Original Report

Behavioural polymorphism in defensive behaviour towards man in farm raised mink (*Mustela vison* Schreber, 1777)

Oleg V. Trapezov

Laboratory of Genetics and Selection of Fur Animals

Institute of Cytology and Genetics

Siberian Department, Academy of Sciences of Russia

630090, Novisibirsk, Russia

E-mail: trapezov@bionet.nsc.ru

Summary

Polymorphism in the defensive reaction towards man was investigated in two colour types (*Standard* and *Sapphire*) of farm-bred mink. Defensive characteristics take three forms: fright (79%), tameness (4%), and aggressiveness (1%). The mean score of behaviour in the total mink population tends to aggressiveness and is equal to –0.21±0.005. Statistical analyses demonstrate that females in both colour phases (*Standard* and *Sapphire*) displayed significantly higher aggressiveness than males. The aggressive part of the mink population is demonstrated by the low scores in behavioural variability and by the mean scores of behaviour in all groups: *Standard* and *Sapphire*, males and females which are practically the same.

The variability in the scores of tameness behaviour increased sharply. In the tame group of animals, *Sapphire* mink have a significantly higher level of domestic behaviour than their *Standard* counterparts. There is a sex difference in *Sapphire* mink also: Males display significantly tamer behaviour than females. At the same time, *Standard* mink did not show a difference in the expression of tameness between males and females. Certain aspects of the data are especially noteworthy. The highest behaviour variability in the total mink population takes place in *Sapphire* mink, i.e. the greatest percentage of aggressive animals appear in *Sapphire* females and tame ones in *Sapphire* males.

Keywords: mink, behavioural polymorphism, defensive behaviour in captivity, standard and sapphire mink, coat colour mutations and aggressiveness, sex and aggressiveness.

Introduction

The aggression of animals towards man, as a kind of defensive behaviour, represents fear-induced aggression in most species (*Blanchard and Blanchard, 1984*). Animal behaviour, from the point of aggression towards man, has attracted special attention due to its role in the historical process of domestication (*Belyaev, 1969, 1979; Belyaev and Trut, 1981*). It has been hypothesized (*Belyaev, 1969*) that reduced aggressiveness towards man was a main trait for which animals were randomly selected during the initial period of domestication. The hypothesis was corroborated by a long-lasting experiment with silver foxes (*Vulpes vulpes*) selected for tame behav-

iour. These animals revealed friendly, dog-like behaviour as well as many other characteristics intrinsic to domesticated animals (*Belyaev, 1980*).

With the aim of examining the universality of destabilizing selection as a factor in domestication of wild animals (*Belyaev, 1980*), a special selection experiment with mink (*Mustela vison* Schreber) belonging to the *Mustelidae* family was organised in 1980. These animals were bred on special farms from the beginning for the sake of their fur. The first stage of this work was connected with the investigation of the polymorphism in farm-bred mink populations with respect to their characteristic response to man. The mink had never undergone any special selection for behaviour.

The present study was conducted in order to examine the variability of defensive behaviour towards man in farm bred mink. Interest was also focused on how this behavioural polymorphism is linked to coat colour mutations and sex.

Materials and Methods

The subjects used in the present study were two colour phases of minks: *Standard* (genetic symbol for colour type - +/+) *and Sapphire* (genetic symbol for colour type *ala plp).* They came from a commercial state fur farm. The S*tandard* ranch-bred mink is similar to that of the wild mink: The pelage is usually dark brown, but may vary from light brown to near black. A number of color variations have arisen from ranchbred mink (*Shackelford, 1941; Smith et al., 1941; Castle and Moor, 1946*). The *Sapphire* colour phase was produced by a combination of two grey colour variations: *aleutian* (genetic symbol for colour type - *ala) and silverblue* (genetic symbol for colour type *-plp).* It resulted in a clear pale blue shade of fur (*Ness et al., 1988*). Altogether, 31,920 young animals (males and females), 5-6 months, were used.

Housing

The animals were housed in pairs (male and female) in standard rearing wire netting cages (90 cm long x 45 cm wide x 45 high) with a 45 x 45 x 45 cm wood nest box. The mink were fed a basic ready-mix farm feed and fresh water was available *ad libitum.* The animals were maintained in a natural light-dark cycle.

Testing the level of defensive behaviour towards man

The level of mink defensive behaviour towards man was assessed in September-October by means of a "catch-test" in which the mink was let out in the wire netting cage. The observer stood in the front of the cage, opened the cage door, his arm inserted carefully through the door and tried to catch the animal by hand, which was protected by a special mitten. The behavioural tests were carried out between 8:00 and 20:00 local time, except during the morning feeding break from 10 till 11 a.m. and the afternoon feeding break from 4 till 5 p.m. The animals were retested in September-October of the next year.

Results and discussion

Defensive characteristics take one of several forms. These were estimated separately. There were:

I. Evasion, i.e. the coward, timid, or frightened reaction towards man. The mink leaped, or swerved away (slowly or quickly in panic) from the hand (Fig. 1). This behaviour was scored as "O".

II. The calm exploratory reaction, or domestic behaviour, or tameness was scored as one of five degrees:

+1. The demonstration of trustfulness (Fig. 2). The mink approaches the man's hand more or less slowly, sometimes with interruptions, sniffs at it, moving the whiskers, but without any physical contact.

+2**.** The physical contact (Fig. 3). The mink displays exploratory reaction when the observer bring the tips of his fingers into physical contact with the snout and throat.

+3. The mink displays active exploratory behavior with the man's hand (Fig. 4).

+4. It is possible to touch the body of the mink, but impossible to handle it(Fig. 5).

+5. The animal can be handled without special precautions against bites (Fig. 6). In all these five degrees, the observer does not need to protect his hand with a mitten.

III. Four kinds of aggressive behaviour were distinguished:

-1. The demonstration of aggressiveness (Fig. 7). At the beginning of the testing, the mink moved away from the man's hand into the nest box, stood in the corner and displayed menace with teeth and vocalization.

-2. The aggressive contact (Fig. 8). The mink jumped to the entrance of the nest box, brought his teeth into contact with the hand of the man and bit it with considerable intensity.
-3. High intensity of attacks involved an increased biting by the mink of the man's hand. (Fig.9). The attacking mink rushed quickly to the man's hand and bit it.
-4. Extremely high intensity of attacks towards the man targeted by the animal (Fig. 10). Mink responded to the appearance of a man in front of his closed cage by "rage" attacks with an attempt to bite the observer through the wire netting of the cage wall.

The curves of the score distribution (Fig. 11) show that flight was the most common response (79%). The total number of animals with aggressiveness towards man is 17%, and with tameness - 4%. The frequency of animals with the highest level of attacking (-4) and with tame reaction (+5) is extremely rare – $1x10^{-3}$.

Table 1 shows that the mean score of behaviour in the total mink population tends to aggressiveness and is equal to -0.21±0.005. Females in both genotypes *(Standard and Sapphire)* display significantly higher aggressiveness than males ($P < 0.001$).

Table 1. The results of farm bred mink examined for defensive behaviour towards man

		Aggressiveness			Frightened		Tameness			Total minks population		
Coat colour type	Sex	No. of animals	Mean scores	σ^2	No. of animals	Mean scores	No. of animals	Mean scores	σ^2	No. of animals	Mean scores	σ^2
Standard	Males	1104	−1.61 ± 0.02	0.23	7262	0.00	334	−1.67 ± 0.05	0.81	8700	−0.14 ± 0.008	0.26
	Females	1715	−1.65 ± 0.02	0.28	6917	0.00	168	+1.74 ± 0.07	0.85	8800	−0.29 ± 0.008	0.38
	Males and females	2819	−1.63 ± 0.01	0.26	14179	0.00	502	+1.69 ± 0.06	0.64	17500	−0.21 ± 0.006	0.32
Sapphire	Males	819	−1.61 ± 0.02	0.24	5782	0.00	599	+2.07 ± 0.05	1.69	7200	−0.01 ± 0.01	0.67
	Females	1926	−1.66 ± 0.02	0.29	5071	0.00	223	+1.81 ± 0.07	1.14	7220	−0.39 ± 0.01	0.74
	Males and females	2745	−1.64 ± 0.01	0.27	10853	0.00	822	+2.00 ± 0.04	1.69	14420	−0.20 ± 0.008	0.76
Total minks population	Males	1923	−1.61 ± 0.02	0.23	13044	0.00	933	−1.93 ± 0.03	1.44	15900	−0.08 ± 0.006	0.42
	Females	3641	−1.65 ± 0.01	0.28	11988	0.00	391	+1.78 ± 0.05	1.04	16020	−0.33 ± 0.007	0.53
	Males and females	5564	1.64 ± 0.01	0.26	25032	0.00	1324	+1.88 ± 0.03	1.44	31920	−0.21 ± 0.005	0.50

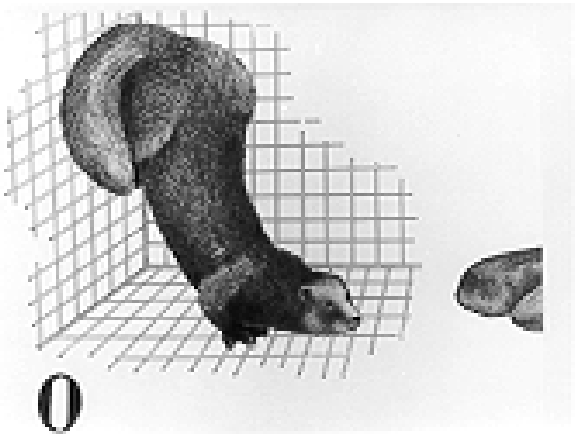

Fig. 1. Evasion, the coward, timid, or frightened reaction towards man

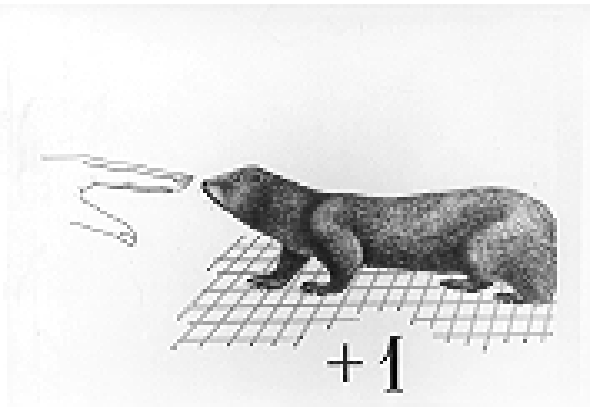

Fig. 2. The demonstration of trustfulness

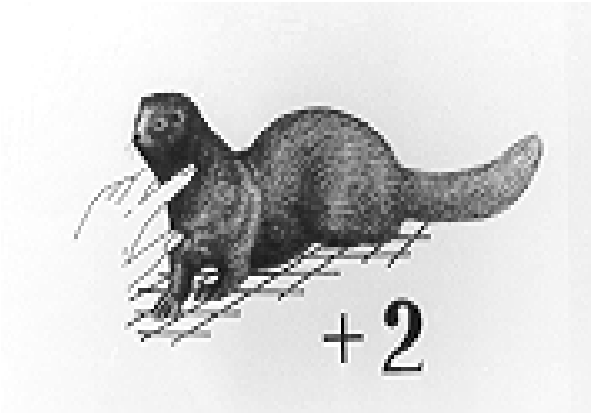

Fig. 3. The mink displays exploratory reaction towards man's hand

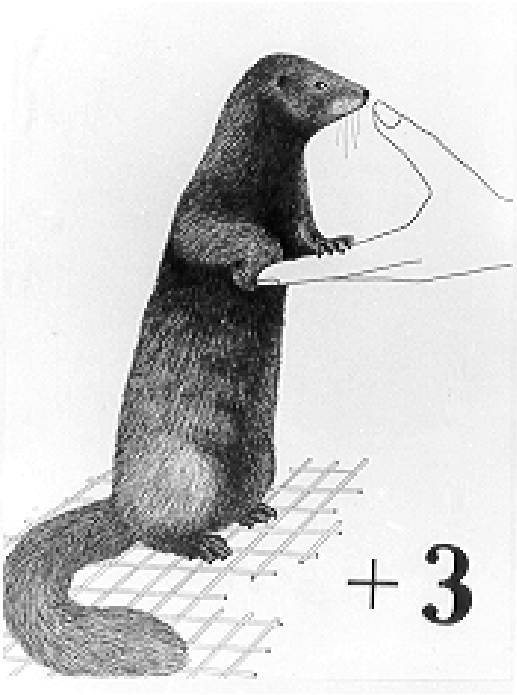

Fig. 4. The mink displays active exploratory behaviour

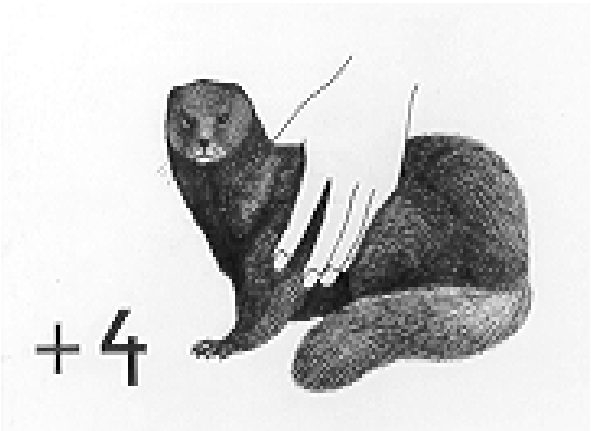

Fig. 5. It is possible to touch the mink's body

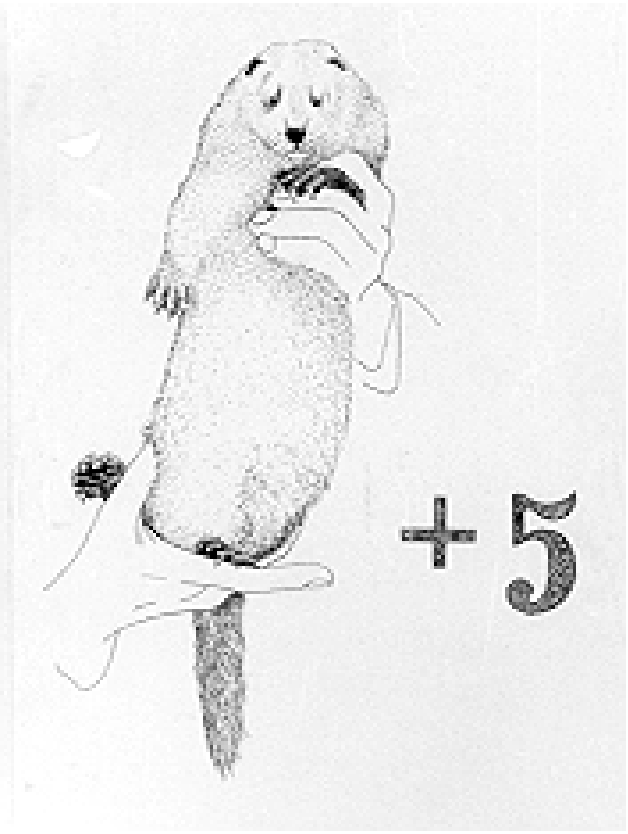

Fig. 6. The animal can be handled without special precautions against bites

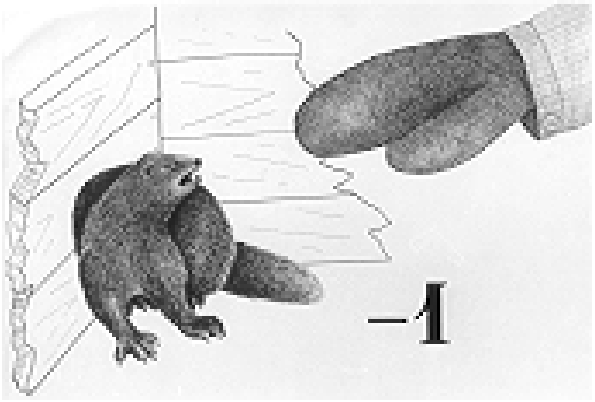

Fig. 7. Demonstration of aggressiveness

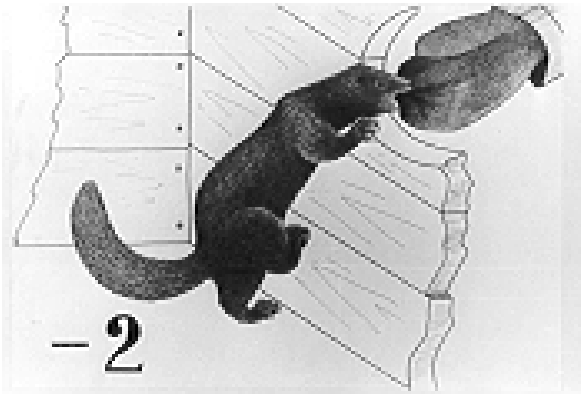

Fig. 8. Attacks from the shelter

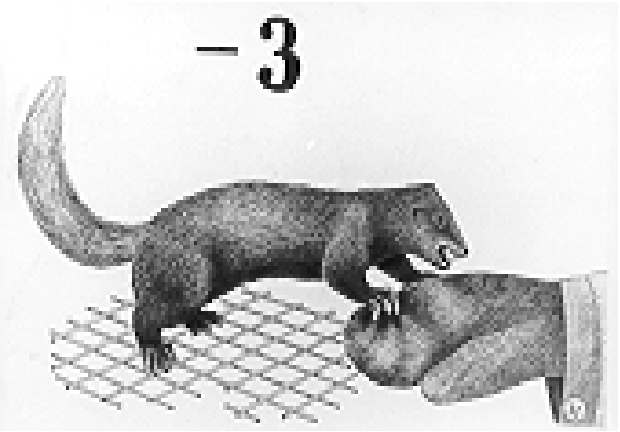

Fig. 9. Attacks and biting in the open cage

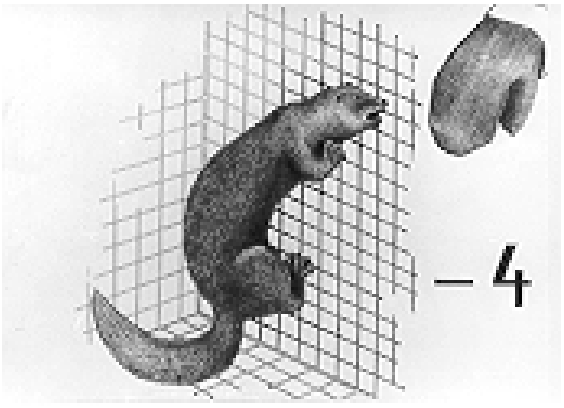

Fig. 10. Rage attacks with an attempt to bite the observer though the wire netting of the cage wall

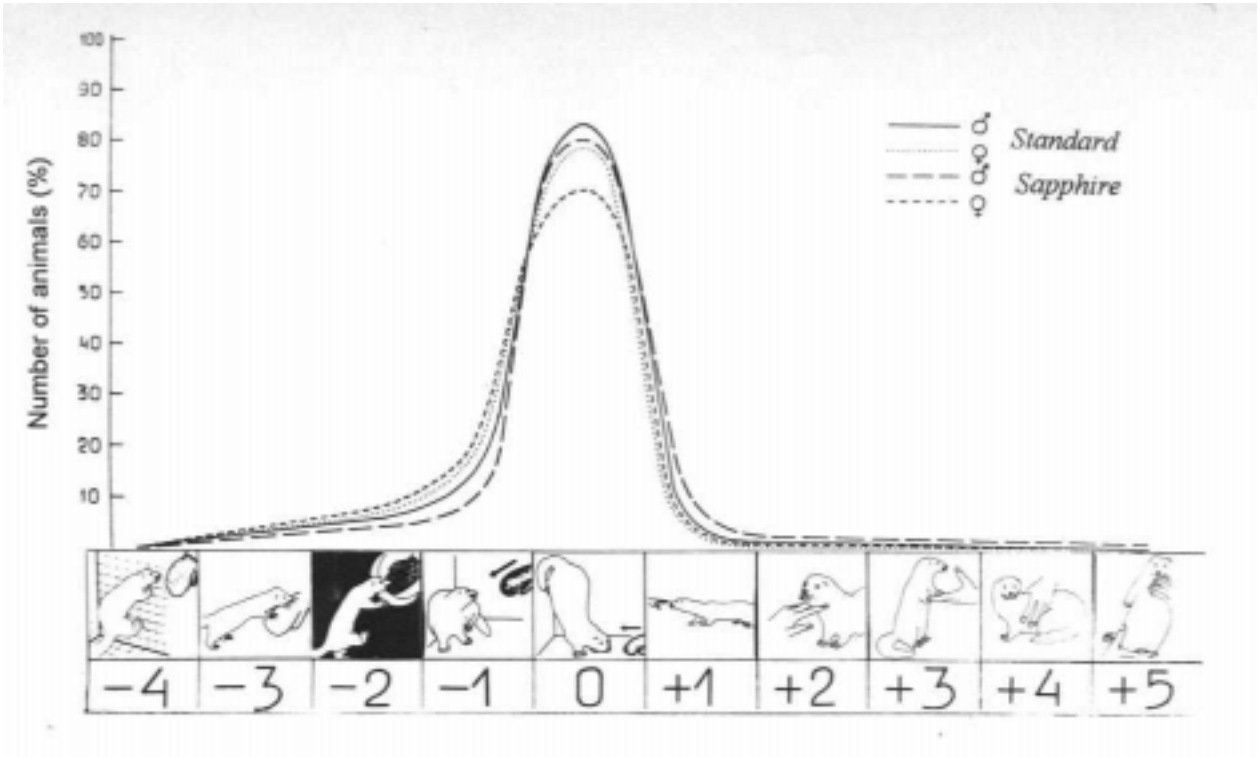

Fig. 11. The curves of score distribution: aggressive (17%), frightened (79%), tame (4%).

The aggressive part of the mink population demonstrates that the low level of the scores of behavioural variability (σ^2 = 0.26) and the mean scores of behaviour in all groups*: Standard and Sapphire,* males and females, are practically the same.

The variability of tameness behaviour scores increased sharply (σ^2 = 1.44), especially in S*apphire* animals (σ^2 = 1.69). In the tame group of animals, *Sapphire* mink have a significantly higher level of domestic behaviour than their *Standard* counterparts ($P < 0.001$). There is a sex differential in *Sapphire* mink also. Males display significantly tamer behaviour than females ($P < 0.001$). At the same time, *Standard* mink do not show the difference in the expression of tameness between males and females.

These observations are partly in agreement with Keeler's studies. Clyde E. Keeler in his classic set of papers on psychogenetics published since the 1940s, announced that individuals bearing various mutant hair-character genes among numerous mammalian species, including man, should exhibit a correlation in morphology, physiology, and behaviour (*Keeler and King, 1942, Keeler, 1942, 1945, 1947; Keeler et al., 1968; Keeler, 1975*). He reported that tameness in captive red foxes is linked in a pleiotropic manner to the alleles for pelage coloration. The distances of evasive action exhibited by captive foxes were inversely related to the number of mutant coat colour alleles in genotype. Keeler also reported that docility in the domestic Norway rat is linked to the non-agouti coat-colour allele. According to the recessive coat colour mutation in mink Keeler testified that from the beginning, they were tamer than the normal *Standard* coloured mink from which they were derived. However, those with the dominant coat colour mutations are of the same nervous tendency as a dark mink.

Certain aspects of our obtained data are especially noteworthy: The highest behaviour variability in the total mink population examined was in the *Sapphire mink* (σ^2 = 0.76), i.e. the highest percentage of aggressive animals appeared in *Sapphire* females - 27%, and the tame ones in *Sapphire males* - 8**%.** Although it is well known that most behaviours are polygenic (i.e., influenced by many genes), in our

tests we can see that recessive coat colour alleles in homozygotes: *aleutian* (genetic symbol for colour type - *ala) and silverblue* (genetic symbol for colour type - *plp)* may have a strong impact on the development of certain behavioural characters, namely to increase the deviation to a high level of aggressiveness in females and to a low level of aggressiveness in males.

Acknowledgements

I am indebted to Pastor Robert Mueller of the Confessional Evangelical Lutheran Church for his assistance in English grammar.

References

Belyaev, D.K. 1969. Domestication of animals. Science 1:47-52.

Belyaev, D.K. 1979. Destabilizing selection as a factor in domestication. Journal of Heredity 70:301-308.

Belyaev, D.K. 1980. Destabilizing selection as a factor in domestication. In Vartanian NW (ed): <<Well-being of Mankind and Genetics.>> Proceeding of the XIV International Congress of Genetics. Moscov: Mir Publ., Book 1, pp 64-80.

Belyaev, D.K. and Trut, L.N. 1981. Accelerating evolution. Science in USSR 5:24-64. Blanchard, D.C. and Blanchard, R.J. 1984. Affect and Aggression: an animal model to human behaviour In: "Advances the Study of Aggression." Orlando: Academic Press, Vol. 1. pp I- 62.

Castle, W.E. and Moor, 1946. Mutation in mink under domestication. Journal of Heredity 37:137-145.

Keeler, C.E. 1942. The association of the black (non-agouty) gene with behaviour in the Norway rat. Journal of Heredity 33:371-384.

Keeler, C.E. 1945. Gene determined physical modifications affecting the sociometry of rats. Sociometry 8:30-41.

Keeler, C.E. 1947. Modification of brain and endocrine glands, as an explanation of altered behaviour trends, in coat-character mutant strains of the Norway rat. Journal of the Tennessee Academy of Science 22:207-209.

Keeler, C.E. 1947. Coat color, physique, and temperament. Journal of Heredity 9:271-277.

Keeler, C.E. and King, H.D. 1947. Multiple effects of coat color genes in the Norway rat, with special reference to temperament and domestication. Journal of Comparative Psychology 34: 241-250.

Keeler, C.E., Ridgway, S., Lipscomb, L. and Fromm, E. 1968. The genetics of adrenal size and tameness in color phase foxes. Journal of Heredity 59:82-84.

Keeler, C.E. 1975. Genetics of behavioral variations in color phases of the red fox. In Fox MW (ed): <<The Wild Canids: Their Systematics, Behavioral Ecology and Evolution.>> New York: Van Nostrand-Reinhold, pp. 339-413.

Ness, N.N., Einarson, E.J., Lohi 0., Jorgensen, G. 1988. Beautiful fur Animals - and Their Colour Genetics. Glostrup, Denmark: Scientifur.

Shackelford, R.M. 1941. Mutation in mink. Trans. Wis. Acad. Sci. Artni-Lett., 34:45.

Smith, S.E., Whitaker, C.H., Davids, L.F., Noble, P.V. 1941. The inheritance of three coat ccolour mutations in ranch-raised mink. Journal of Heredity 32:173-176.