild rabbit females in years 1997 – 2000 (numbers)

cage code	1997		1998		1999		2000		Average	
	litters	born								
1	2	5	3	12	4	12	2	9	2,8	9,5
2	3	10	3	7	3	12	3	12	3,0	10,2
3	0	0	3	15	5	16	4	18	3,0	12,2
4	0	0	0	0	3	16	4	12	1,8	7,0
5	3	12	3	15	3	10	4	15	3,2	13,0
6	3	8	3	8	4	18	4	18	3,5	13,0
7	3	11	3	11	3	8	4	19	3,2	12,2
8	-	-	3	9	2	9	1	3	2,0	7,0
9	-	-	2	9	3	11	1	4	2,0	8,0
10	-	-	0	0	-	-	4	19	2,0	9,5
total	14	46	23	86	30	112	31	129	2,7	10,4
$\bar{x}$	2,0	6,6	2,3	8,6	3,3	12,4	3,1	12,9		

- empty cage

**Table 2.** Young breeding with mothers in years 1997 – 2000 (in numbers)

Years	Months																		Total number of born animals	Death		Total number at weaning animals
	I		II		III		IV		V		VI		VII		VIII		IX			No	%	
	b	d	b	d	b	d	b	d	b	d	b	d	b	d	b	d						
1997	-	-	-	-	-	-	16	2	7	-	9	2	7	-	7	2	-	-	46	6	13	40
1998	-	-	18	1	13	-	14	2	8	2	16	1	10	3	7	1	-	-	86	10	12	76
1999	4	4	20	4	24	6	18	-	17	8	2	-	10	-	10	1	7	-	112	23	21	89
2000	11	7	27	16	15	5	18	1	6	-	24	6	4	1	21	5	3	-	129	41	32	88
together	15	11	65	21	52	11	66	5	38	10	51	9	31	4	45	9	10	-	373	80	21	293

b - born

d - dead

## Proceedings of the 3<sup>rd</sup> International Symposium

### Physiological Bases for Increasing the Productivity of Mammals Introduced in Zooculture

*September 27-29, 2005*

*Petrozavodsk*

243 pp, ISBN 5-9274-0203-8

The collection of materials presents the reports of the 3rd International Symposium «Physiological Bases for Increasing the Productivity of Mammals Introduced in Zooculture» (Petrozavodsk, September 2005) on the most relevant issues of physiological and biochemical investigations of vital functions of predatory fur animals and rodents introduced in zooculture. The collection is devoted to the study of the physiological and biochemical state of the organism and its regulation, influence of environmental factors and biologically active substances on organism, its reproductive function and development.

The symposium has been supported by the Russian Academy of Science, Department of Biological Science

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#### **Introduction**

The investigation of organism adaptability to the influence of environmental factors is one of the fundamental problems of ecological physiology. Theoretical elaboration of this problem is concerned

in general with research into the main principles of adaptation of the whole organism and its separate systems to external factors. In this connection this problem has the immediate relation to the animals introduced in zooculture. This field of knowledge being situated on the junction of biological and agricultural sciences is investigated rather poorly, except for the fur animals farming based on breeding of predatory mammals and, partly, rodents in captivity. However, in the last decade, more and more species have been involved in zooculture with the use of strict technology as regards their breeding, and today as never before we meet with the problem of animal organism adaptability to new conditions of farm keeping and of searching for resistance enhancement ways to influence unusual environmental factors, be they natural (climatic) or directly technological. In most cases, factors connected with the technology of breeding in captivity - vaccination, shifts, removal of young animals, transportation of pedigree herd, new or unusual, sometimes of poor quality forages - affect animals' physiological state, result in disorders of hemopoietic organs function, immune, digestive system, metabolism and demand certain tension from an organism. In respect to organism adaptability limits definition the investigation of blood homeostasis maintenance factors (enzymatic, isoenzymatic systems, fat-soluble vitamins, thyroid hormones, white blood cells) in adaptation to

various feeding level, weather conditions impact, seasons, in different ontogenetic periods and reproductive cycle phases is rather important. Search of organism resistance increase ways such as biologically active substances (BAS) of metabolic and immunologic effect is also of importance. Restricted when bred in captivity to equal keeping conditions, but of various ecogenesis, the investigated species of fur animals represent a fortunate experimental model for study and estimations of factors influenced not only in the process of evolution development, but also of new factors, connected with breeding technology.

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N.N.Tyutyunnik

### **Ecological factors controlling the spread of parasitic diseases among fur animals in Karelia**

*L.V. Anikieva, V.S. Anikanova*

A number of ecological adaptations of the nematode *T. leonina* and coccidia of genera *Eimeria* and *Isospora* to the principal abiotic factor – the temperature, were identified. It is demonstrated that the parasites' life cycle is adapted to avoiding the negative impact of low temperatures: the reproductive phase takes place in homothermic hosts. The relatively short period of exogenous growth in the life cycle of parasites in Karelia is balanced by the prolonged discharge of eggs and oocysts into the environment, high resistance of the eggs and larvae to environmental stress factors and their prolonged invasive capacity.

### **Breeding in Russia**

*N.A. Balakirev*

The current situation is characterized by considerable changes caused by the reform of economic relations in general, including the agro-industrial sphere. The data about prospects of fur animals development are presented.

### **Nontraditional provenders in rations of fur animals**

*N.A. Balakirev, M.V. Wolkova*

The feeding and nourishing characteristics of fodder yeast, biotrin, mycelium residues of the antibiotic production (tetracyclin, penicillin, gentamycin), mycelium as a produce of citric acid, epidermat and other agents, was investigated. Feeding fur animals with these feeds in the above amounts is found to have no negative effect on the protein metabolism of animals, which is evidenced by results of the blood biochemical tests. Our research makes it possible to recommend these nontraditional provenders in rations of fur animals.

### ***In vitro* activity of amylolytic enzymes from chinchilla's digestive tract**

*B. Barabasz*

Carbohydrates play an important role in chinchilla's nutrition. High level of their digestion results from chinchilla's adaptation to live in a hard, dry, and mountain climate with very poor flora that occurs in their natural habitats. Fodder available for the animals contains relatively little water, but increased level of fiber and starch (Barabasz, 2001). Although strict norms of chinchilla nutrition have not been worked out yet, up-to-date performed experiments indicate that optimum content of nutritional hydrocarbons (no-nitrogen extractible substances) in a fodder should reach to 50%, and the level of structural hydrocarbons (raw fiber) – to about 14%-16%. Because granulated full-dose fodder is applied as an exclusive type of a diet in chinchilla nutrition at present, the accurate information on their nutritional requirements are very important. Small number of studies on chinchilla's nutritional requirements was carried out, among others, by Barabasz and Olejnik (1998, 2000, 2001), Baranceva (1974), Borowiec (1971), Borsting et al. (1992), Huet et al. (1999) as well as Jorgensen et al. (1989).

Studying the activity of enzymes from chinchilla's digestive tract is one of the method for achieving that. When content of a component in a diet increases, activity of the enzymes transforming it also increases, but only to some extent – to so-called

physiological saturation limit, above which there is no increase of the activity, because an organism cannot manage to produce needed enzymes. It suggests some optimum level of the component in a diet, above which it is not so well utilized. Barabasz and Olejnik (1998, 2001) studied the activity of amyolytic enzymes from chinchilla's digestive tract. They found that the highest activity of these enzymes occurred in pancreas. However, the authors did not observe the apparent limit, at which inhibition or even stop of enzymatic reactions could be recorded. Therefore, the authors accepted that there was potential opportunity to increase the content of the component in a diet and that chinchilla has great ability for adaptation to its digestion level higher than at other fur animals.

The authors undertook the study to evaluate the activity of amyolytic enzymes from chinchilla's digestive tract depending on the level of no-nitrogen extractible substances, as well as fiber and its NDF, ADF and ADL fractions in a diet.

#### *Material and methods*

The study was performed on a chinchilla's farm and in laboratory of Department of Small Animal Breeding, University of Agriculture in Cracow in spring 2005. In total, 25 young chinchillas divided into 5 groups of 5 animals each, were tested. The animals were fed till maturation with 5 types of full-dose commercial mixtures with various levels of nutrients. Chemical composition of mixtures used in the experiments is presented in Table 1.

Table 1. Chemical composition of feeding mixtures used in the experiment (%).

Fodder	Dry matter	Ash	Total protein	Crude fat	Crude fiber	No-nitrogen extractible substances (starch, sugars)
A	92.0	10.0	18.4	1.8	11.0	50.8
B	92.0	7.1	17.0	1.4	12.8	53.7
C	90.5	7.6	17.4	1.9	13.2	50.4
D	95.3	8.0	19.2	2.8	14.1	51.2
E	93.6	5.6	14.5	2.2	17.9	53.4

The chemical analyses of diets for general nutrient's content was carried out by means of wendeen method; enzymatic fractions of the fiber were determined using Van Soest's method.

The activity of amyolytic enzymes was determined in pancreas as well as mucous membrane of jejunum and ileum. Samples for analyses were achieved from experimental animals by means of post-slaughter method. Only small samples were taken from pancreas and mucous membrane from intestine after cleaning out the digestive tract content. All operations were made at low temperature and for a short time. Achieved samples were quickly frozen and stored at -20°C. Total amyolytic activity of enzymes was determined in vitro in accordance to

method of Smith and Roj's (Olejnik, 1987). Samples for amyolytic activity determination were homogenized in physiological liquid with starch addition and then incubated at the presence of phosphorus buffer at pH 7.1. Optical density of a solution was measured at wavelength 600 nm and expressed in milligrams of starch hydrolyzed in a time unit after recalculation onto 1 gram of a tissue crude matter.

#### *Results and discussion*

Amyolytic activity in studied fragments of digestive tract (pancreas, jejunum and ileum) is presented in Table 2.

Table 2. Activity of amylolytic enzymes in studied fragments of chinchilla's digestive tract.

Fodder	Content in fodder (%)		Enzymatic activity (mg/min/g)		
	crude fiber	No-nitrogen extractible substances	pancreas	jejunum	ileum
Activity expressed in mg/min/g					
A	11.0	50.8	72.00±3.70	9.80±1.52	4.76±0.25
B	12.8	53.7	77.84±3.06	12.39±1.13	7.94±1.12
C	13.2	50.4	80.32±3.42	13.09±1.59	4.48±0.13
D	14.1	51.2	77.34±5.10	4.87±1.79	5.07±0.72
E	17.9	53.4	39.11±2.44	4.29±1.34	4.25±1.88
Activity expressed in % in reference to a group with 12.8% fiber level					
A	11.0	50.8	92.50	79.10	59.65
B	12.8	53.7	100.00	100.00	100.00
C	13.2	50.4	103.18	105.65	56.14
D	14.1	51.2	99.35	39.30	63.53
E	17.9	53.4	50.24	34.62	53.25

Table 2 apparently indicates that the highest enzymatic activity proving good utilization of digestive abilities, occurred at 12%-13% of fiber level. Such content can be considered as optimum for chinchilla's diet. Activity of amylolytic enzymes decreases at its lower level or excess. At 17.9% (fodder E), the activity decreased almost by 50%. It suggested that such high level of fiber for chinchilla's diet was not beneficial and it did not favour a good utilization of nutrients. Also Barabasz and Olejnik (2000, 2001) as well as Borsting et al. (1992) drew similar conclusions on the optimum fiber level during chinchilla nutrition in their earlier studies.

More detailed analysis of the crude fiber composition taking into account its fractions (Table 3) suggests that their most ratio was found.

Table 3. Composition of fiber fraction in applied fodder types.

Fodder	Content of crude fiber (%)	NDF	ADF	ADL
A	11.0	63.0	15.7	20.7
B	12.8	55.5	18.4	16.7
C	13.2	60.6	18.0	20.1
D	14.1	60.5	16.8	21.9
E	17.9	59.0	20.8	17.5

Fodder B with NDF : ADF : ADL proportion was 3.3 : 1.1 : 1. Such ratio was slightly worsened in other fodders, i.e. C – 3 : 0.9 : 1 and D – 2.8 : 1.2 : 1.

No dependence between no-nitrogen extractible substances (starch, sugars) content in a fodder and activity of amylolytic enzymes in studied fragments

of digestive tract of chinchilla fed with this fodder, was found. It may suggest that the component level ranging from 50.4% to 53.7%, is optimum and does not disturb the normal physiological digestive processes in chinchilla's digestive tract. Found activity level was not high as compared to that at nutria (Barabasz and Olejnik, 1998), which may prove worse chinchilla's adaptation to digest and utilize no-nitrogen extractible substances in fodder or existing opportunities to increase the share of the component in fodder. Further studies on this issue should be performed.

Investigations are being carried out in the frames of Project N 65 About Research Cooperation between Russian Academy of Sciences and Polish Academy of Sciences, protocol of October 10, 2004.

### **An implantation of melatonin to 2.5-month old ferrets and its influence on fur maturation terms and reproduction abilities**

*B. Barabash, D.N. Pereldik, I.I. Bagdonas*

An under skin implantation of synthetic melatonin "melacril" (6 mg of hormone per head) took place on the third decade of July and caused an acceleration (on 40 days) of winter fur maturation which didn't affect on the quality of fur.

The reproduction period and whelping of ferret's females injected with melatonin came 1,5 month earlier than in females bred in normal conditions. An average amount of litter was lower than in a

control group (6,10 instead of 8,15 in a control group).

### **Eperation of lymphocytes and dynamics of rosette-forming cells in polar fox of different age**

*Y.A. Berezina, I.A. Domsy*

The use of available data that characterize the immune status of an organism of animals is necessary for full characteristic of their natural resistance and physiological state. At present the estimation of the immune system of agricultural animals, including that at a cellular level, is widespread. The aim of the given work was the separation, identification and studying of the dynamics of changes of the number of T- and B-lymphocytes of the immune system in polar fox at a different age. Among leukocytes these categories of cells hold the lead in the immune response. Advancing in age the increase of a relative number of T- and B-lymphocytes in animals takes place. That corresponds to the highest capacity of an organism to the immune response to alien proteins. Thus, the organism has a high natural resistance that gives a high survival of the young. That is the main index of productivity in fur-bearing animal breeding.

### **The current state and the perspectives of spirulina use in fur breeding**

*V.A. Berestov*

The advantages of *Spirulina platensis* use in fur animals breeding are stated. The features of using this alga in sable breeding were highlighted.

### **Effect of locomotor activity on interior indices of young animals of nutria**

*O.Y. Bespyatykh*

The effect of locomotor activity of the young of nutria on their interior indices was studied. It was shown that the decrease of a locomotor activity of animals resulted in the decrease of the mass of heart

and lungs and to the increase of the mass of liver, kidneys and adrenals. That is evidence of the decrease of metabolic rate in animals.

### **Comparative analysis of autoxidation of mammalian haemoglobins**

*A.G. Borisova*

Autoxidation of oxyhaemoglobins to methaemoglobin was measured at different temperatures and pH in haemoglobin solutions from human being, polar fox, ox and sheep. The rate of autoxidation was lower in ox and sheep than in human being and polar fox at any given temperatures, demonstrating that ruminant haemoglobins are less sensitive to autoxidation than the others. Autoxidation was accelerated by rising temperature in all haemoglobins, decrease of pH also heightened the rate constant. This revealed the catalytic role of hydrogen ions in the autoxidation reaction of haemoglobin. Thermodynamic properties of haemoglobins correlated with the activation energy of thermohemolysis of erythrocytes.

### **Interrelation of intensity of processes free-radical oxidation and parameters of the immune status at the minks**

*L. Y. Boyarintsev, T.L. Boyarintseva, I.V. Mamaeva, K.U. Kostyleva, Y.A. Zyrianova, M.U. Zlobina, N.N. Tyutyunnik*

It is established, that between immunity system parameters, concentration of lipids peroxyl oxidation products and oxidant system activity exists correlation dependence.

According to received the data exist direct correlation dependence between common antioxidant activity and activity complements in blood. The return correlation dependence is present between concentration MDA and ability B-1. The increase of concentration MDA in blood testifies to intensity of processes peroxyl oxidation of lipids, hence there is a return correlation dependence between activity of process a POL and functional activity B-1. Probably such changes testify to susceptibility receptor T and B-1, taking place on a surface of a biological membrane oxidizing

destruction. In turn functioning of antioxidant system of blood interferes with negative changes in cell a part of immunity.

### **Cytochemical investigation of sapphire mink blood leucocytes**

*A.G. Golubeva, L.B. Uzenbaeva, V.A. Ilukha, N.N. Tyutyunnik*

Differences of subcellular leucocytes structure in standard and sapphire mink were demonstrated using cytochemical method. The computer images of leucocytes were obtained. Specificity of peroxidase positive granules and changes in localization of alkaline phosphatase and glycogen in sapphire mink leucocytes was found.

### **Seasonal changes of antioxidant enzymes activity in organs of different color type mink**

*N.A. Gorlyakova, V.A. Ilyukha, V.V. Ostashkova*

Comparison of influences of season and color type of mink on activity of antioxidant enzymes in organ demonstrates that first play more important role than second. In some cases activity of superoxidodismutase and catalase depend on color type of mink. Genetic differences are largest in spring period when functional shift on organism and on antioxidant system was increased.

### **Adjusted norms and standard diets for mink**

*T.M. Demina, O.V. Rastimechina, N.A. Balakirev*

In this study results of the research on energetic and protein feeding norms for minks are presented. New feeding norms decrease (in comparison with the year 1981) energetic level of food at 10 % (average in biological periods), protein level of food at 5 % (in 100 kcal of EE).

The structure of feeding and diets (including non-traditional means of feeding) are presented. These norms make possible to minimize the use of protein without losses in productivity.

### **The influence of antioxidant emicidin on the safety of females and young mink**

*T.V. Demina, I.S. Sugrobova, O.V. Rastimechina, V.I. Melnichenko*

The influence of antioxidant emicidin on mink safety was investigated. It was found out that emicidin when injected orally in dose 25 mg an animal a day, to mature females in lactation period absolutely excludes females lactation exhaustion. It also assists to increase the safety of cubs – an output of cubs on females – of 7 %.

### **Reproductive capability of females, growth and development of mink in different conditions of housing**

*T.M. Demina, E.G. Sergeev, N.E. Kulikov, E.A. Tinaeva, N.A. Balakirev, N.I. Tinaev*

Different indexes: reproduction showings, intensity of growth, weight of adrenal glands, fur quality of minks in different conditions of their housing were investigated.

Animals of the experimental group were kept in cages by Recommendations Concerning Farm Animals of the Council of Europe.

The animals of control group were kept in cage correspond to the requirements of Russian technologies on breeding of fur animals. The obtained results show, that essential distinctions in the females production, dynamics of pups weight and fur quality of minks of the both groups haven't been detected.

### **The use of probiotic "zoonorm" for treatment kits polar foxes**

*E.I. Drozdova, N.N. Loenko, S.V. Xolodkov*

In the laboratory and field experiment conducted the therapeutic effect of probiotic «Zoonorm» on ill kits polar foxes at early age (3 to 15 days). After addition «Zoonorm» the symptoms of the diarrhoea in kits polar foxes disappeared during 2-3 days.

### **Use of biologically active additive of 2% EPW water extract of propolis in rations for feeding slaughter young of fur-bearing animals**

*V.V. Durova*

The use of biologically active additive of EPW (2 % water extract of propolis) in rations for feeding the young of silver fox and standard dark-brown mink in a dose of 4-6 ml per 1 kg of animals' live mass with 15-day courses a month during the period of growing gives 100 % survival of the young and increases the quality of fur production by 4.5-7.9 %.

### **Effect of bioadditive – 10% suspension of ginseng cell culture on reproductive functions of fur-bearing animals**

*V.V. Durova*

The administration of bioadditive of 10 % suspension of ginseng cell culture according to an advised scheme to the basic ration of a breeding stock of standard dark-brown mink stimulates reproductive functions of those fur-bearing animals. The fertility of mink females increased by 6.8–13.7 %, that is 0.65–0.9 pup. The output of pups per main female increased by 1.15 pups. Stillborn pup rate decreased by 26.3%.

### **Age articular cartilage micromorphology of caged minks**

*E.S. Durtkarinov*

The results obtained are of fundamental meaning in arthrology for age norm evaluation of joint and its involutive transformations in postnatal ontogenesis.

### **Content of several elements in whole blood and blood serum of young raccoon dogs**

*O.E. Evenko, N.A. Suntsova, V.Z. Gazizov, N.A. Shulatyeva, I.S. Lapteva, V.M. Korotaev*

It is investigated content of 17 minerals in young raccoon dogs with fur defects. In the blood most

concentration Na and Ca is in the serum blood. The whole blood had more concentration S, Mg and other, than the whole blood. The whole blood and serum blood had same concentration Cr and As.

### **Quantity of two antigenic variants of alpha-macroglobulin of American mink in normal ontogenesis**

*V.I. Ermolaev, M.A. Savina, L.A. Skripkina*

The alpha-macroglobulins (AM) are high molecular weight inhibitors of proteases. There are two variants of AM - AIM and A2M in American mink sera. The A2M subfamily is monomorphic. The AIM subfamily is polymorphic: 14 allotypes (alloantigenic variants) have been identified in mink. Concentration of AIM and A2M during postnatal ontogenesis in American mink was studied. The results obtained indicate that concentrations of these variants of protein were matched to different periods of ontogenesis. Apparently, the substitution of the evolutionary conserved member of the alpha-macroglobulin family (A2M) for the most evolutionary unstable member (AIM) takes place in normal ontogenesis.

### **Evaluation of microelements complex use efficiency and its influence on young standard minks development intensity**

*S.A. Ermolina, V.A. Sozinov*

The complex of microcells renders positive influence on energy of growth of young growth after отсадки (a gain of alive weight, increase of the linear sizes of a body). Also it is necessary to note, that puppies норок, receiving a ferriferous preparation (a complex of microcells), are less subject to diseases with display of a syndrome of an anemia.

### **Age changes of serum iron and haemoglobin in young standard minks**

*S.A. Ermolina, V.A. Sozinov*

High iron concentration in blood serum and low content of haemoglobin in mink puppies at birth was observed. During growth the level of iron in blood serum sharply reduced, whereas concentration of hemoglobin was increased. After coming of iron deficiency in organism the intensity haemoglobin concentration gain reduced. With transition of young animals from only dairy feed to usual diets to 120-day age the increase of these both parameters was observed, they achieve almost as high iron and hemoglobin level in blood serum as in adult animals blood.

### **Prospects of the unloading method as effective element of zoological crop**

*J.S. Zabolotskih*

Outgoing from results of scientific probes and factorial tests of a unloading method in animal industries and in fur farming (Arakelyan, 1973; Saraev, 1974; Zabolotskih, 1982, 1986, 2000; Guryev, 1990; Dervyanov, 1996), successful application of unloading dietary therapy in medicine (Nikolaev and others, 1973, 1988; Babenkov and others, 1981) it is possible to conclude, that the unloading concept is more common-biological. She is the important structural link of any biological system, and the unloading method as the innovational element, actively should be used in a national economy and takes appropriate place not only in zoological technology, but also in biological social crop.

### **Nourishing qualities of new animal food for minks cubs**

*E.M. Zelenova, E.G. Kvartnikova*

This work represents the results of balance experiment on the use of nourishing substances new food, which was set on minks cubs colored demi-baff.

In the balance experiment there were found coefficients of digestion of nourishing substances of new food by minks cubs, %: protein – 60,9; carbohydrates – 33,6; organic substances – 48,8; gross energy – 52,2.

100 g of new food contains digestible nourishing substances, g: protein – 45,9; carbohydrates – 1,8; metabolic energy – 214 Kcal (897 Kj).

### **Does the feeding with mushroom shiitake increase reproductive capacity of mammals?**

*T. Zorenko, I. Motmillere, N. Matjuskova*

Oriental medicine yet for a long time uses the preparations made of shiitake mushrooms for treatment of an impotence and increase of sexual activity of the person. Meanwhile, experimental data on the influence of shiitake feeding upon the reproduction and development of animals are sparsely available. The mechanism of influence of the shiitake on physiology of a reproduction is not clear as well.

The goal of the present study was to investigate the effect of shiitake and oyster mushrooms feeding on reproduction in the social vole *Microtus socialis*. The effect of dietary supplementation of hot water extract from shiitake mushrooms upon reproduction of social vole. The fertility in the vole couples who received shiitake extract supplement was 1.4-1.8 times higher than in the control couples as judged by proportion of females who got involved in mating. The average weight of newborn pups in SES-fed couples increased by 20%. We have demonstrated placenta and milk mediated stimulation of the development of exterior morphological features and sexual maturity in vole pups, whose parents have received dietary SES.

Within 30 days with 58 young males experiments according to their ability for pairing have been lead. 38 males (65,5%) have successfully coupled with females, but 20 males (34,5%) did not show interest to females, or tried to copulate, but there were marked unsuccessful intromissions and were no ejaculation. What to do with males which didn't couple? Not mating males have been divided into three groups - 6 animals each, and received: the first - *shiitake extract supplement* (SES) together with

bran, the second - *oyster mushrooms extract supplement* (OES) and the third (*control group* of males) – bran, which was moistened with water (CES). As a result within 10-33 days (in average  $17,7 \pm 3,26$ ) at 100 % of males, who received shiitake extract supplement, the sexual activity was showed, and they have successfully mated. For the same time only 66,7% of males, received an extract of the oyster mushrooms, and 83,3 % of control males, have started pairing. Thus the first pairing at groups SES and CES was marked during 10-71 days (in average  $42,8 \pm 12,44$  and  $43,4 \pm 8,26$  accordingly). During the following 3 weeks the second mating is noted at 100 % from SES-fed and only at 66,7% from OES- and CES-fed males.

The sexual activity of males before feeding by food additives in the form of mushrooms (normal sexual activity) was compared with sexual activity of males after feeding 2 or 8 weeks (males with the lowered sexual activity). Experiments have shown stimulating effect of shiitake on sexual activity of males. If in OES and CES-fed males the number of ejaculations (and series of copulation) in 1st and 2nd pairing does not differ, in SES-fed - there is an increase in number of ejaculations as a result of feeding ( $p < 0,05$ ). In males with OES and CES in 1st and 2nd pairing a level of genital stimulation (number of thrusts per intromission) and the general duration of copulation remains to stimulation at a constant level or vary slightly at SES - they authentically increases. ( $p < 0,01$ ). If to consider, that the increase of genital stimulation leads to increase of number ovulated ova and probabilities of their implantation in a uterus of females (Зоренко 1996), it is possible to expect increase in number of the cubs falling each male-father, as it's observed. At SES on male it is necessary 7,4; at OES - 5,2 and in the control 4,6 cubs.

There was estimated the influence of shiitake extract supplement on fertility of social voles. Before feeding male copulation caused approach of pregnancy and a birth of cubs in females approximately in identical number of pairs (about 40 %). Copulation of SES-fed males led to increase in 2 times of probability of a birth of cubs (83,3 % of pairs), in OES- and in the CES-fed ones probability of a birth of the young differed a little; this parameter decreased (41,2 and 35,3 % of pairs accordingly) a little. The influence of males on increase of fertility of females could be connected with strengthening sexual activity of males (to

increase genital stimulation and numbers of ejaculations that in turn increased quantity of sperm emission in sexual ways of females), and besides, quality of sperm could improve.

The biological analysis shows those in SES-fed males the weight of vesicular gland on 65-45 mg above, than in OES-fed males and in the control ones, they are relative weight significantly above ( $p < 0,05$ ). As the secret of coagulating gland provides a feed and activity of spermatozoa the increase in its weight specifies increase of male's fertility. The biological analysis shows also, that in males after SES feeding in the age of 6-9 months the weight of testis and its epididymis is more than their appendages that in turn influence quality of spermatogenesis. Density of the sperm received from epididymis of SES-fed males significantly above, than of control males (accordingly 0,9 and 0,6 standard units,  $p < 0,01$ ). In comparison of males after SES and OES feeding density of sperm at the first also above, but differences are not statistically significant.

In copulation case the copulation plug, what promotes transport of sperm in a uterus of female is formed. Formation of copulation plug depends on secretion of coagulating gland. In case of if it is not formed or less on the size, it can decrease probability of fertilisation of female. In ejaculation the plug, what promotes transport of sperm in a uterus of female is formed. Formation of a plug depends on secretion of prostate gland. In case if it is not formed or less on the size, it can decrease probability of fertilisation of female. In SES-fed males the total weight of plugs for all period of copulation and probability of its formation increase (before feeding 76 %, as a result of feeding 100 %, 35% and 88 % accordingly in the first, in the second and third series of copulation). The probability of formation of a plug in females in copulation with OES-fed male does not exceed 79 % and in CES-fed males - 66,7 %.

Mobility of spermatozoa also differs in males of three groups and makes 60,6 % (SES), 38,7 % (OES) and 39,1 % (CES). SES feeding statistically significantly increase mobility of spermatozoa. Accordingly considerably below at feeding shiitake a share lifeless, immobility of spermatozoa ( $8,3 \pm 1,81$  %) in comparison with sperm of OES-fed ( $16,8 \pm 4,17$ %) and CES-fed males  $30,6 \pm 5,54$ %, differences are significant. The part of vibrating

spermatozoa approximately is identical in all 3 groups of males.

Carried out research show, that the extract of mushrooms shiitake first of all influences on spermatogenesis, improving quantity and mobility of spermatozoa, strengthening sexual activity of males that raised effect of copulation. It is possible to assume, that a complex of active substances of an extract shiitake: prostaglandins, polysaccharides, ions of metals (zinc) influences increase on production vesicular gland (and according to their weight) that provides a feed sperm and their mobility. The oyster extract supplement so appreciable influence on sexual activity of males does not render. If the improvement action of shiitake mushroom as the supplement to dietary on animals' reproductive abilities will be proved, then it could be used for feeding several zoo-animals species, which due to some reason reproduce poorly in captivity.

#### **Vitamins A and E in the polar fox during postnatal ontogenesis**

*T.N. Ilyina*

The vitamin A and E concentration in the blood serum, lever, kidney and heart of polar fox (*Alopex lagopus* L.) was determined during the postnatal ontogenesis by high performance liquid chromatography method. Groups had animals at the age 1, 5, 20, 35, 50, 90 180, 300 days, and 1.5 и 4.5 years of life. It was identified that the vitamin A and E level changes in the polar fox blood and organs were most significant during early ontogenesis and connected with principal stages of growth and development in this period. During later phases of development the vitamin A and E in the tissues depends both on exogenous inflow and on age changes of morphofunctional systems.

#### **The morphological features of a dermal integument at fur animals**

*A.S. Istomin*

The paper contains the results of researches of morphological and functional features of fur animals' dermal integument.

#### **Influences of some biologically active substances on polar fox antioxidant system**

*S.N. Kalinina, V.A. Ilyukha, S.S. Filimonkov*

The influences of some biologically active substances (melacril, mercasolil, thyroxine) on polar fox antioxidant system in six organs (liver, kidney, heard, spleen, lung and skeletal muscle) was investigated. The higher resistant of polar fox antioxidant system to influences of investigated biologically active substances in comparison with other animals was demonstrated. Differences in reaction of different part of antioxidant system on biologically active substances were found out. It was established that melacril have a stronger effect on the antioxidant system than mercasolil and tiroxine.

#### **Biological role of iodine in the organism of animals**

*L.Y. Karpenko*

Biological role of iodine in an organism of animals is very important. The article contents own researches by definition of the maintenance of iodine in milk mares, the maintenance of iodine in different biological liquids at dogs, the maintenance of iodine in serum of blood of different kinds of animals.

#### **Estimation of activity phagocytosis at chronic renal insufficiency at dogs**

*L.Y. Karpenko, A.I. Enukashvili*

The article says about studying of parameters oxygen dependent and oxygen independent link of phagocytosis at chronic renal insufficiency at dogs.

**Biochemical estimation of a condition of antioxidant system of dogs**

*L.Y. Karpenko, A.A. Bakhta, A.B. Andreeva*

Criteria of an estimation of condition of antioxidant system in dogs and criteria of an estimation of intensity of processes peroxidase oxidations of fats at dogs were investigated and determined.

**Requirements for sanitary-chemical quality of food mixes for minks in represent feeding base**

*E.G. Kvartnikova, R.I. Michailova*

This work represents the new limits of biochemical quality of food mixes for minks.

**Reproductive function, and brain catecholamines after chorionic gonadotropin stimulation of mink females selected by behaviour**

*D.V. Klochkov, T.A. Alekhina, O.V. Trapezov, O.I. Prokudina*

Mink selection for aggressive behaviour type results in catecholamine level increase in hypothalamus that is consequently one of inhibiting factor for reproductive function.

**Current state and the perspectives of fur breeding development in "Pryazhinskoye" closed corporation at present-day reality**

*V.P. Koloushkin*

Historical information about process of organization fur farm "Pryazhinskoye" and analyses of status, problems and perspectives in modern condition was made.

**Main biochemical indices of nutria's blood at food deprivation**

*V.M. Korotaev, N.A. Suntsova, V.Z. Gazizov, L.E. Boyarintsev, O.E. Evenko, I.S. Lapteva*

During two-week starvation nutrias were weighed and measured. After starvation the biochemical indices of blood: albumen, glucose, alkaline phosphatase, aspartate aminotransferase and chlorides were tested. It was discovered that to the end of the experiment the live weight decreased by 1285,00±61,49g. Biochemical indices show the intensity of metabolism.

**Chorionic gonadotropin stimulation effect in prepubertal period on follicle development and early embryonic development in mink, evaluation of potential fertility**

*D.V. Klochkov, G.K. Isakova, P.A. Eryuchenkova*

Females stimulated by chorionic gonadotropin had significantly higher general fertility judging by number of ready for ovulation maturing follicles in the second part of mating period.

**Chorionic gonadotropin administration to prepubertal mink females. Effect on early embryonic development of their posterity and follicle development**

*D.V. Klochkov, P.A. Eryuchenkov*

Investigation of chorionic gonadotropin effect on females' fertility and embryonic development of minks was carried out. Females stimulated by chorionic gonadotropin had significantly higher general fertility judging by number of ready for ovulation maturing follicles in the second part of mating period.

### **Effects of two phase protein feeding on performance of blue foxes during growing-furring period, a field study**

*N. Koskinen, T. Dahlman, I. Pölönen, J. Valaja, T. Rekilä*

The feeding trial was carried out on 172 blue foxes during growing-furring period (94 males and 78 females). The feeding trial was conducted as a field study 25.8.-11.11.2003 in private fur farm in Evijärvi, Finland (Oy Turkistarha Jussi Eilonen). The aim of this study was to evaluate the effects of two phase protein feeding on growth, health and fur quality parameters of blue foxes during growing-furring period.

The groups were control group and research group. Control feed contained normal protein level (recommendation of Finnish Fur Breeders Association) without amino acid supplement (commercial blue fox feed with 28 % protein of ME during 25.8.-22.9. and 25% protein of ME during 23.9.-11.11.). Research feed contained 25 % protein of ME during 25.8.-22.9 and 20 % protein of ME during 23.9.-11.11. both with supplemented methionine. The control feed was made and delivered to the farm daily. The research feed was made once a week and stored in the farm. Both groups were fed with the same amount of food daily. Animals were weight biweekly during the trial and they were pelted at the end of the trial. Pelt length (cm) and weight (g) was measured after which they were graded at the Finnish Fur Sales Company Ltd for color, clarity, fur density, guard hair quality, coverage, quality and overall impression. The faeces were analysed for phosphorus, liquid nitrogen and total nitrogen.

All blue foxes maintained good health during the feeding trial nor did high amount of cereals cause any faecal problems. No statistically significant differences between treatments were found in mean weight gain in the trial. Final average weight (per cage) was 16,92 kg in control group and 16,67 kg in research group. In the trial no statistically significant differences between treatments were found in pelt length, pelt weight, color, clarity, fur density, guard hair quality, coverage, quality and in overall impression. Phosphorus and nitrogen content of the faeces were much lower in the control group: P 8.8 and N 5.3 g/kg in research group, P 13.0 and N 9.7 g/kg in control group.

In conclusion, the experiment showed that with two phase protein feeding during growing-furring period with supplemented methionine blue foxes grow normally and the pelts are similar fed with higher protein containing feed. By using less expensive raw materials such as cereals and methionine in blue fox feed the producing costs are lower. By using less protein and ash containing raw materials in feed also phosphorus and nitrogen loads are getting smaller. Although supplemental methionine is essential for normal hair priming in low protein feeds. Without adequate methionine the hair growth and the skin development is abnormal. Generally, the two phase feeding during growing-furring period produces healthy animals and high-quality pelts, even the effect of lower (15 % protein of ME) protein level on growth and fur properties should be studied.

### **Low protein and methionine in blue fox diet during growing-furring season, a field study**

*N. Koskinen, T. Dahlman, I. Pölönen, J. Valaja, T. Rekilä*

The feeding trial was carried out on 382 blue foxes during growing-furring period. Half of the blue foxes were males and half of them were females. The feeding trial was conducted as a field study 5.9.-14.11.2001 in private fur farm in Uusikaarlepyy, Finland (Cederholms Pälsfarm ab). The aim of this research was to study the effects of low dietary protein level with supplemented methionine on blue fox growth and fur properties in practise.

The groups were control group and experimental group. Control feed contained normal protein level (recommendation of Finnish Fur Breeders Association) without amino acid supplement (commercial mink feed with 33 % protein of ME). Experimental feed contained low protein (19 % protein of ME) and supplemented methionine (2 g/kg). The control feed was made and delivered to the farm daily. The experimental feed was made once a week and stored in the farm. Both groups were fed with the same daily amount of feed. Animals were weight biweekly during the trial and they were pelted at the end of the trial. Pelt length (cm) and weight (g) was measured after which they were graded at the Finnish Fur Sales Company Ltd for color, clarity, fur density, guard hair quality,

coverage, quality and overall impression. The faeces were analysed for phosphorus, liquid nitrogen and total nitrogen.

All blue foxes were healthy during the feeding trial nor did high amount of cereals cause any faecal problems. No statistically significant differences between treatments were found in mean weight gain in the trial. Final average weight per cage was 13.10 kg in control group and 13.39 kg in research group. Although specific growth rate (SGR, % per day) was better in experimental group ( $p < 0.05$ ). In the trial no statistically significant differences between treatments were found in pelt length, pelt weight, clarity, fur density, guard hair quality, coverage, quality and in overall impression. Blue foxes in the control group had slightly darker pelts ( $p < 0.05$ ). Phosphorus and nitrogen content of the faeces were much lower in the control group.

In conclusion, the experiment showed that with lower dietary protein with supplemented methionine blue foxes grow normally and the pelts are the same as fed with more expensive mink feed. By using less expensive raw materials such as cereals and methionine in blue fox feed the producing costs are lower. By using less protein and ash containing raw materials in feed also phosphorus and nitrogen loads are getting smaller. Although supplemental methionine is essential in low protein feeds. Methionine is essential for hair growth. Without adequate methionine the hair growth and the skin development is abnormal. The energy content of the experimental feed was slightly lower than in control feed but still blue foxes grew similarly in both groups. Generally, the low dietary protein level (19% and supplemental methionine) is sufficient for growth and to produce high-quality pelts in growing-furring period.

#### **The influence of Monclavit-1 on incubatory eggs**

*A.F. Kuznetsov, S.V. Litvyakov, K.V. Salandaev*

The relative cheapness of " Monclavit-1" medicine, its safety, ecological and effective measures of using; its possibility for disinfection of incubate eggs definite the perspectives of this medicine using in poultry farming.

#### **Biochemical and morphological showings of mink kept in different housing systems**

*N.E. Kulikov, N.A. Balakirev, E.A. Tinaeva, T.M. Demina, E.G. Sergeev, N.I. Tinaev*

This work is a contribution to the study of morphological and biochemical parameters in blood and serum of minks in different conditions of their housing.

Values of these parameters were established. The obtained results show, that these factors not connected with the condition of minks housing (of Russian technologies and correspond to the Recommendations of the Standing Committee of the Council of Europe).

#### **Monclavit use efficiency at cows endometritis**

*S.V. Litvyakov, A.F. Kuznetsov*

The usage of Monclavit-1 for treatment of endometritis gives a very significant effect in both acute and chronic forms of disease.

#### **Monclavit-1 effect on blood and faeces indices at treatment of calves dyspepsia**

*S.V. Litvyakov*

Per oralis usage of Monclavit in dyspepsia of calf's assists of some changes in immunological blood indexes that in whole make the increasing of stability and their convalescence organism.

#### **Therapeutical efficiency of Monclavit-1 for cows mastitis treatment**

*S.V. Litvyakov*

The investigations were demonstrated that intrasternal usage Monclavit-1 one time per day oblige to reduce the period of caws convalescence, the sick caws of serious and sometime chronic mastitis. In the same time we may conjecture that the increasing of short-dated usage of Monclavit-1

to 2-3 time per day oblige to make the very therapeutically effect.

### **Comparative study of lactate dehydrogenase isoenzymes in tissues of mammals**

*N.V. Matsuk, V.V. Ostaschkova, V.A. Ilukha, A.R. Unzhakov, V.V. Belkin, A.V. Jakimov*

LDH isoenzymes present in heart, liver, lung, kidney, spleen and skeletal muscle of farm-bred (minks *Mustela vison Br*, polar foxes *Alopex lagopus L*) and wild animals (castors *Castor fiber L.*, *C. canadensis Kuhl.*, hare *Lepus fimidus L.*, red mouse *Clethrionomys glareolus Schreb.*, elk *Alces alces L.*, marten *Martes Martes L.*) and albino laboratory rat *Rattus rattus L.* were revealed by agar gel electrophoresis according to Wieme's procedure. In mammals the isoenzymatic LDH spectrum of different tissues is organ and species specific.

### **Reproductive strategies in felidae reproduction**

*S.V. Naydenko, M.N. Erofeeva, K. Norbauer, F. Geritz, K. Evgenov*

Reproductive success of lynx (*Lynx lynx*) males didn't evidently effect on the order and number of coupling with females, but depended on their sperm quality.

### **Effective utilization of biostimulators in fur farming**

*A.M. Nikitenko, V.V. Malina, N.N. Tyutyunnik*

The received results testify about grows stimulated action nSTG (a preparation from a hypophysis of a mink) and additives to diets immunomodulator (KAFI, Gomotin, Mobes) in various combinations that is shown in increase in monthly additional weights. Activation of a homeostasis positively affects formation of a fur and a physiological condition.

### **Stimulation of reproductive function of young females of mink**

*P.P. Orlov, N.A. Shulyatieva*

The effect of a silicon-organic biostimulant Migugen on the reproductive function of young females of mink was studied. It was shown that the administration of that biostimulant into the fodder of animals favoured the decrease of the number of barren females by 22 %, fatal births – by 16 % and increased the viability of kits.

### **Increase of litter vitality in young females of nutria**

*P.P. Orlov, N.A. Shulyatieva*

The studies on the increase of litter vitality of young females of nutria resulted in the devising of the method of female stimulation with a biostimulant Migugen that gave an opportunity to increase the output of pups by 63 %.

### **Endocrine and reproductive effects of color mutations in silver foxes (*Vulpes vulpes*) bred in captivity**

*L.V. Osadchuk*

Captive breeding of wild animals is a first step of domestication. The process is accompanied by a number of adaptations to captive conditions, which have been forming for generations and resulting in morphological, behaviour and physiological changes. One of common morphological consequences of domestication is a coat-color mutation named Star that is characterised by some unpigmented areas on the skin and negative effects on reproduction. Many domesticated animal species have this mutation including very recently domesticated fur animals such as farm-bred silver fox, mink and otter. The aim of the present project is to investigate of pleiotropic effects of Star gene on fertility and the hormonal control of reproduction in selected for nonaggression to humans for many generations and unselected silver foxes. For the first annual stage of the study plasma progesterone, oestradiol and cortisol concentrations and their

contents in the ovaries and adrenals were compared between selected and unselected vixens in anoestrus and pregnancy. In addition, fertility was estimated by the number of corpora lutea, implantation sites and litter size. The data obtained showed that there was no effect of Star gene on the number of corpora lutea (potential fertility), but a significant effect of this gene on the litter size was established particular in selected vixens. Detrimental effect of Star gene on ovarian and adrenal weights occurred in both behavioural group of vixens. Star gene also decreased plasma concentrations of progesterone and cortisol, ovarian progesterone content and adrenal content of both hormones during pregnancy while the effect was more expressed in selected in comparison with unselected vixens. The results obtained demonstrated significant and negative effects of Star gene on the endocrine control of pregnancy resulting in increase in embryonic losses and decrease of the litter size. This trend was expressed clearer in silver fox vixens from the selected population. Additional factor that would impair the hormonal support of pregnancy in the animals carrying Star gene was a decreased adrenocortical activity.

### Morphofunctional state of lymphatic system of organ of vision in canidae

*S.M. Paninsky*

The article is devoted to studying of outflow of lymph from the basic structures of an eye at dogs and silver - black foxes.

### Some aspects to consider for improving reproduction of blue foxes (*Alopex lagopus*)

*P. Pylkkö, N. Koskinen, J. Sepponen, T. Rekilä*

Blue fox (*Alopex lagopus*) is the most important species for fur farming in Finland. At present selective breeding is focused to large and heavy animals. Ten years ago average weight of blue fox female varied from 7 to 10 kg. Today individuals over 20 kg can be found.

Fur farmers have been alerted since 1990, because number of vixens born has not been as expected. Mink (*Mustela vison*) has improved the litter size (1 vixen/artificially inseminated female) during the last 20 years (Fig 1, Tarhaajan kalenterit 1983 - 2003). However, the litter size of blue fox has stayed the same or decreased during the years 1983-2003 (Fig 1).

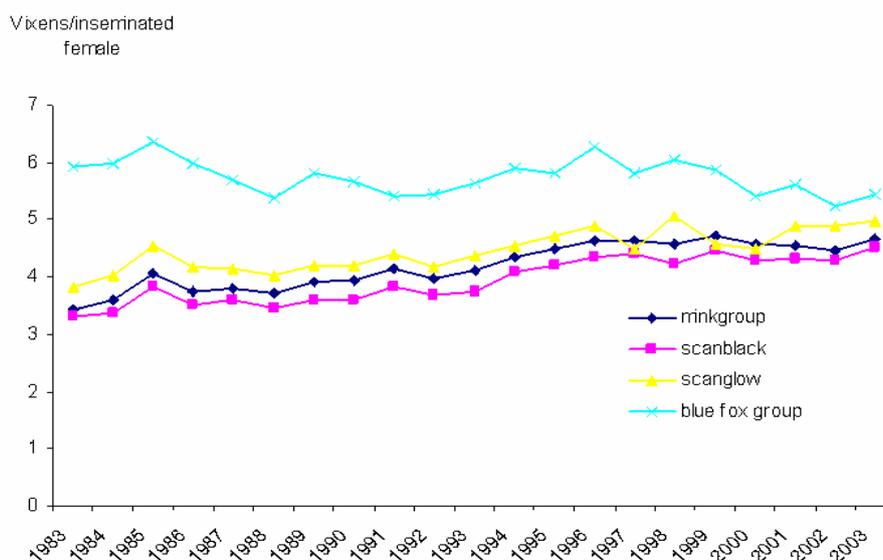


Figure 1. The litter size of blue fox (*Alopex lagopus*) and mink (*Mustela vison*) from 1983 to 2003. Blue fox group includes all fur colors and cross breeds. In mink, the economically most important shades of colors are at the moment scanblack and scanglow. (Tarhaaja kalenterit 1983 -2003)

Aim of the study was to

- determine if the first year litter size correlates to the second year litter size
- determine the electric resistance ( $\Omega$ ) of vaginal epithelium during estrus, the time period of estrus and the litter size in Finnish and Estonia blue fox pure breeds and their interbreeds
- determine the effect of season, when blue fox females are selected for breeding, to the litter size/female
- clarify the effect of average body weight of artificially inseminated blue fox female to the litter size/female

Results of this study indicate that the first year's litter size/inseminated female correlates to the second year's litter size in blue foxes. Females which give birth to small number of vixens in the first year of breeding will do so in the second year of breeding also. Interbreed (50%, one parent being Finnish and one Estonian) of blue fox have higher vaginal electronic resistance ( $\Omega$ ) during the estrus than the Finnish and Estonian pure breeds alone. Thus, estrus lasts a shorter period and is clearly detected in the 50% interbreed. In addition, the litter size/inseminated female is the largest in the 50% interbreed and in pure Estonian blue fox breed. In general high body weight has a negative effect to the litter size/inseminated blue fox female. Blue fox females selected for breeding at weaning give birth to a larger number of vixens than females selected in fall.

In this study we have shown that there are several aspects to consider for improving the blue fox breeding. The first year's litter size/female is important when breeding animals are selected. In addition the blue fox breed should be taken into consideration when improvement of litter size is sought. The season when breeding animals are chosen is as well important. The average body size of blue fox female at the time of artificial insemination has an effect to the litter size. However, these aspects for improving litter size/female need still to be further studied in order to establish the right means for fur farming.

### **Development and testing of Euro-standard cages for fur-bearing animals**

*I.A. Plotnikov*

Test specimens of cages for fur-bearing animals were developed. They satisfy the requirements of "Recommendations concerning fur animals – T-AP (96) 19" adopted on 22.06.99 by Standing Committee of the European Convention on the Protection of Animals kept for Farming Purposes, Council of Europe. It is found that new cages have no effect on the growth of animals and the size of their fells.

### **Using of melatonin in zooculture**

*O.L. Rapoport, L.Y. Kiselyev, N.N. Novikova*

In 1985 the mass introduction of hypodermic implantations of granules, containing melatonin and accelerating maturation of a winter fur of minks, foxes, polar foxes, polecats, was begun. About 1 million fur – bearing animals were processed annually. During the last years granules for hypodermic implantations, containing substances increasing the efficiency of melatonin, have been developed and tested.

### **Putative effect of light intensity to reproduction in blue foxes (*Alopex lagopus*)**

*T. Rekilä, T. Korhonen, N. Koskinen, J. Sepponen, P. Pylkkö*

Majority of blue foxes in Finland are housed in traditional shed houses. The shed house usually has nontransparent roofs against sunlight. Increasing daylight and intensity of light during spring is a key factor in stimulating reproduction. Despite of long lasted selection for reproductive success the number of nonreproducing females is however high. Could the explanation for this be that nontransparent roofs serve as a hindrance to the sunlight and therefore affect to the total light intensity.

Light intensity was measured from January to May in a traditional shed house with a nontransparent

roof. A rearing hall with the 30% light transpiring roof was used as a reference. Total 50 primiparous blue fox female siblings were randomly allocated in the shed house and in the rearing hall. The blue fox vixens were artificially inseminated.

The highest light intensity was detected four weeks earlier in the shed house than in the rearing hall (Figs 1 and 2). After the light intensity peaked outside it decreased in the shed house but stayed at high level in the rearing hall. The number of inseminated females was higher in the hall than in the shed house (47 vs. 37,  $P < 0.001$ , respectively). This difference in the number of inseminated females is probably due to high light intensity enough for females to reach estrus. The light intensity in the rearing hall resembles the light intensity in a natural environment. However, in the shed house the light intensity first increased and then decreased.

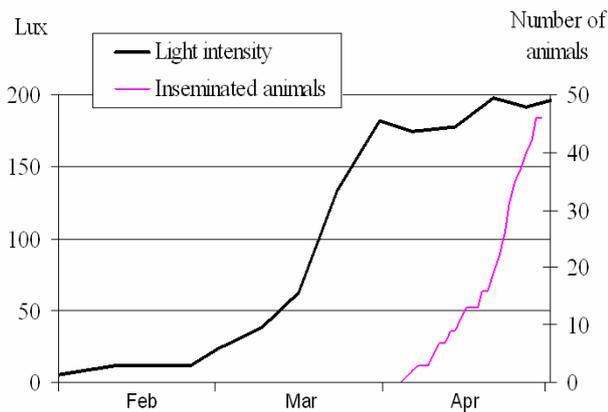


Figure 1. Light intensity and cumulative number of inseminated blue foxes in the hall.

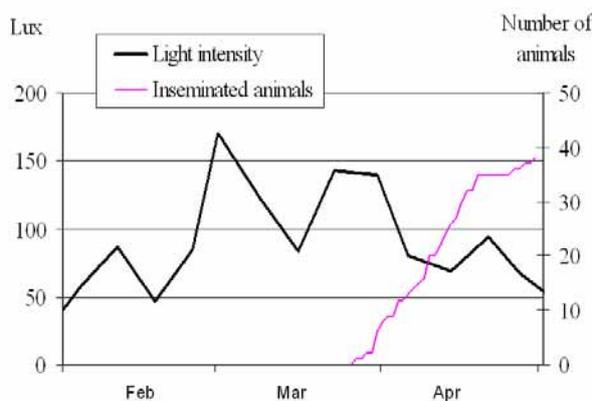


Figure 2. Light intensity and cumulative number of inseminated blue foxes in the traditional shed housed.

Little is known about sufficient light intensity needed for a good reproduction result in blue foxes. However, practical experience is that 100 lux is the lowest dose of light needed for estrus. Light intensity below 100 lux was detected in the shed house (Fig 2). Blue foxes females are naturally adjusted to increasing daylight hours and light intensity in the spring rather than first rapidly increasing and then rapidly decreasing light intensity. It probably would be worthwhile to study whether the light intensity fluctuation correlates to the number of nonreproducing females.

### **Mercasolium and thiroxine effects on liver cathepsin D activity and haematological indices of polar foxes**

*N.L. Rendakov, E.A. Gorelova*

Thyroxine and thyreostatic mercasolilum (thiamazole) different doses effects on cathepsin D activity in liver, some blood indices and body mass of polar foxes were studied. The dose-dependent effect was revealed only for body mass. Mercasolilum administration caused the decrease of cathepsin D activity in liver lysosomes and the increase of body mass. Thyroxine resulted in cathepsin D specific activity rise and protein concentration reduction in lysosomal fractions of liver. Thyroxine dose enlargement led to reduction of both general and specific cathepsin D activity in liver.

### **Age dynamics of thyroid hormones concentration in polar foxes**

*N.L. Rendakov, N.N. Tyutyunnik*

Alterations of thyroid hormones level in farm-raised polar foxes' serum were studied at ages of 1, 5, 10, 20, 35, 50 and 160 days. It was shown that 1-day old foxes had increased thyroxine and triiodothyronine concentrations as compared with 5-day old animals. Phase dynamics of the hormones was revealed in growing polar foxes with relatively high iodothyronines content at the age from 20 to 35 days after birth with the further declining.

### **Probable physical-chemical mechanisms of evolutionary development of regulatory reactions in protein solutions under external exposure**

*S.P. Rozhkov*

An equilibrium thermodynamic model was developed allowing to obtain equations of lines of the phase transitions: sol-gel, liquid-liquid, liquid-solid in a three component system water-protein-salt. These lines were presented in coordinates of protein solubility versus salt concentration. Phase transitions are conjugated with transformation of different structural-dynamic states of protein solution. One of them is a quasi-equilibrium monomer $\leftrightarrow$ cluster state in which the principle of osmotic homeostasis is realized. Decomposition of this state caused by temperature or salt concentration changes followed by phase transition, manifests specific structural-dynamic behavior which is very similar to cytoplasm alterations during the process of the nonspecific adaptive syndrome of a cell system (NASCS). This gives an opportunity to model NASCS basing on a pseudo three-component system.

### **One-year sable females reproductive characteristics**

*Z.S. Ruchkina, T.M. Chekalova*

In the article are given characteristics of reproductive abilities of one-year female sable by cage keeping and pointed reasons of absence of kindle by majority among them.

### **Spectrum of carbohydrases of mink and blue fox in ontogenesis**

*E.B. Svetchkina*

There was studied the formation of the activity of enzymes hydrolyzing hydrocarbons of minks and blue foxes in postnatal ontogenesis. Activity of amylase, lactase and saccharase was determined in their small intestine. The study showed that lactase activity increased from birth to transition to a definitive nutrition. In the course of aging alteration of amylase saccharase activity in small intestine of

minks and blue foxes puppies was uneven, fluctuating and increasing in late stages of ontogenesis. The fluctuations of activity are probably connected either with hormonal regulation of carbohydrate exchange or with presence of certain stress-factors (undereating, overcooling, overheating).

### **The use of pathogenicity factors of micro-organism by construction immunobiological preparation**

*A.N. Semikrasova, S.S. Saveliev, N.A. Polunina, O.B. Litvinov*

The suggested medication can be used as the specific preventive measures of streptococcus's and pseudomonas among polar foxes.

The immune medication is innocuous, creates immunity of polar foxes pups, from female polar foxes, immunized before reproduce period.

### **The influence of behavior's type on productivity of minks and foxes in different conditions of housing**

*E.G. Sergeev, T.M. Demina, N.E. Kulikov, E.A. Tinaeva, N.A. Balakirev, N.I. Tinaev*

The behavior of minks and polar foxes in different conditions of their housing was investigated.

The animals of experimental group were kept in cages by Recommendations Concerning Farm Animals of the Council of Europe.

There were a subject to gnaw and wooden shelf for rest in the experimental cage for females of polar foxes. The animals from control group were kept in cages correspond to the requirements of Russian technologies on breeding of fur animals.

Three types determine character of mink behavior: aggressive, calm and coward. There was no aggressive reaction among the polar foxes. The females of polar foxes spent time on a shelf of rest to 76,2 % of their daytime.

Indexes of the reproduction of animals with different types of behavior were investigated. A relation was not established between behavior, conditions of minks housing and their prolificacy.

Results of polar foxes breeding showed that in experimental cages with additional elements of comfort the females had statistically proved lower in indexes: prolificacy and an output of cubs on a female.

#### **Stimulation of follicle development by 11-deoxy-analogue of prostaglandin E1**

*L.V. Sidorova*

Hormonal activity stimulation for minks is possible by the use of PG S16 (50 mcg/kg) before mating period, because estrogenic activity raise and progesterone level decrease were observed at testing of this analogue that resulted in more intensive follicle growth, greater amount of egg cells, and more early mating period start in animals.

#### **The detoxication of an organism with application of enterosorbents and local decompression**

*V.G. Skopichev, L.V. Zhichkina*

The detoxication of organisms is of great importance. Enterosorbent fitosorb adsorbs toxins on its surface in gastroenteric tract and moves them out of organism.

#### **Clinical substantiation of health of animals at the analysis of crystallization of saliva of dogs of nursery of the Ministry of Internal Affairs**

*V.G. Skopichev, A.A. Stekol'nikov, M.K. Kasumov, L.V. Zhichkina*

Studying of crystallization of saliva allows diagnosing various pathologies in an organism of animals.

#### **The x-radiography and morphological correlations in a rating of age modifications of a bone and joint system of fur animals**

*N.A. Slesarenko, E.S. Durtkarinov, A.I. Torba*

The methods of a X-radiography and morphological analysis fix a radiographic semeiology and morphological pattern of age destructive modifications of bone and joint system for cage fur animals (sable, fox) from new birth till seven years. The received data matter in questions of an estimation and forecasting of animals locomotorium in conditions of a cage keeping.

#### **Characteristics of enteric-associated lymphoid tissue topography in polar foxes**

*N.A. Suntsova*

Quantity of lymphoid follicules of intestine wall lymphoid plaques in 8 month old males was more than in females. Quantity of single lymphoid follicules of the female more then the male in the walle thik gut.

#### **Using recombinative antitoxical preparat pHMB for increase of minks productivity**

*N.N. Tinaev*

The influence of biosubstance – probiotik pHMB on live weight and fur quality of young minks was investigated.

It was found out that biopreparat statically proved increased live weight of young mink and fur quality to 91,9 % on female and 120,2 % on male in experimental group, with comparison 80,6-111,0 in control group.

### **Combinative method of fur animal killing**

*N.I. Tinaev, V.A. Skobelev, E.A. Tinaeva, C.G. Sergeev, N.E. Kulikov*

The authors have worked out the combinative humane methods of fur animal (minks and putorius) killing based on anesthetics for the general narcosis (fenazepam and pentobarbiton) using and subsequent killing by an injection of muscular relaxants (ditilin and azid natrii).

### **The domestication of fur bearers and homological rows in variability of their coat colors (American mink as a model)**

*O.V. Trapezov*

In 1920, N.I. Vavilov read a paper "The Law of Homologous Genes in Hereditary Variation" held in Saratov (Vavilov, 1922). Homologous variation has been demonstrated for virtually all plants and animals. This parallelism of phenotypic variability allows to predict similar forms and properties in virtually all closely related biological species. Thus, homology of coat color concerns not only families and orders, even classes. In the course of domestication of American mink, coat color appeared homologous to the one of observed in other species that had been under domestication (cat, dog, rabbit, horse, cattle, pig). Vavilov's law of homologous series in variation offers properties for searching new coat color variations in fur bearers.

### **The mendelian law's and fur animals breeding (140 years of the laws of heredity)**

*O.V. Trapezov*

The International Work Shop devoted to the question "Genetics after Genome" was held in Brno (Moravia) in May 1925. The main idea of this assembly was to clarify the role of genetics in modern problem of evolution and selection practicing.

### **The results and the perspectives of physiological and biochemical investigations of fur-bearing animals introduced in zooculture**

*N.N. Tyutyunnik*

The problem of interrelation between an organism and its environment is for many decades in the center of scientific investigations, among which the direction is coming to light connected with study of structural and functional mechanisms, providing an opportunity for life preservation and separate parameters of its functions in complex and occasionally unfavourable environmental conditions.

The main directions of researches of animal ecological physiology laboratory of Institute of biology are submitted, conducted at the level of serum, leukocytes, organs and tissues enzymes, blood isoenzymes, digestive tract enzymes, vitamins, sex and thyroid hormones, lysosomal proteolytic enzymes in polar foxes organs, humoral factors of non-specific immunity in the process of individual and species-specific adaptations to the natural and technological environmental factors. The opportunity of fur-bearing animals' physiological state correction and reproductive function optimization by bioactive substances of metabolic and immunologic effects is under investigation.

### **Use of the mineral component "Shungistim" in polar foxes breeding**

*N.N. Tyutyunnik, Y.K. Kalinin, A.R. Unzhakov, H.I. Meldo, E.B. Svetchkina, I.V. Baishnikova*

The study of natural mineral shungit and mineral water solution influence on growth, development and physiological state of polar foxes pups are carried out.

The use of these components has not exerted negative effect on physiological state of pups, however some alterations in biochemical structure of blood testify to insufficient uptake of nutritious substances by animals organisms. The data obtained show the efficiency of this mineral component.

### **Influence of selenium and succinic acid on physiological state, haematological and biochemical indices of young minks**

*A.R. Unzhakov, N.L. Rendakov, N.N. Tyutyunnik, H.I. Meldo*

The study on influence of selenium and succinic acid on growth, development and physiological state of young minks is carried out. It is established, that in July the number of fallen minks in control group was significantly higher, than in experimental groups ( $P < 0,05$ ). The haematological and biochemical parameters were within normal range in control and experimental groups.

### **Use of the method of food deprivation for polar foxes in slaughter period**

*A.R. Unzhakov, N.N. Tyutyunnik, H.I. Meldo*

The effect of full alimentary starvation (with water) of polar foxes on blood (serum) biochemical components, on activities of blood enzymes – ASAT, ALAT, LDH, AP, LDH-isoenzymes in organs and body weight was studied. No significant changes in blood enzymes activities and fur quality after 8-day starvation in foxes were revealed. In accordance with biological peculiarities of fur-bearing animals we recommend the method of 8-day alimentary starvation for farm-raised polar foxes in autumn. The method of 8 day food deprivation of polar foxes may have the significant economical effect.

### **Lactic dehydrogenase-C – A specific isoenzyme of testes**

*A.R. Unzhakov, N.N. Tyutyunnik, H.I. Meldo*

Lactic dehydrogenase-C (LDH-C) is a specific cell isoenzyme involved in spermatogenesis and spermatozoa metabolism of animals. Use of this isoenzyme in fur farming for culling of sterile males from breeding herd is possible.

### **Internal characteristics of standard dark-brown mink in the course of domestication**

*O.I. Federova*

In the article are represented findings of investigation about changes of mink standard dark brown internals in the course of domestication over the last 40 years. As a result of selection for enlargement took place certain changes in morphologic and functional status of American mink internals.

### **The possibility of coupling between sables and polecats**

*G.A. Fedoseeva*

It was found out the possibility of the coupling between sables and polecats.

### **On the age influence on slaughter nutrias meat and carcass by-products outcome**

*S.A. Fominykh, N.A. Suntsova, V.Z. Gazizov*

The purpose of our research was to perform comparative studies of deadweight of nutria meat and nutria by-products depending on the age. The deadweight of nutria was assessed at the age of 8-9 and 12 months. As the age criteria increases, the deadweight of nutria meat also increases from 45, 0 % up to 55, 8 %. The outcome of food by-products decreases from 58,16 % to 53, 37 %.

### **The structure of gonads and hormone levels in foxes and polar foxes, kept in cage**

*N. Shulgina*

The investigation of ovaries histological structure and generally endocrine compartment in foxes and polar foxes females of different age was conducted. Dynamic of thyroid cortisol and sexual hormone in the blood of animals was investigated.

**Different constitution type color foxes fur quality**

*N.N. Shumilina*

This article is devoted to study of influence of different types of color foxes constitution on quality of hair covering. For obtaining furs of grow high quality, it is desirable to grow foxes of strong and rough type of the constitution. Animals of gentle type of the constitution have furs with a lot of defects.

**Morphometric os penis indices and epididymis mass influence on reproductive mink qualities**

*N.N. Shumilina, T.V. Mayorova*

Some morphometric parameters of os penis and epididymis and their effect on reproductive qualities were studied.

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**Keywords** in alphabetic order if not included in the title.

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