Improving Mink Nutrition

(1957 Progress Report)

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Foundation of the herd: OSC standard dark male mink.

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1957 MINK NUTRITION RESEARCH

A Progress Report of Nutrition Research
Carried out at the Oregon State College Fur Farm
Oregon Agricultural Experiment Station

Introduction

Presented are results of mink nutrition research conducted by the Oregon State College Experimental Fur Farm in 1957. Research during 1957 was directed along two lines of approach: (1) utilization of various marine fishes and supplemented cereal concentrates, and (2) the importance of diet on occurrence of fur abnormalities. Council members of the Oregon State Fur Breeders Association and the Mink Farmers' Research Foundation, Milwaukee, Wisconsin gave helpful suggestions.

These investigations included animal feeding experiments involving 670 ranch mink, laboratory analysis of feedstuffs and animal tissues, and study of physiological conditions associated with normal and abnormal fur conditions. The College mink breeding colony in 1957 contained 166 breeder female mink producing 620 kits for a ranch average of 4.34 and a litter average of 4.83. Test animals were largely made up of kits of the year, and these included 496 standard dark, 90 pastel and 84 sapphire mink. These animals were divided into groups that were as similar as possible as regards sex, age, and genetic background, and were started on nutritional trials July 1. A significant difference from other year's work was all fish utilized in experimental diets during 1957 were not eviscerated.

Diet expenses were based on feed costs only and do not include labor and other charges. Profit, as used here, is therefore the difference between feed cost and pelt sale price. Criteria used in evaluation of the mink performance during these experiments were fur quality, growth rate and length of pelt. Fur quality was evaluated by experienced graders of the Seattle Fur Exchange and was confirmed by actual pelt sales. Growth studies involved live weights taken on all animals periodically during the course of the experiments. Pelt length measurements were taken from the tip of the nose to the base of the tail on the dried skins.

Since the major concerns in mink research involved nutrition and management practices, over-all operation of the Fur Farm is now carried out by the Department of Dairy and Animal Husbandry. Active cooperation with the Department of Fish and Game Management is maintained in research on fisheries products. During the year, feed storage facilities have been improved in an effort to provide more uniform and adequate feeding conditions. An additional 5-horsepower compressor unit with freezing time recorder was installed and the entire freezer plant was remodeled, providing greater capacity for future operations.

Acknowledgements

Funds supporting studies concerning the effects of nutrition on abnormal fur quality in mink were supplied through a grant from the Mink Farmsers' Research Foundation, Milwaukee, Wisconsin.

Extensive improvement and remodeling of freezer facilities was carried out with funds granted by the Oregon Agricultural Experiment Station.

Numerous interested persons associated with the fur industry generously donated time and money.

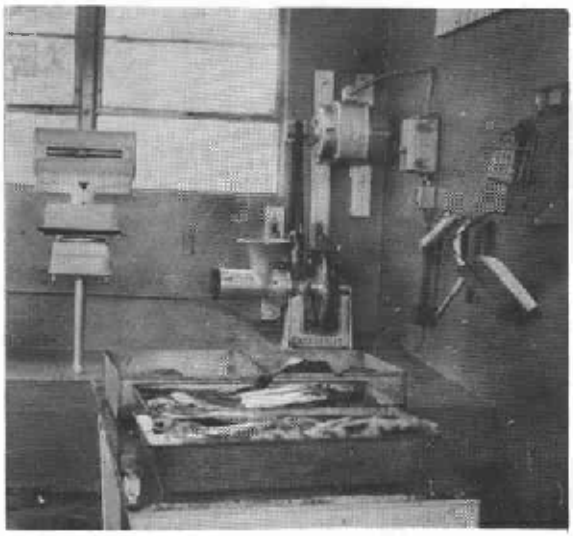
Evaluation of fur quality of experimental test animals was performed by judges from the Seattle Fur Exchange.

The veterinary Diagnostic Laboratory of the Department of Veterinary Medicine of Oregon State College provided valuable service through Dr. Dean H. Smith in regard to diagnosis and treatment of disease problems.

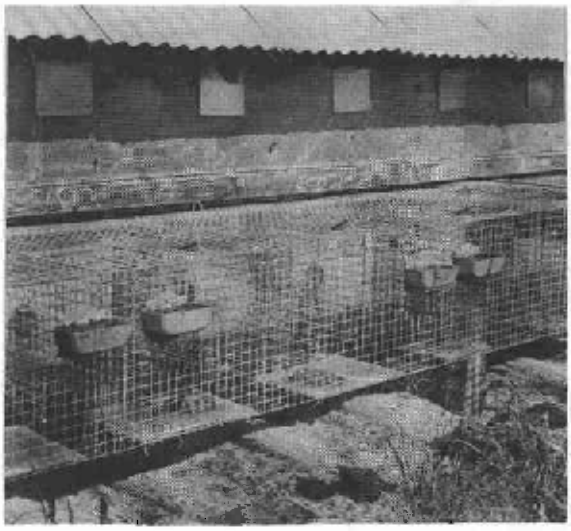
Extensive biochemical analyses were performed under the direction of Dr. John R. Schubert, Department of Agricultural Chemistry, Oregon State College.

The staff of the O.S.C. Experimental Fur Farm are pleased to acknowledge the assistance given by the individuals and agencies listed above, without which the conduct of this program would have been most difficult.

Physical Facilities -- OSC Experimental Fur Farm



Interior of OSC feed room showing grinder and weighing device.



Exterior view of breeder pens showing glass feed plates used during whelping period.

Summary

Over several years, one standard control ration (No. 1) has been fed, to allow a constant check on the quality of the herd and efficiency of management practices. Recent advances in mink nutrition have indicated improvements that might be made in this basic feed mix, and an "improved basal" (No. 2) mix has been devised. This ration will be modified in line with new developments each year. During the past two years, performance on this ration has been excellent.

Growing interest in economy of mink feeding without sacrifice of pelt quality has led to studies with supplementary cereal mixtures fed at relatively high levels. A cereal supplement designed to be used in high fish rations has been developed at this Station and satisfactorily utilized at various levels during the past two experimental seasons. Inclusion of this cereal supplement has tended to reduce production costs primarily through lower feed intake requirements and in addition, mink of good size and good fur quality have been produced.

Investigations aimed at development of alternate fish sources for use in mink rations were continued with the studies of hake and skate. As in the past, numerous cotton pelts occurred in mink in the group fed hake. Some, however fewer, also occurred in mink in the group fed the diet containing hake that was cooked prior to mixing. Indications from these tests are that some factors interfering with the normal development of the fur is present in hake and that this factor is at least partly resistant to heating.

The studies involving skate as a major constituent of the mink ration were encouraging in that a high rate of growth and large pelts were produced. Fur quality, and particularly color, was not as good in the skate-fed mink as it was in the control group.

Investigations in past years have indicated that carcasses of mink having the cotton pelt condition of the underfur are markedly lighter in color than those of mink having normal pelts. Extensive blood studies carried out this year indicate that there is indeed an anemia present in cotton mink. A limited number of trials indicate that this anemia responds favorably to administration of vitamins thiamine and folic acid.

Several experiments were carried out where various types of fat were added to the diet to determine whether they had an effect upon occurrence of the cotton pelt condition. Addition of 5% herring oil, either in the fresh state or after having been subjected to ionizing radiation, resulted in the production of an off-colored, brownish pelt, but did not give rise to the characteristic cotton pelt. Addition of a synthetic compound similar to that produced in rancid fat, tertiary butyl perioxide, also did not result in the formation of characteristic cotton pelt conditions in mink. It appears probable from these investigations that rancid fat is not a basic cause of the cotton pelt condition.

Outline of Animal Experiments

Data presented in the following pages from the animal experiments refer only to standard dark mink, since numbers of sapphires which were included were considered too small to be significant. Results and observations on performance of mink on various experimental diets are described in text and table form.

Objectives of Experimental Treatments:

Experimental Group 1:

Group 1 was fed the basic control diet which has been used for a number of years. Its main purpose is to serve as a general check on the performance of the animals over the years.

Experimental Group 2:

Group 2 was fed the specially designed improved basal diet. Purpose of this group is to attempt top performance utilizing recent advances in nutritional knowledge.

Experimental Group 3:

Group 3 animals illustrated performance of mink on relatively high cereal diets including a minimum of red meat products.

Experimental Group 4:

Group 4 was set up to demonstrate performance on an economy ration. The ration fed was similar to that used with Group 3 with the exception that horse-meat, liver, and tripe were included only two days weekly, as contrasted with every day with Group 3. At the start of the furring out period (September 10) all red meats were removed completely from both rations in experimental groups 3 and 4.

Experimental Group 5:

This group was designed to investigate the effects of feeding hake at a 30% level in the diet. Hake was cooked in open kettles prior to mixing with other diet ingredients.

Experimental Group 6:

This group was designed to illustrate performance on a diet containing 30% skate.

Experimental Group 7:

Group 7 and the groups which follow were designed specifically for the investigation of fur abnormalities. The diet fed group 7 contained 60% whiting which had been implicated in the production of cotton pelts in the past.

Experimental Group 8:

This group illustrates performance on a high level of uncooked hake. Initially, 60% hake was included in the diets of these animals, however, this level had to be lowered somewhat due to early losses.

Experimental Group 9:

This group received a ration containing 5% irradiated herring oil, (subjected to ionizing radiation at Arco, Idaho) to test the effects of oxidized fat upon fur quality.

Experimental Group 10:

Group 10 was set up to investigate the effects on fur quality of throwing mink off feed at about the time when active growth is slowing down and furring is beginning. Spoiled feed was given for three consecutive days.

Experimental Group 11:

Group 11 was designed to illustrate the effects of 5% added fat (as light-pressed herring oil) on fur quality.

Experimental Group 12:

Group 12 was designed to illustrate the effects of a synthetic oxidant (tertiary butyl peroxide) on fur quality. The oxidant was fed for 10 days during the period of most active fur growth: November 13-23.

Table 1. Description of Diets

Diet Numbers and Percentages Fed

Ingredient	1 July 1	1 July 1	2 Aug 15	2 Sept 15	3 July 1	3 Sept 10	4* July 1	4* Sept 10	5 July 1	5 Sept 10	6 July 1	6 Sept 10	7 July 24	7 Oct 18	8 July 1	8 Aug 3	8 Sept 5	8 Sept 9	8 Sept 11	9 July 17	10 Sept 3	11 Sept 13	12 Nov 12
Horsemeat	7	8		10	7		7		7		7		7		7	7				7	7	7	7
Liver	4	3	3		3		3		3		3					10			10	4	4	4	
Tripe	14	10	15	15	8		8													14	14	14	
Sole	42	10	10	20	10	25	15/10	25	10	20	10	20					10	10		37	42	37	51
Rockfish	25	20	20	20	22	25	30/22	25	15	15	15	15	10	11	10	10	15	15	15	25	25	25	25
Turbot		40	40	15	35	20	40/35	20	20	10	20	10	15	16	15	15	20	20	20				
Hake									30**	30**					60	50	30	20	30				
Whiting													60	64									
Skate											30	30											
OSC-1	8												8	9	8	8	25			8	8	8	8
OSC-34		9	12	20																			
OSC-44					15	30	15/15	30	15	25	15	25						25	25				
Herring Oil																				5		5	

* Horsemeat, liver and tripe were included in the ration only on Mondays and Fridays during period July 1-Sept. 10. Ration during remainder of week consisted of fish and cereal mixture.

** Cooked

Types	Number of Animals in Each Group																						
Standard																							Adult
Dark M	40		40		40		40		40		40		8			8			8	8	6		10
F	30		30		30		30		30		30		7			7			7	7			
Sapphire																					Hybrid		
M	10		10		10		10														4		
F	10		10		10		10																
Pastel																							
M									10		10		8			8			8	8			
F									5		5		7			7			7	7			
TOTAL	90		90		90		90		85		85		30			30			30	30	10		10

Table 2. Proximate Analysis of Diet Constituents--1957

	Item	Percentages					
		Dry Matter	Crude[1] Protein	Crude[1] Fat	Crude[1] Fiber	Ash[1]	N.F.E.[1]
Fish:	Mixed sole[2]	18.10	70.88	6.80	--	15.30	--
	Mixed rockfish[3]	27.90	67.42	17.85	--	21.86	--
	Red rockfish	29.60	58.11	17.26	--	19.53	--
	Bacaccio	30.42	55.56	23.67	--	14.53	--
	Rooster fish	23.69	58.13	27.99	--	11.48	--
	Turbot	29.34	52.86	43.21	--	6.61	--
	Pacific hake	18.78	70.93	5.22	--	21.57	--
	East coast whiting	22.46	68.61	10.69	--	11.22	--
	Skate	19.06	85.36	7.66	--	12.91	--
Meats:	Horsemeat	32.54	58.48	30.52	--	2.74	--
Concentrates:							
	OSC-1	91.80	24.16	5.20	7.65	17.72	41.56
	OSC-34	91.72	32.87	8.65	7.48	11.31	36.41
	OSC-44	91.70	33.59	7.59	3.00	11.34	40.79

1 Figures are expressed as percent of the dry matter.
2 Mixed sole consisted primarily of English, dover, rex and Sand Dabs.
3 Mixed rockfish consisted primarily of red snapper, Bacaccio, rosefish, green rockfish and several other related species were also included.

Table 3. Formulas of Cereal Concentrates Used in 1957 Experiments

OSC Concentrate 1

Constituent	Percent of Mix	Percent Nutrient Content					
		Dry Matter	Crude Protein	Crude Fat	Crude Fiber	Ash	N.F.E.
Wheat germ	25.00	---	---	---	---	---	---
Cer-L-Meal	25.00	---	---	---	---	---	---
Brewer's yeast	18.75	91.80	24.16	5.20	7.65	17.72	41.56
Alfalfa meal	18.75	---	---	---	---	---	---
Bone meal	12.50	---	---	---	---	---	---
	100.00						

OSC Concentrate 34

Constituent	Percent of Mix	Percent Nutrient Content					
		Dry Matter	Crude Protein	Crude Fat	Crude Fiber	Ash	N.F.E.
Wheat germ meal	25.00	---	---	---	---	---	---
Brewer's yeast	4.17	---	---	---	---	---	---
Alfalfa meal	12.50	---	---	---	---	---	---
Dried skim milk	8.33	91.72	32.87	8.65	7.48	11.31	36.41
Meat meal	16.67	---	---	---	---	---	---
Soybean meal	16.67	---	---	---	---	---	---
Corn flakes	16.67	---	---	---	---	---	---
Supplements[1]							
	100.00						

[1] Concentrate supplements included: (1) Methionine at 0.05 percent of the dry matter; (2) Terramycin at 4.5 grams per ton of mixed feed; and (3) Fortafeed 2-49C at 0.1 percent of the mixed feed.

Table 3. Formulas of Cereal Concentrates Used in 1957 Experiments (Continued)

OSC Concentrate 44

Constituent	Percent of Mix	Percent Nutrient Content: Dry Matter	Crude Protein	Crude Fat	Crude Fiber	Ash	N.F.E.
Whole rolled wheat	15.0	---	---	---	---	---	---
Steel cut oats	15.0	---	---	---	---	---	---
Wheat germ meal	5.0	---	---	---	---	---	---
Dried skim milk	15.0	---	---	---	---	---	---
Dried whey, 25% protein	5.0	---	---	---	---	---	---
Soybean oil meal	15.0	91.70	33.59	7.59	3.00	11.34	40.79
Herring meal, 70% protein	15.0	---	---	---	---	---	---
Meat meal, 50% protein	5.0	---	---	---	---	---	---
Molasses dried beet pulp	2.5	---	---	---	---	---	---
Stabilized beef fat	2.5	---	---	---	---	---	---
Distillers solubles	2.5	---	---	---	---	---	---
Dicalcium phosphate	1.0	---	---	---	---	---	---
Iodized salt	0.5	---	---	---	---	---	---
Premix[1] (vitamins, etc.)	1.0	---	---	---	---	---	---
	100.0						

Premix[1]

Constituents	Per Pound
Calcium pantothenate	750 milligrams
Riboflavin	181 milligrams
Vitamin B-12	1.3 milligrams
Pyridoxine	100 milligrams
Folic acid	45 milligrams
Thiamine hydrochloride	200 milligrams
Vitamin E	500 I units
Vitamine A, stabilized dry	78,000 I units
dl Methionine	0.15 pounds

[1] Premix ingredients: wheat flour middlings, soybean oil meal, corn distillers dried grains with solubles, vitamins A and B-12 supplement, riboflavin supplement, calcium pantothenate, alpha-tocopherol acetate, folic acid, thiamin hydrochloride, dl Methionine and pyridoxine.

Table 4. Cost and Returns* on Various Diet Test Groups of Standard Dark Mink

Diet Test Group	No. Mink Pelted	Ave. Feed Cost per Animal	Ave. Return per Animal	Ave. Profit per Animal over Feed Cost
1	67	$7.62	$23.25	$15.63
2	65	5.76	23.82	18.06
3	67	5.43	24.13	18.70
4	66	4.99	22.67	17.68
5	65	6.28	21.78	15.50
6	69	6.04	21.85	15.81

* Returns were calculated from actual sale prices.

Table 5. Pelt Length* (No. of Animals)
of
Standard Dark Mink on Various Diets

MALES

Pelt Length (Inches)	Diet Groups 1	2	3	4	5	6	7	9	10	11	12
19	1	-	-	1	-	-	-	-	-	-	-
20	-	-	-	1	1	1	-	-	-	1	3
21	1	1	5	5	5	3	1	2	1	-	1
22	1	1	2	2	4	3	-	-	-	-	-
23	8	4	9	10	10	9	2	1	3	-	2
24	13	10	8	8	6	8	-	-	3	3	2
25	5	10	7	1	7	7	2	2	-	4	1
26	8	9	8	8	3	9	1	1	1	2	1
27	2	2	-	2	-	-	-	2	-	-	-
28	-	1	-	-	-	1	-	-	-	-	-
No. Males in Group	39	38	39	38	36	41	6	8	8	10	10
Group Average (Inches)	24.5	25.0	24.2	23.9	23.6	24.4	24.2	24.6	24.0	24.7	22.9

FEMALES

Pelt Length (Inches)	Diet Groups 1	2	3	4	5	6	7	9	10
17	-	-	-	-	1	-	-	-	-
18	-	1	-	1	1	2	-	-	-
19	5	5	11	10	8	6	-	1	1
20	10	8	7	10	8	7	3	1	1
21	9	11	7	4	8	10	-	3	4
22	2	2	3	3	2	3	-	2	-
23	2	-	-	-	-	-	-	-	1
No. Females in Group	28	27	28	28	28	28	3	7	7
Group Average (Inches) &	20.7	20.6	20.4	21.8	20.3	20.6	20.4	21.1	21.1

* Measurements on dried skins were taken from the nose to the base of the tail.

Table 6. Final Weight (No. of Animals)
of
Standard Dark Mink on Various Diets

MALES

Weight (Grams)	Diet Test Group 1	2	3	4	5	6	7	8	9	10	11	12
Under 1000	1	-	-	-	3	-	-	-	-	-	-	-
1000	-	-	-	-	-	-	-	-	-	-	-	-
1100	-	1	2	4	3	2	1	-	-	1	-	3
1200	1	1	3	1	2	1	1	-	1	-	1	-
1300	1	-	2	2	4	4	1	2	-	1	-	1
1400	4	5	2	6	5	2	-	2	1	-	-	1
1500	11	4	3	5	8	4	1	-	-	2	2	1
1600	6	7	9	6	4	6	1	-	1	1	1	1
1700	4	7	4	1	3	3	2	-	1	2	1	1
1800	5	5	7	5	5	6	-	1	1	-	2	1
1900	1	5	4	1	1	3	-	1	-	1	2	1
2000	5	3	4	4	1	7	-	-	1	-	1	-
2100	-	1	-	2	-	-	-	-	-	-	-	-
2200	1	-	-	1	-	1	-	-	2	-	-	-
2300	-	1	-	-	-	2	-	-	-	-	-	-
2400	-	-	-	1	-	-	-	-	-	-	-	-
No. Males in Group	40	40	40	39	39	41	7	6	8	8	10	10
Group Average (grams)	1663	1731	1678	1662	1500	1741	1494	1564	1808	1571	1727	1497

FEMALES

Weight (Grams)	Diet Test Group 1	2	3	4	5	6	7	8	9	10
Under 600	-	-	-	-	1	-	1	1	-	-
600	-	-	-	-	1	-	-	-	-	-
700	-	-	2	1	1	1	1	1	-	-
800	10	9	7	8	5	5	3	2	1	2
900	10	7	11	8	9	9	1	1	1	2
1000	6	7	5	9	6	6	1	1	2	1
1100	-	6	5	1	5	3	-	1	2	1
1200	3	1	-	1	1	4	-	-	1	-
1300	-	-	-	1	-	1	-	-	-	1
1400	1	-	-	-	-	-	-	-	-	-
No. Females in Group	30	30	30	29	29	29	7	7	7	7
Group Average (grams)	982	991	960	977	966	1015	785	866	1046	1021

Table 7. Fur Color Ratings* (No: of Animals)
of
Standard Dark Mink on Various Diets

MALES

Color Rating	Diet Test Groups										
	1	2	3	4	5	6	7	9	10	11	12
No. 1	5	4	5	2	3	1	-	-	-	2	1
No. 2	6	8	4	5	4	6	-	-	2	1	2
No. 3	11	14	14	20	13	17	3	3	4	3	5
No. 4	17	12	16	11	12	17	2	5	2	4**	2
No. 5	-	-	-	-	6	-	2	-	-	-	-
Total Males in Group	39	38	39	38	38	41	7	8	8	10	10

** Hybrids

FEMALES

Color Rating	Diet Test Groups								
	1	2	3	4	5	6	7	9	10
No. 1	5	6	5	3	4	1	1	2	2
No. 2	8	11	8	1	5	6	-	1	-
No. 3	9	6	13	11	12	10	-	2	2
No. 4	5	4	2	13	6	12	2	2	3
No. 5	1	-	-	-	2	-	1	-	-
Total Females in Group	28	27	28	28	29	29	4	7	7

* Color ratings run from 1 (Best) to 5 (Poorest)

Results

Performance of animals on the basic control ration was equal or superior to that on the same ration in previous years, indicating a satisfactory state of breeding and management in the College herd.

The "improved control" ration yielded excellent results in terms of growth and fur quality, thus confirming the previous year's experience. Cost of production was lowered, indicating that efficiency of mink production may be increased by careful formulation of rations in accordance with known requirements and chemical analysis of feedstuffs. Feed consumption was actually lowered by elimination of some unnecessary diet ingredients.

Diets 3 and 4 demonstrated the practicability of feeding an appropriate cereal concentrate mix at a level of 15% of the diet until maximum growth was attained (about September 10) and at a 30% level thereafter until pelting. Economy of feeding horsemeat, tripe, and liver in these rations only two days out of the week was not borne out, since returns over feed cost were considerably higher (about $1.00 per mink) when the red meats were fed daily. It may be significant that there was a lower incidence of "wet belly" pelts among group 3 and 4 animals as compared to the control animals. This factor influenced the comparative returns from these groups.

Hake is a fish in relative abundance which offers possibilities as an alternate feed source for mink. When fed cooked at a 30% dietary level to group 5, it did not result in satisfactory performance either in terms of growth or fur quality as compared to the control groups. Some 12% cotton pelts occurred in this group. Further investigations using rigorously controlled cooking conditions may be indicated in an attempt to improve the usefulness of this product.

The feeding of skate in diet group 6 resulted in quite satisfactory growth, however fur quality (particularly color) was inferior. Further studies are indicated with this fish to overcome this problem, either through processing methods or diet supplementation.

In previous years, the feeding of fairly high levels of cleaned (eviscerated) whiting has not resulted in the production of the cotton pelt abnormality, although numerous reports have implicated this fish as a cause of cotton pelts under ranch conditions. In the 1957 experiments non-eviscerated whiting was fed to the animals in experimental group 7, and 7 definite cotton pelts resulted among the 30 animals. This suggests that a factor involved in formation of the cotton pelt condition may exist within the viscera of the whiting.

A similar type experiment involved diet group 8, where uncleaned and uncooked hake formed initially 60% of the diet. This level of hake proved unsatisfactory: The animals lost weight and eight of them died during the first month on experiment. (It is interesting that whiting was successfully fed at this high level in a diet otherwise similar.) The level of hake was reduced to 50%, and then to 30% of the total, its place being taken by fish known to be satisfactory, such as sole, rockfish, and turbot. When the hake level was reduced, mink once more began to gain weight and health returned to normal. However, of the surviving 22 animals, 13 or 60%, were cottons. Apparently hake, like whiting,

contains some factor predisposing the formation of the cotton pelt condition, and since the incidence was considerably higher than in experimental group 5, cooking may aid to some extent in inactivating the factor.

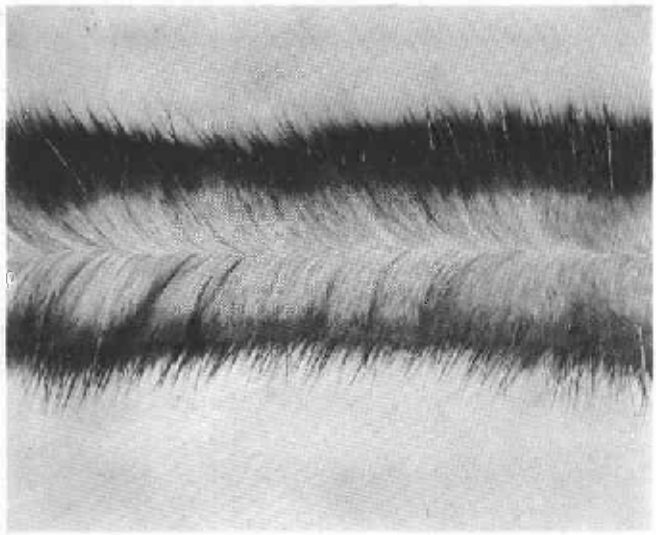
Experimental groups 9, 11, and 12 were devoted to the study of effects of fat on fur quality, based on the theory that peroxides formed during rancidification of dietary fats or oils could oxidize certain essential nutrients and render them unavailable to the mink. Diet 9 contained 5% light pressed herring oil which had been treated by ionizing radiation in an attempt to induce extreme rancidity, while diet 11 contained a similar amount of the same oil un-irradiated. Diet 12 involved the use of a synthetic oxidant, tertiary butyl peroxide, fed at the rate of 1 gram per animal daily for 10 days at the height of fur growth. While fur color on the oil-containing diets was not good (a brownish cast was noticeable) no characteristic cotton pelts were produced on any of these treatments. A summation of accumulated data suggests that rancid dietary fat does not play a dominant role in production of cotton mink.

Experimental group 10, deliberately thrown off feed by inclusion of spoiled fish in their diet, did not show any cotton pelts. Over a four-year period this type of treatment has not yielded any significant number of cotton animals, suggesting that sudden dietary upsets, notwithstanding their obvious disadvantages in terms of general animal health, do not result in permanent fur damage.

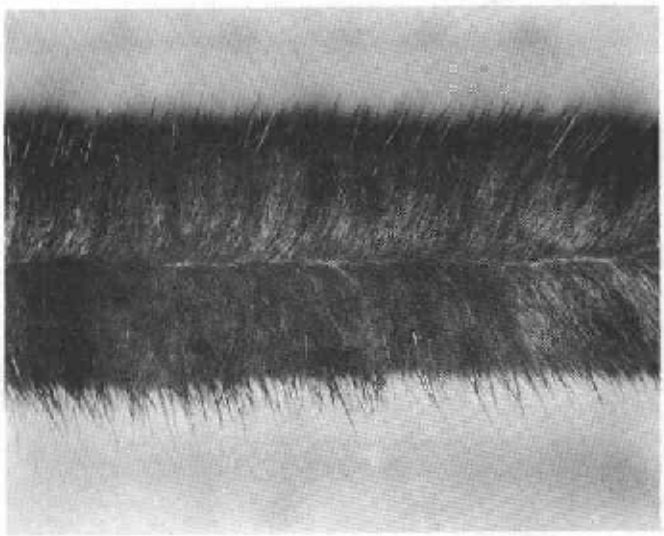
Laboratory studies confirmed suspected differences in blood composition in normal and cotton mink. Photographs of pelts and blood smears from representative normal and cotton animals are included (figure 1). Among 50 normal animals studied, hemoglobin averaged 17.55 grams %, red blood cell count averaged 9.76 million/mm^3 and hematocrit averaged 48.1% packed cells. The same observation on 22 cotton mink showed values of 12.19 grams %, 8.51 million/mm^3 and 32.5%, respectively.

Animals on diet 8 were not pelted, but were administered pure solutions of certain B vitamin preparations. No improvement in the blood picture was noticed following injection of liver extract or vitamin B_{12}, but significant improvement followed injection of thiamine and folic acid, singly or together. It remains to be demonstrated whether improvement in fur quality will also result from administration of these vitamins under feeding conditions where cotton pelts might be expected. For this, a strain of black laboratory mice has been developed and experiments involving both purified diets and fish diets are under way.

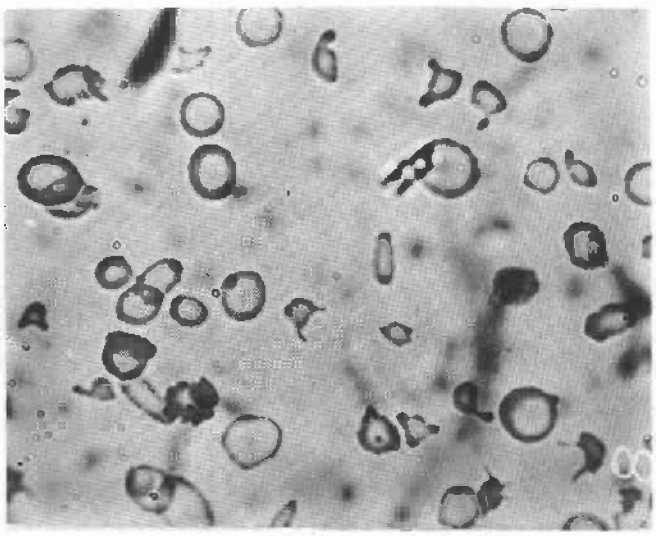
Figure 1. Pelts and Blood Smears: Normal and Cotton Mink.



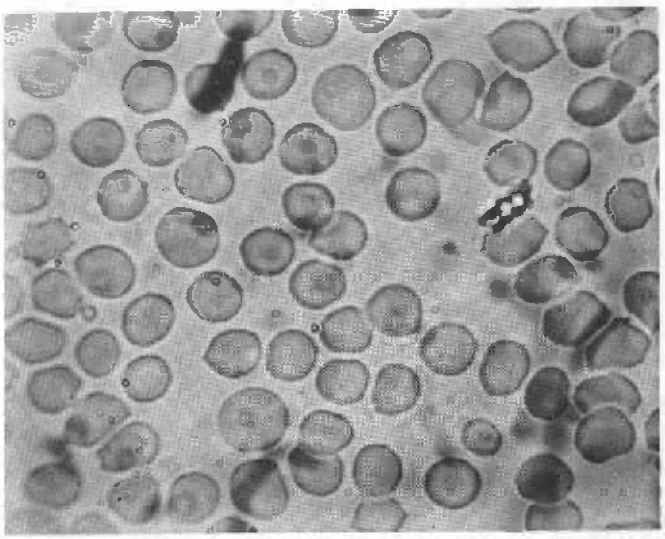
Mink 3192, male, diet group 5, showing typical cotton condition of underfur.



Mink 2987, male, diet group 2, showing normal fur quality.



Blood smear from mink 3192, (Cotton).



Blood smear from mink 2987, (Normal).