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VARIATION IN *PEROMYSCUS MANICULATUS*
RUFINUS FROM COLORADO AND
NEW MEXICO

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THE subspecies of deer-mouse known as *Peromyscus maniculatus rufinus* (Merriam) has a wide range in the southern Rocky Mountains of Colorado and New Mexico, and it occurs also in parts of Utah and Arizona.¹ The four stocks studied were secured from two localities in middle and southern Colorado and from two localities in southern New Mexico (Fig. 1).

The methods employed are described in my paper on *Peromyscus maniculatus bairdii*.² The wild mice caught at each locality are brought to the laboratories of the University of Michigan Museums at Ann Arbor, where they are kept and bred under relatively uniform environmental conditions; they are fed a standard diet. In the spring, when molt is least in progress, the mice which have reached the proper age are killed by ether, the body measurements are taken immediately, the bones are saved for future study, and the skin is stretched uniformly on a rack before drying.

¹ Osgood, W. H., "Revision of the mice of the American Genus *Peromyscus*," *U. S. Dept. Agric., No. Amer. Fauna*, No. 28 (1909): pl. 1.

² Dice, L. R., "Variation in a geographic race of the deer-mouse, *Peromyscus maniculatus bairdii*," *Occ. Pap. Mus. Zool. Univ. Mich.*, 239 (1932): 1-26.

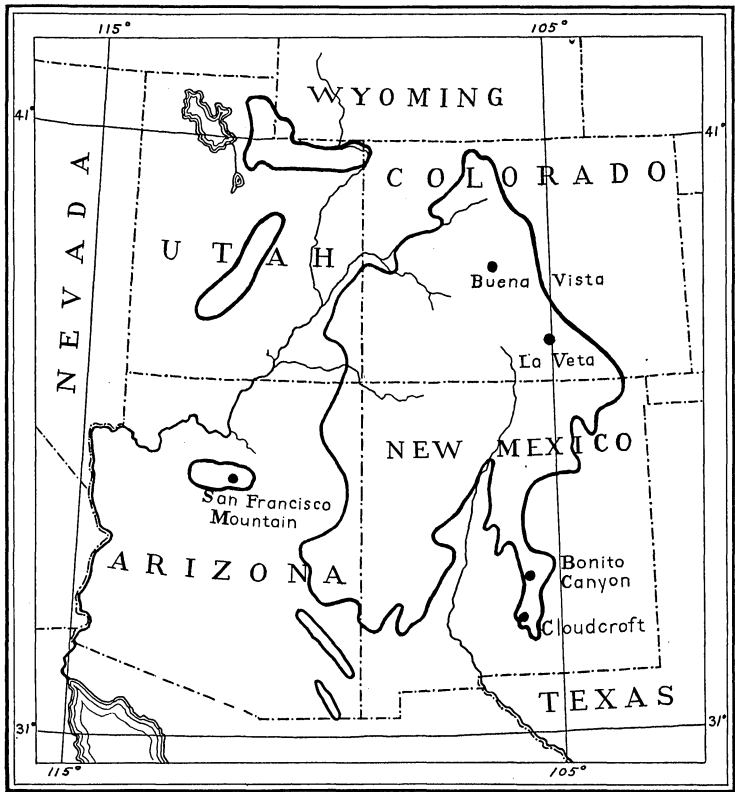


FIG. 1. Distribution of *Peromyscus maniculatus rufinus*, based mainly on Osgood and Bailey. The localities from which the four stocks originated are given, and also the type locality of the subspecies: San Francisco Mountain.

All the body measurements of these mice have been made by myself. The measurements of the bones were made by Robert M. Bradley, Paul F. Hickie, Milton F. Landwer, and Lenore Ward. The tint photometer readings were made by Robert M. Bradley, Paul F. Hickie, Sherman A. Hoslett, B. T. Ostenson, and Lenore Ward. The map was drawn by Grace Eager.

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ORIGIN OF THE STOCKS

Bonito Canyon, New Mexico.—Twenty-three females and 29 males were taken in 1928 by G. W. Bradt, in Bonito Canyon, in the Sierra Blanca Range, about 25 miles southeast of Carizozo, New Mexico. The location is just below the entrance of Bear Canyon, and the elevation is between 8000 and 9000 feet. All the mice were taken in meadows, which were probably abandoned farm clearings. The laboratory-born generation of this stock had as parents 13 field-caught females and 14 males; there was no inbreeding. The mice caught in the field were all killed when they had been kept in the laboratory for 46 weeks. The mice of the 1-year age class averaged when killed 44.3 (40–67) weeks for both the females and for the males.

Buena Vista, Colorado.—The parents of the stock were secured by the University of Michigan-Carnegie Institution of Washington Expedition of 1925. The field-caught mice were trapped by myself on a rocky talus slope in the pinyon-cedar belt at Cottonwood Hot Springs, 6 miles west of Buena Vista, Colorado, during July, 1925. Some of the females were pregnant when taken and gave birth to young after arrival in the laboratory. As the animals were not marked for some time it became impossible to determine which animals were taken in the field and which were born in the laboratory. There resulted 10 females and 11 males, of which 7 females and 8 males became the parents of the resultant stock. There was a moderate amount of inbreeding in generations after the first, but the offspring of only a few pairs of brother and sister matings

are included in the tables. Several inbred lines were established, as is described later in this paper, but the inbred generations of these lines are not included in the tables of Buena Vista stock, although they are considered in the tables showing the results of inbreeding. The average age of the mice of the 1-year class was 52.3 (40-68) weeks for the females and 51.2 (40-67) weeks for the males, and of the 2-year class the average age was 102.2 (96-112) weeks for the females and 105.1 (96-153) weeks for the males. In the D inbred line the average age of the 1-year class for the F_2 and F_3 generations was 53.0 (40-76) weeks for the females and 51.5 (40-62) weeks for the males. In the E inbred lines the average age of the 1-year age class for the F_2 , F_3 , and F_4 generations was 47.4 (40-57) weeks for the females and 44.6 (40-57) weeks for the males.

Cloudcroft, New Mexico.—In the summer of 1927 the University of Michigan-Walker-Harris Expedition to New Mexico took 24 females and 20 males alive in the heavy coniferous forests at the top of the Sacramento Mountains near Cloudcroft. Three of the females proved to be pregnant when captured and gave birth to litters in the laboratory. Eighteen other females and 18 males were used as parents for the stock reared in the laboratory. This stock was not inbred. Most of the laboratory-bred animals are first generation offspring from the field-caught mice. The mice caught in the field were kept in the laboratory an average of 93.5 (92-94) weeks for the females and 93.8 (93-96) weeks for the males before preparation as specimens. The laboratory-bred mice of the 1-year class averaged in age 47.4 (36-78) weeks for both the females and the males. For the 2-year class the average ages were 88.8 (79-116) weeks for the females and 87.4 (79-93) weeks for the males.

Besides the mice taken at Cloudcroft and kept alive, a number of others were killed and prepared as specimens in the field. Of these wild-killed animals, 4 females and 11 males are apparently fully adult.

La Veta, Colorado.—The stock originated from 11 females and 2 males taken the first week of August, 1925, by the University of Michigan-Carnegie Institution of Washington Expedition to Colorado. These were all taken by myself in brushy thickets on a mountain slope near Ojo Spring, 8 miles west of La Veta, Colorado. Both of the males and 8 of the females were used as parents for the stock. Owing to there being but two male progenitors there was considerable inbreeding in the laboratory. The 10 field-caught females were kept an average of 74.9 (56–146) weeks in the laboratory before preparation as specimens. The laboratory-bred 1-year class averaged 59.1 (47–78) weeks for the females and 54.0 (37–78) weeks for the males. The 2-year class averaged 100.1 (95–110) weeks for the females and 100.1 (95–112) weeks for the males.

EFFECT OF CAPTIVITY

Life in the laboratory seems to have had little effect on the characters of these stocks of *Peromyscus m. rufinus*. This is in general agreement with the previously published results of the study of *P. m. bairdii*, which were reared under the same conditions.

Certain individuals became very fat in captivity, while in nature one seldom finds a very fat deer-mouse. A few of the laboratory mice are unusually lean. The weight is probably affected by this tendency to become abnormally fat or lean, but none of the body measurements seem to be affected.

Eleven apparently adult males killed in the field at Cloudcroft differ from the laboratory-bred mice of the 1-year class of the same stock only in having a slightly shorter hind foot (Table I). The difference amounts to $0.467 \pm .175$ mm. The other body measurements are not significantly different, which probably indicates that the wild-killed animals (omitting those obviously immature) averaged about one year of age. Seventeen females and an equal number of males captured at Cloudcroft and then kept for two years in the laboratory differ from the laboratory-bred 2-year-old mice of the

same stock only in having a shorter hind foot. The difference is $0.388 \pm .151$ mm. for the females and $0.833 \pm .143$ mm. for the males. None of the other measurements of body or skeleton are significantly different.

Ten females caught alive at La Veta and kept one to two years in the laboratory average in the measurements of body and skeleton close to the measurements of the 2-year-old laboratory-bred females of the same stock. The hind foot of the field-caught mice, however, averages $1.062 \pm .216$ mm. shorter, the difference being nearly 5 times the probable error. This agrees with the trend noted above for the stock from Cloudercroft, and therefore is probably significant.

In *Peromyscus m. bairdii* the hind foot was also found to be slightly shorter in mice caught in the field at Grafton, North Dakota, and kept for over a year in the laboratory, than in laboratory-bred 2-year-old mice of the same stock. The differences are $0.580 \pm .173$ mm. for the females, but only $0.041 \pm .201$ mm. for the males. The number of animals measured are few and the differences were at the time interpreted as being not significant. In view of the consistently shorter foot length of field-bred over laboratory-bred *rufinus*, however, these differences in *bairdii* might be considered also as possibly significant.

That life in my laboratories has not in any way stunted the mice seems obvious. The only measurement affected by captivity is the size of the hind foot which is slightly longer in the laboratory-bred animals. Perhaps the abundant food and warm quarters of the laboratory give the laboratory-bred animals on the average a slightly better start in life than is given to those bred in nature; or possibly there is something in the greater amount of travel probably required of young mice in nature which causes their feet to cease growing earlier in life.

In color there is no appreciable difference between the field-caught mice reared in the laboratory and the laboratory-bred mice. *Peromyscus m. rufinus* caught at Cloudercroft and at La Veta and kept in the laboratory for one to two years are

not significantly different in tint photometer readings of the dorsal stripe (Table V) and of the side (Table VII) from laboratory-bred animals of the same stocks and of comparable ages.

That the color of the mice may in some manner be affected by the laboratory environment cannot with our present information be disproved. No critical comparison between mice killed as adults in the field and those grown in the laboratory has been attempted. The skins prepared in the field were taken in the summer, while those from the laboratory were prepared in the spring. Many of the wild-killed specimens are slightly immature. If life in the laboratory has any effect on the pelage color of these mice the effect must be the same on the field-caught animals as on those born in the laboratory.

VARIATIONS DUE TO AGE AND SEX

There is an important amount of growth in these mice after they are one year of age. This is shown by the fact that the body and skeletal measurements of all the stocks average greater for the 2-year age class than for 1-year age class. On the other hand there is no significant difference in color, either of the dorsal stripe or side, between the mice averaging two years of age and those averaging one year. This is in agreement with *Peromyscus m. bairdii*, in which subspecies there is also a considerable amount of growth after the mice are one year of age, but no change in color after the first year.

The males in these stocks of *rufinus* have on the average slightly longer hind feet than the females, and the males also average somewhat heavier in weight. This agrees with the sexual differences in *Peromyscus m. bairdii*. None of the other measurements of body or skeleton differ significantly between the sexes. Neither do the males differ significantly from the females in pelage color either on the dorsal stripe or side.

GEOGRAPHICAL VARIATION IN MEASUREMENTS

The body length averages from 2.6 to 5.8 millimeters greater in the mice of the Bonito Canyon stock than in any of the

TABLE I
 AVERAGE BODY MEASUREMENTS OF *Peromyscus maniculatus rufinus*

Stock	No.	Measurements in mm.				weight gm.
		body length	tail length	hind foot	ear	
Buena Vista, Colo.	♀ 21	90.29 ± .60	72.15 ± .69	19.848 ± .105	18.767 ± .124	20.76 ± .55
	♂ 14	89.00 ± .95	68.92 ± .73	20.121 ± .106	18.257 ± .184	24.03 ± .98
1-year age class	♀ 81	85.90 ± .32	69.65 ± .32	19.738 ± .051	17.935 ± .055	20.60 ± .29
	♂ 80	85.53 ± .33	70.53 ± .31	19.947 ± .044	17.985 ± .061	21.91 ± .30
La Veta, Colo.	♀ 12	92.33 ± .59	73.58 ± .88	20.692 ± .105	18.700 ± .179	24.67 ± 1.13
	♂ 7	90.57 ± 1.00	75.57 ± .49	20.743 ± .177	18.429 ± .113	28.53 ± 1.82
1-year age class	♀ 30	88.07 ± .57	73.34 ± .73	20.413 ± .076	18.037 ± .115	20.89 ± .43
	♂ 53	86.45 ± .38	73.42 ± .49	20.666 ± .061	18.149 ± .094	23.72 ± .56
Field-caught	♀ 10	90.40 ± .99	76.44 ± .89	19.630 ± .189	18.070 ± .105	19.12 ± .67

TABLE I—(Continued)
 AVERAGE BODY MEASUREMENTS OF *Peromyscus maniculatus rufinus*

Stock	No.	Measurements in mm.				weight gm.
		body length	tail length	hind foot	ear	
Bonito Canyon, N. Mex..						
1-year age class	♀ 31	92.23 ± .47	65.71 ± .58	20.045 ± .080	18.061 ± .084	23.11 ± .61
	♂ 14	89.00 ± .95	68.92 ± .73	20.121 ± .106	18.257 ± .184	24.03 ± .98
Field-caught	♀ 22	96.00 ± .49	71.24 ± .77	19.982 ± .100	18.741 ± .077	23.01 ± .70
	♂ 27	94.81 ± .47	71.19 ± .51	20.289 ± .092	19.244 ± .084	27.16 ± .90
Clouderoft, N. Mex.						
2-year age class	♀ 16	92.87 ± .63	70.67 ± .91	20.294 ± .101	19.131 ± .113	20.39 ± .74
	♂ 13	91.46 ± .73	71.73 ± 1.07	20.715 ± .092	19.177 ± .102	22.47 ± .90
1-year age class	♀ 63	86.44 ± .35	69.59 ± .38	20.113 ± .054	18.462 ± .068	19.86 ± .33
	♂ 63	86.76 ± .35	70.92 ± .46	20.249 ± .072	18.300 ± .065	20.51 ± .48
Field-caught	♀ 17	93.35 ± .56	74.06 ± .86	19.906 ± .112	19.000 ± .156	20.66 ± .67
	♂ 17	90.18 ± .36	71.41 ± .77	19.882 ± .109	18.806 ± .089	24.78 ± .68
Wild-killed	♀ 4	89.50 ± 1.36	70.00 ± 1.58	19.450 ± .113	18.200 ± .182	22.30 ± 1.32
	♂ 11	88.09 ± .73	69.09 ± 1.19	19.782 ± .159	18.173 ± .167	21.66 ± .29

Variation in *Peromyscus m. rufinus*

TABLE II
 AMOUNT OF GEOGRAPHICAL VARIATION IN BODY MEASUREMENTS *Peromyscus maniculatus rufinus*
 Differences between the means from different localities

Stocks compared	Measurements in mm.				weight gm.
	body length	tail length	hind foot	ear	
Clouderoft minus Buena Vista					
♀ 2-year age class	2.58 ± .87	-1.48 ± 1.14	.446 ± .146	.864 ± .168	-0.37 ± .92
♂ 2-year age class	2.46 ± 1.20	2.81 ± 1.30	.594 ± .140	.920 ± .210	-1.56 ± 1.33
1-year age class					
♀	.54 ± .47	-.06 ± .50	.375 ± .074	.527 ± .087	-.74 ± .44
♂	1.23 ± .48	.39 ± .55	.302 ± .084	.365 ± .089	-1.40 ± .57
Clouderoft minus La Veta					
♀ 2-year age class	.54 ± .86	-2.91 ± 1.26	-.398 ± .145	.431 ± .211	-4.28 ± 1.35
♂ 2-year age class	.89 ± 1.24	-3.84 ± 1.18	-.028 ± .199	.748 ± .152	-6.06 ± 2.03
1-year age class					
♀	-1.63 ± .67	-3.75 ± .82	-.300 ± .093	.425 ± .134	-1.03 ± .54
♂	.31 ± .52	-2.50 ± .67	-.417 ± .094	.151 ± .114	-3.21 ± .74
Field-caught	2.95 ± 1.14	-2.38 ± 1.24	.276 ± .220	.930 ± .188	1.54 ± .95
Clouderoft minus Bonito Canyon					
♀ 1-year age class	-5.79 ± .59	3.88 ± .69	.068 ± .097	.401 ± .108	-3.25 ± .69
♂ 1-year age class	-5.76 ± .52	3.76 ± .62	.018 ± .109	.273 ± .109	-4.36 ± .88
Field-caught					
♀	-2.65 ± .74	2.82 ± 1.15	-.076 ± .150	.259 ± .174	-2.35 ± .97
♂	-4.63 ± .59	.22 ± .92	-.407 ± .143	-.438 ± .122	-2.38 ± 1.13

other stocks of *rufinus* here considered; this difference is consistent and significant in each age class and in both sexes (Table II). The Cloudercroft and La Veta mice are about equal in body length, while the Buena Vista mice average somewhat shorter.

The tail is longest in the La Veta mice. The tail length averages nearly the same in the Buena Vista and Cloudercroft stocks, and both average over 2 mm. shorter in this character than the La Veta mice. The tails of the Bonito Canyon mice, which are the shortest of all, average consistently and significantly shorter than the tails of the Cloudercroft mice, the differences for both sexes, in the 1-year age class, being over 3 mm.

In length of hind foot there is no significant difference between the stocks from Cloudercroft and from Bonito Canyon. The La Veta mice have a tendency to have longer feet than either of these two stocks, but the differences are not wholly consistent. The Buena Vista mice have the shortest feet of all, averaging over 0.3 mm. shorter than the Cloudercroft mice, and the differences are of considerable statistical significance, being from $2\frac{1}{2}$ times to 5 times their probable errors.

The ears of the Cloudercroft mice average longer than those of any of the other stocks, the only exception being that the males caught in Bonito Canyon and kept in the laboratory until mature have longer ears than the corresponding Cloudercroft males. There seems to be no important difference in ear length between the mice of the stocks from Bonito Canyon, La Veta, and Buena Vista.

In weight the mice from Bonito Canyon average the heaviest; the La Veta mice are next; while the Buena Vista and Cloudercroft mice weigh the least. The individual variation in weight, however, is considerable, and the differences between the averages of the different stocks are not of very great statistical significance.

The length of the femur is not significantly different in the four stocks compared (Tables III and IV).

TABLE III
 AVERAGE MEASUREMENTS OF FEMUR AND SKULL FOR *Peromyscus maniculatus rufinus*

Stock	No.	Measurements in mm.				
		femur	mandible	skull length	condyle-zygoma	bullar width
Buena Vista, Colorado						
2-year age class	♀ 20	16.440 ± .112	16.332 ± .057	24.490 ± .070	17.420 ± .056	10.758 ± .031
	♂ 13	16.285 ± .103	15.908 ± .077	24.058 ± .137	17.092 ± .136	10.875 ± .040
1-year age class	♀ 75	15.965 ± .064	15.889 ± .043	24.003 ± .067	17.037 ± .044	10.624 ± .020
	♂ 74	15.996 ± .050	15.855 ± .030	24.010 ± .049	17.051 ± .032	10.686 ± .019
La Veta, Colorado						
2-year age class	♀ 10	16.850 ± .129	16.500 ± .081	24.829 ± .121	17.643 ± .084	10.900 ± .064
	♂ 7	16.100 ± .127	16.200 ± .091	24.186 ± .138	17.157 ± .104	10.571 ± .060
1-year age class	♀ 29	16.400 ± .098	16.083 ± .085	24.330 ± .102	17.396 ± .062	10.758 ± .037
	♂ 46	16.021 ± .066	15.920 ± .046	24.203 ± .062	17.243 ± .048	10.789 ± .028
Field-caught	♀ 8	16.088 ± .143	15.900 ± .143	24.114 ± .116	17.443 ± .049	10.700 ± .090
Bonito Canyon, New Mexico						
1-year age class	♀ 27	15.889 ± .072	16.026 ± .052	24.192 ± .070	17.150 ± .049	10.773 ± .036
	♂ 42	16.092 ± .060	16.071 ± .047	24.418 ± .075	17.331 ± .056	10.808 ± .030
Field-caught	♀ 21	16.450 ± .079	16.419 ± .047	24.910 ± .074	17.724 ± .055	10.981 ± .032
	♂ 27	16.200 ± .073	16.278 ± .048	24.837 ± .063	17.652 ± .043	11.081 ± .032
Clouderoft, New Mexico						
2-year age class	♀ 15	16.663 ± .112	16.480 ± .068	25.000 ± .132	17.673 ± .101	10.867 ± .043
	♂ 12	16.367 ± .131	16.375 ± .092	24.992 ± .123	17.658 ± .061	10.933 ± .041
1-year age class	♀ 58	15.784 ± .065	16.131 ± .040	24.396 ± .065	17.296 ± .044	10.813 ± .019
	♂ 60	15.690 ± .056	16.042 ± .037	24.423 ± .059	17.306 ± .031	10.747 ± .026
Field-caught	♀ 17	16.494 ± .123	16.300 ± .065	24.944 ± .087	17.824 ± .076	11.000 ± .044
	♂ 17	16.059 ± .116	16.318 ± .065	24.783 ± .107	17.544 ± .064	11.012 ± .035

TABLE IV
 GEOGRAPHICAL VARIATION IN MEASUREMENTS OF FEMUR AND SKULL OF *Peromyscus maniculatus rufinus*
 Differences between the means from different localities

Stocks compared		Measurement in mm.				
		femur	mandible	skull length	condyle-zygoma	bullar width
Clouderoft minus Buena Vista 2-year age class	♀	.223 ± .158	.148 ± .089	.510 ± .149	.253 ± .115	.109 ± .053
	♂	.082 ± .167	.467 ± .120	.934 ± .184	.566 ± .149	.058 ± .057
1-year age class	♀	-.181 ± .091	.242 ± .059	.393 ± .093	.259 ± .062	.189 ± .042
	♂	-.306 ± .075	.187 ± .048	.413 ± .077	.255 ± .045	.061 ± .038
Clouderoft minus La Veta 2-year age class	♀	-.187 ± .171	-.020 ± .106	.171 ± .179	.030 ± .131	-.033 ± .077
	♂	.267 ± .182	.175 ± .129	.806 ± .185	.501 ± .121	.362 ± .073
1-year age class	♀	-.616 ± .118	.048 ± .094	.066 ± .121	-.100 ± .076	.055 ± .042
	♂	-.331 ± .087	.122 ± .059	.220 ± .086	.063 ± .057	-.042 ± .038
Field-caught	♀	.406 ± .189	.400 ± .157	.830 ± .145	.381 ± .090	.300 ± .100
Clouderoft minus Bonito Canyon 1-year age class	♀	-.105 ± .097	.105 ± .066	.204 ± .096	.146 ± .066	.040 ± .041
	♂	-.402 ± .082	-.029 ± .060	.005 ± .095	-.025 ± .064	-.061 ± .040
Field-caught	♀	.044 ± .146	-.119 ± .080	.034 ± .114	.100 ± .094	.019 ± .054
	♂	-.141 ± .137	.040 ± .081	-.054 ± .124	-.108 ± .077	-.069 ± .047

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The measurements of the skull and mandibles average nearly the same for the stocks from Cloudercroft and from Bonito Canyon. The La Veta mice also average close to these two stocks in the length of the mandible, in condylo-zygomatic length, and in bullar width; but in condylo-premaxillary length (skull length of the tables) the skulls of the La Veta mice are somewhat shorter. The Buena Vista mice differ from the other three stocks in having smaller skulls and mandibles, as is shown by all the measurements being smaller. The skulls of the Buena Vista mice are slightly smaller even in condylo-premaxillary length than the La Veta mice, the differences ranging in the several age and sex classes from $.128 \pm .194$ to $.339 \pm .140$ mm. These differences are consistent in trend, though only of slight statistical significance. Compared to the mice from Cloudercroft those from Buena Vista average smaller in every measurement of the skull and mandible, and the differences, except for bullar width, are of considerable statistical probability.

So far as these figures may represent the actual relationships of the wild populations in regard to body proportions, there is no geographical trend in femur length, in the external body measurements, nor in weight. Although La Veta and Bonito Canyon lie geographically between Buena Vista and Cloudercroft, the mice of the first two mentioned localities do not have body measurements intermediate between those of the more widely distant places. On the contrary, the La Veta mice have the longest tails and the largest hind feet of the stocks here compared; while the Bonito Canyon mice have the greatest body length and are heaviest in weight. Only in ear length do the Cloudercroft mice have the greatest measurements, and in this character the differences are not fully consistent in the several age and sex classes.

In skull measurements the two New Mexican stocks average practically the same, while the Buena Vista mice are distinctly smaller. The La Veta mice are similar in most of the skull measurements to the New Mexican stocks, but in condylo-premaxillary length of skull they are intermediate between

the New Mexican stocks and the mice from Buena Vista. Possibly this may indicate a geographical trend in skull size, the most northern mice having the smallest skulls.

GEOGRAPHICAL VARIATION IN PELAGE COLOR

The color of the dorsal stripe is brightest in the mice from La Veta (Tables V and VI). This is shown by higher average tint photometer readings for all the colors of these mice than for any of the other stocks. The darkest dorsal stripes are found on the mice from Cloudercroft, whose tint photometer readings average from 1.32 to 2.92 units less than those from La Veta. The differences are from 3 to 8 times their probable errors. The Cloudercroft mice have lower readings in every comparison, and the differences are of high statistical probability. The Bonito Canyon and Buena Vista mice are intermediate in the shade of the dorsal stripe between the two other stocks, but the dorsal stripe of the Buena Vista mice averages somewhat brighter in color than in the mice from Bonito Canyon.

A slight geographic trend is therefore indicated to occur in the color of the dorsal stripe. The darkest colored dorsal stripe occurs in the Cloudercroft mice, the most southerly stock, and the stock next most darkly colored is that from Bonito Canyon, which also is in southern New Mexico. The most brightly colored dorsal stripe is found on the mice from La Veta, and the next most brightly colored occurs in the mice from Buena Vista, both of which localities are in Colorado. Although the Bonito Canyon mice have the dorsal stripe not a great deal darker in color than in the mice from Buena Vista, and although the order of brightness of color of dorsal stripe in the four stocks does not exactly coincide with the geographical sequence, there is nevertheless a slight geographical segregation, for the two stocks of Colorado mice are consistently more brightly colored than the two stocks from New Mexico.

In the color of the side of the body the stocks of *Peromyscus m. rufinus* fall into two groups. The mice from La Veta and

TABLE V
 AVERAGE COLOR OF DORSAL STRIPE IN *Peromyscus maniculatus rufinus*
 Tint photometer readings

Stock	No.	red	yellow	green	peacock-blue	blue-violet
Buena Vista, Colorado 2-year age class	♀ 21	9.60 ± .39	8.21 ± .30	6.62 ± .23	5.86 ± .18	5.14 ± .14
	♂ 14	8.57 ± .28	7.50 ± .23	6.18 ± .19	5.46 ± .16	4.89 ± .15
1-year age class	♀ 81	9.31 ± .12	7.90 ± .10	6.54 ± .08	5.80 ± .07	5.11 ± .06
	♂ 80	9.30 ± .13	7.97 ± .10	6.58 ± .08	5.94 ± .07	5.25 ± .06
La Veta, Colorado 2-year age class	♀ 9	10.22 ± .32	8.61 ± .23	6.72 ± .21	5.83 ± .17	5.22 ± .18
	♂ 5	11.60 ± .56	10.00 ± .50	7.90 ± .42	6.90 ± .36	6.10 ± .31
1-year age class	♀ 31	10.60 ± .18	8.87 ± .16	7.16 ± .15	6.16 ± .12	5.56 ± .12
	♂ 52	10.38 ± .19	8.72 ± .15	7.02 ± .12	6.17 ± .11	5.44 ± .09
Bonito Canyon, New Mexico 1-year age class	♀ 28	9.32 ± .23	6.89 ± .14	6.00 ± .18	4.61 ± .10	4.71 ± .14
	♂ 37	9.27 ± .18	6.58 ± .14	5.95 ± .14	4.62 ± .10	4.62 ± .11
Field-caught	♀ 22	9.45 ± .16	7.41 ± .14	6.25 ± .11	5.00 ± .10	4.73 ± .09
	♂ 27	10.09 ± .25	7.83 ± .19	6.65 ± .14	5.20 ± .14	5.24 ± .11
Cloudcroft, New Mexico 2-year age class	♀ 15	7.60 ± .13	6.18 ± .15	5.07 ± .10	4.36 ± .12	3.90 ± .12
	♂ 13	9.04 ± .39	7.08 ± .31	5.77 ± .22	4.88 ± .20	4.42 ± .20
1-year age class	♀ 58	7.80 ± .08	6.31 ± .06	4.98 ± .05	4.41 ± .04	3.92 ± .03
	♂ 59	7.83 ± .12	6.44 ± .10	5.14 ± .07	4.53 ± .05	4.03 ± .05
Field-caught	♀ 17	7.03 ± .16	5.82 ± .15	4.53 ± .11	4.06 ± .10	3.53 ± .08
	♂ 17	7.82 ± .21	6.29 ± .17	4.97 ± .14	4.38 ± .12	3.79 ± .10
Wild-killed	♂ 7	7.79 ± .22	6.64 ± .21	5.43 ± .20	4.79 ± .18	4.50 ± .19

TABLE VI
GEOGRAPHICAL VARIATION IN COLOR OF DORSAL STRIPE OF *Peromyscus maniculatus rufinus*
Differences between means of tint photometer readings

Stocks compared	red	yellow	green	peacock blue	blue-violet
Clouderoft minus Buena Vista					
2-year age class	♀ -2.00 ± .41 ♂ .47 ± .48	-2.03 ± .34 - .42 ± .39	-1.55 ± .25 - .41 ± .29	-1.50 ± .22 - .58 ± .26	-1.24 ± .18 - .47 ± .25
1-year age class	♀ -1.51 ± .14 ♂ -1.47 ± .18	-1.59 ± .12 -1.53 ± .14	-1.56 ± .09 -1.44 ± .11	-1.39 ± .08 -1.41 ± .09	-1.19 ± .07 -1.22 ± .08
Clouderoft minus La Veta					
2-year age class	♀ -2.62 ± .34 ♂ -2.56 ± .68	-2.43 ± .27 -2.92 ± .59	-1.65 ± .23 -2.13 ± .47	-1.47 ± .21 -2.02 ± .41	-1.32 ± .22 -1.68 ± .37
1-year age class	♀ -2.80 ± .20 ♂ -2.55 ± .22	-2.56 ± .19 -2.28 ± .18	-2.18 ± .16 -1.88 ± .14	-1.75 ± .13 -1.64 ± .12	-1.64 ± .12 -1.41 ± .10
Clouderoft minus Bonito Canyon					
1 year age class	♀ -1.52 ± .24 ♂ -1.44 ± .22	- .58 ± .15 - .14 ± .17	-1.02 ± .19 - .81 ± .16	- .20 ± .11 - .09 ± .11	- .79 ± .14 - .59 ± .12
Field-caught	♀ -2.42 ± .23 ♂ -2.27 ± .33	-1.59 ± .21 -1.54 ± .25	-1.72 ± .16 -1.68 ± .20	- .94 ± .14 - .82 ± .18	-1.20 ± .12 -1.45 ± .15

those from Buena Vista show no differences of statistical significance in the tint photometer readings of the color of the sides (Tables VII and VIII). Likewise the mice from the two New Mexican localities, Cloudercroft and Bonito Canyon, are apparently alike in this character. Both stocks from Colorado are, however, lighter in color on the sides than are either of the stocks from New Mexico. This is shown by higher tint photometer readings for each of the 5 colors studied, in each age class and in both sexes. In every comparison the Colorado mice have higher readings than the New Mexican mice. The differences are considerable and of high statistical probability. For instance, the readings for the Buena Vista mice as compared to the Cloudercroft mice range, in the two age classes and in the two sexes, from 4.21 to 4.69 tint photometer units higher for red, the differences being from 7 to 16 times their probable errors; and from 2.24 to 2.91 units higher for blue-violet, with differences 6 to 21 times their probable errors. The readings for all the colors are higher in the Colorado mice, and there is no difference in hue between the several stocks.

In pelage color there is then an indication of geographical segregation in the four stocks of *rufinus* compared. The color of the dorsal stripe is slightly darker in the New Mexican mice than in the Colorado animals. This geographical difference is much more pronounced for the color of the side, and the New Mexican stocks are decidedly darker on this part of the body than are the Colorado mice.

GENETIC VARIATION WITHIN A POPULATION

The hereditary characters carried by the different individuals of a population are well known to be more or less different. Wright³ has shown that there are important differences in adult weight, fertility, longevity, resistance to tuberculosis, and other characters, in several inbred families of guinea-pigs originating from the same stock. In other domestic mammals and in man it is recognized that certain

³ Wright, Sewall, "The Effects of Inbreeding and Crossbreeding on Guinea Pigs," *U. S. Dept. Agric., Bull.* 1090 (1922): 63 pp.

TABLE VII
 AVERAGE COLOR OF THE SIDE IN *Peromyscus maniculatus rufinus*
 Tint photometer readings

Stock	No.	red	yellow	green	peacock blue	blue-violet
Buena Vista, Colorado						
2-year age class	♀ 21	23.76 ± .42	20.33 ± .33	15.19 ± .31	13.14 ± .20	11.48 ± .24
	♂ 14	23.50 ± .52	20.79 ± .47	15.14 ± .30	12.79 ± .36	10.93 ± .28
1-year age class	♀ 81	23.74 ± .19	20.28 ± .17	15.53 ± .14	12.99 ± .13	11.53 ± .12
	♂ 80	23.95 ± .22	20.59 ± .17	15.80 ± .12	13.26 ± .11	11.81 ± .10
La Veta, Colorado						
2-year age class	♀ 9	23.33 ± .56	19.67 ± .52	15.33 ± .49	12.44 ± .40	11.00 ± .44
	♂ 5	23.80 ± 1.57	21.20 ± .59	15.80 ± .88	14.20 ± .75	11.80 ± .96
1-year age class	♀ 31	25.00 ± .39	19.29 ± .38	16.19 ± .33	12.58 ± .30	11.77 ± .31
	♂ 52	23.69 ± .26	19.15 ± .19	15.54 ± .16	12.62 ± .19	11.37 ± .15
Bonito Canyon, New Mexico						
1-year age class	♀ 28	20.09 ± .34	15.68 ± .29	12.54 ± .21	10.11 ± .17	9.21 ± .18
	♂ 37	20.65 ± .24	16.30 ± .23	13.20 ± .18	10.51 ± .17	9.85 ± .19
Field-caught	♀ 22	20.05 ± .31	15.91 ± .29	11.98 ± .30	9.86 ± .20	8.45 ± .26
	♂ 27	20.30 ± .34	16.63 ± .31	12.56 ± .25	10.56 ± .19	9.28 ± .21
Cloudcroft, New Mexico						
2-year age class	♀ 15	19.07 ± .47	16.27 ± .32	12.07 ± .37	10.07 ± .25	8.60 ± .24
	♂ 13	19.08 ± .44	16.15 ± .35	11.92 ± .26	10.00 ± .23	8.69 ± .22
1-year age class	♀ 58	19.53 ± .18	16.36 ± .13	12.10 ± .11	10.02 ± .09	8.84 ± .10
	♂ 59	19.68 ± .20	16.85 ± .17	12.25 ± .13	10.47 ± .11	8.90 ± .10
Field-caught	♀ 17	19.82 ± .39	16.59 ± .30	12.59 ± .25	10.06 ± .21	8.65 ± .19
	♂ 17	20.41 ± .46	17.29 ± .26	12.53 ± .25	10.41 ± .19	9.00 ± .17
Wild-killed	♂ 7	19.29 ± .13	16.29 ± .33	12.00 ± .24	10.57 ± .27	9.14 ± .21

Variation in *Peromyscus m. rufinus*

TABLE VIII
GEOGRAPHICAL VARIATION IN COLOR OF SIDE *Peromyscus maniculatus rufinus*
Differences between means of tint photometer readings

Stocks compared	red	yellow	green	peacock blue	blue-violet
Cloudcroft minus Buena Vista					
2-year age class	♀ -4.69 ± .63 ♂ -4.42 ± .68	-4.06 ± .46 -4.64 ± .59	-3.12 ± .48 -3.22 ± .40	-3.07 ± .32 -2.79 ± .43	-2.88 ± .34 -2.24 ± .36
1-year age class	♀ -4.21 ± .26 ♂ -4.27 ± .30	-3.92 ± .21 -3.74 ± .24	-3.43 ± .18 -3.55 ± .18	-2.97 ± .16 -2.79 ± .16	-2.69 ± .16 -2.91 ± .14
Cloudcroft minus La Veta					
2-year age class	♀ -4.26 ± .73 ♂ -4.72 ± 1.63	-3.40 ± .61 -5.05 ± .69	-3.26 ± .61 -3.88 ± .92	-2.37 ± .47 -4.20 ± .78	-2.40 ± .50 -3.11 ± .98
1-year age class	♀ -5.47 ± .43 ♂ -4.01 ± .33	-2.93 ± .40 -2.30 ± .26	-4.09 ± .35 -3.29 ± .22	-2.56 ± .31 -2.15 ± .22	-2.93 ± .33 -2.47 ± .13
Cloudcroft minus Bonito Canyon					
1-year age class	♀ .56 ± .38 ♂ .97 ± .31	.68 ± .32 .55 ± .29	.44 ± .24 .95 ± .22	.09 ± .19 .04 ± .20	.37 ± .21 .95 ± .21
Field-caught	♀ -.23 ± .50 ♂ .11 ± .57	.68 ± .42 .66 ± .40	.61 ± .39 .03 ± .35	.20 ± .29 .15 ± .27	.20 ± .32 .28 ± .27

characteristics tend to run in families. It is then to be expected that there will be genetic differences of importance between the several individuals making up every wild population which is not closely inbred.

The amount of individual genetic variability in the populations of wild *Peromyscus* is largely unknown. Should there be a large amount of hereditary difference between different individuals of the same population in respect to the characters of size and of color which we are investigating, one might easily be led to erroneous evaluations of the results of variability studies.

In order to determine the amount of genetic variability in one stock of *Peromyscus m. rufinus* several inbred lines were established in the Buena Vista stock. Pairs of mice were selected at random from those animals in the laboratory, some of which were caught wild in the field and some of which were first generation descendants from the wild mice. The offspring of each pair were inbred by brother-sister matings. Seven such lines were begun, but because of infertility and lack of laboratory space, only 2 lines, designated line D and line E, were carried beyond the first generation.

Of the D-line mice, there are available specimens of 6 females and 7 males about one year old of the first laboratory-bred generation, 14 females and 11 males of the second generation, and 9 females and 8 males of the third generation. Of E-line mice one year of age there are available specimens of 3 females and 4 males of the first laboratory-bred generation, 6 females and 3 males of the second generation, 7 females and 11 males of the third generation, and 3 females of the fourth generation. I have combined the measurements and color readings of the mice of the second, third, and fourth generations of each of the inbred lines, for a comparison indicates that there are no important differences between these several inbred generations, while the number of individuals represented in each generation is too few to be of much statistical value. The first laboratory-bred generation animals are of course not inbred, and these are therefore not included in the

TABLE IX
 MEASUREMENTS ON INBRED LINES OF *Peromyscus maniculatus rufinus*
 Stock from Buena Vista, Colorado; 1-year age class

	No.	Measurements in mm.				weight gm.
		body length	tail length	hind foot	ear	
Inbred line-D						
Generations 2 and 3	♀ 23	76.04 ± .52	62.05 ± .42	18.274 ± .092	16.522 ± .099	14.26 ± .32
	♂ 19	78.00 ± .53	65.28 ± .81	18.474 ± .083	16.858 ± .139	16.32 ± .31
Inbred line-E						
Generations 2, 3, and 4 . .	♀ 16	88.37 ± .58	66.07 ± .69	19.425 ± .106	19.088 ± .091	20.61 ± .50
	♂ 14	84.86 ± .69	66.73 ± .69	19.743 ± .135	18.579 ± .103	21.03 ± .50
Non-inbred stock minus						
inbred line-D	♀	9.86 ± .61	7.60 ± .53	1.464 ± .105	1.413 ± .113	6.34 ± .43
	♂	7.53 ± .62	5.25 ± .87	1.473 ± .094	1.077 ± .152	5.59 ± .43
Non-inbred stock minus						
inbred line-E	♀	-2.47 ± .66	3.58 ± .76	.313 ± .118	-1.153 ± .106	-0.01 ± .58
	♂	.67 ± .76	3.80 ± .76	.204 ± .142	-.644 ± .120	.88 ± .58
		femur	mandible	skull length	condyle-zygoma	bullar width
Inbred line-D						
Generations 2 and 3	♀ 19	14.833 ± .083	15.047 ± .072	22.572 ± .074	16.183 ± .063	10.435 ± .040
	♂ 19	14.994 ± .072	15.316 ± .060	22.861 ± .094	16.339 ± .061	10.472 ± .035
Inbred line-E						
Generations 2, 3, and 4 . .	♀ 14	16.364 ± .120	15.964 ± .082	23.854 ± .112	16.854 ± .076	10.545 ± .051
	♂ 13	15.608 ± .115	15.562 ± .081	23.525 ± .094	16.542 ± .077	10.558 ± .046
Non-inbred stock minus						
inbred line-D	♀	1.132 ± .105	.842 ± .084	1.431 ± .100	.854 ± .077	.189 ± .045
	♂	1.002 ± .088	.539 ± .067	1.149 ± .106	.712 ± .069	.214 ± .040
Non-inbred stock minus						
inbred line-E	♀	-.399 ± .136	-.075 ± .093	.149 ± .131	.183 ± .088	.079 ± .055
	♂	.388 ± .125	.293 ± .086	.485 ± .106	.509 ± .083	.128 ± .050

averages for the inbred lines, but instead are included in the averages for the non-inbred stock.

The inbred mice of the D-line average decidedly smaller in every measurement of the body and skeleton, and they are lighter in weight than are the mice of the non-inbred Buena Vista stock (Table IX). The differences between the combined averages for the second and third inbred generations and the averages for the non-inbred mice of the same stock are statistically very significant; even the ear averages over a millimeter shorter in the D-line.

The first generation mice of the D-line also are smaller in nearly all body measurements than the average for the stock, but the mice of this first generation are by no means so small in body dimensions as are the animals of the second and third inbred generations. Apparently the pair of mice which were the parents of the D-line carried hereditary characters for small size and this characteristic was established in the strain by inbreeding.

The mice of the E-line are very different from those of the D-line in body dimensions. Compared with the non-inbred Buena Vista stock the E-line mice of the second, third, and fourth inbred generations average shorter in tail length, but longer in ear length. The differences in both these dimensions are of high statistical probability. The feet of the E-line mice are also indicated to be somewhat shorter than in the non-inbred mice, but the differences are of only slight statistical significance. The body length and weight are not significantly different from the non-inbred stock. The measurements of the femur and mandible seem not to be significantly different from those of the non-inbred stock, but the condylo-zygomatic length of the skull is slightly shorter in the E-line mice, the differences being 2 times their probable errors for the females and 6 times for the males. There is also an indication that the condylo-premaxillary skull length and the bullar width are less in the E-line mice.

The color of the dorsal stripe in the D-line mice averages only slightly darker than in the non-inbred mice of the Buena

Vista stock (Table X). The greatest difference in tint photometer readings for any color is barely over a half-unit, and the differences are not of great statistical significance. On the other hand the color of the side is much darker, in the inbred mice of this line, than in the non-inbred stock. For no color is the difference less than 1 tint photometer unit, and the differences are from 3 to 9 times their probable errors.

The E-line inbred mice are much darker both on the dorsal stripe and on the side than the average of the non-inbred stock. The differences for the dorsal stripe are never less, in the various colors, than 0.45 tint photometer unit, which differences are from 2 to 8 times their probable errors, and are therefore of considerable statistical significance. The darker color of the side is still more apparent, no color comparison having an average difference of less than 1.80 tint photometer units, and the differences are from 5 to 12 times their probable errors.

From the evidence given by these 2 inbred lines considerable genetic variability is shown to occur in the wild parents of the Buena Vista stock. The D-line is smaller in every measurement of body and of skeleton and is lighter in weight than non-inbred mice of the same stock. The color of the dorsal stripe in the D-line is indicated to be slightly darker than in the non-inbred stock and the color of the side is decidedly darker. In the E-line the tail and possibly the hind foot are shorter than in the non-inbred mice of the same stock, but the ear is longer. Both the dorsal stripe and the side are considerably darker in the E-line than in the non-inbred mice.

That the Buena Vista stock contained many hereditary characters not brought to light by the inbreeding of the D and E lines may safely be assumed. Several variations of color and of color patterns were noted, and preliminary breeding experiments indicated that some of these were inherited, but lack of laboratory space prevented further investigation.

Possibly not all populations of wild deer-mice include an amount of genetic variability equal to that found in the Buena Vista stock, but all wild populations may be expected to be

TABLE X
 COLORS OF INBRED LINES OF *Peromyscus maniculatus rufinus*
 Stock from Buena Vista, Colorado; 1-year age class
 Tint photometer readings

Dorsal stripe			red	yellow	green	peacock blue	blue-violet
Inbred line-D							
Generations 2 and 3	♀	23	9.00 ± .15	7.43 ± .16	6.20 ± .16	5.35 ± .13	4.83 ± .13
	♂	19	9.05 ± .22	7.53 ± .19	6.24 ± .17	5.42 ± .14	4.87 ± .13
Inbred line-E							
Generations 2, 3, and 4	♀	16	8.59 ± .24	7.34 ± .18	6.09 ± .17	5.28 ± .13	4.59 ± .10
	♂	14	8.00 ± .16	6.79 ± .11	5.75 ± .14	5.04 ± .08	4.43 ± .09
Non-inbred stock minus							
inbred line-D	♀		.31 ± .19	.47 ± .19	.34 ± .18	.45 ± .15	.28 ± .14
	♂		.25 ± .26	.44 ± .21	.34 ± .19	.52 ± .16	.38 ± .14
Non-inbred stock minus							
inbred line-E	♀		.72 ± .27	.56 ± .21	.45 ± .19	.52 ± .15	.52 ± .12
	♂		1.30 ± .21	1.18 ± .15	.83 ± .16	.90 ± .11	.82 ± .11
Side							
Inbred line-D							
Generations 2 and 3	♀	23	21.00 ± .29	17.57 ± .24	13.43 ± .17	11.13 ± .14	9.83 ± .15
	♂	19	22.74 ± .40	19.32 ± .32	14.47 ± .28	12.21 ± .23	10.58 ± .21
Inbred line-E							
Generations 2, 3, and 4	♀	16	21.13 ± .43	18.13 ± .32	13.06 ± .36	11.19 ± .25	9.25 ± .26
	♂	14	20.93 ± .25	18.21 ± .17	12.79 ± .23	11.21 ± .17	9.21 ± .21
Non-inbred stock minus							
inbred line-D	♀		2.74 ± .35	2.71 ± .29	2.10 ± .22	1.86 ± .19	1.70 ± .19
	♂		1.21 ± .46	1.27 ± .36	1.33 ± .30	1.05 ± .26	1.23 ± .23
Non-inbred stock minus							
inbred line-E	♀		2.61 ± .47	2.15 ± .36	2.47 ± .39	1.80 ± .28	2.28 ± .29
	♂		3.02 ± .33	2.38 ± .24	3.01 ± .26	2.05 ± .20	2.60 ± .23

made up on a considerable number of different hereditary characters.

The differences in body dimensions between the inbred lines and the non-inbred Buena Vista stock is considerably greater than the differences between the Buena Vista stock and the stocks of *rufinus* from the three other localities here considered (compare Tables II and IX). The same is true of the dimensions of the femur and skull (compare Tables IV and IX). The genetic variation in color shown by the inbred lines to occur in the Buena Vista stock is also considerable, but by no means approaches the amount of difference, either in the color of the dorsal stripe or of the side, between the four geographic stocks (compare Tables VI, VIII, and X). It is quite likely, however, that there is more variability within the Buena Vista population in regard to hereditary differences in color characters than is brought out by these particular inbred lines.

AMOUNT OF VARIABILITY IN BODY MEASUREMENTS

By Table XI it is shown that the foot length is the least variable of the body measurements of these mice. The body length and ear length are about equally variable. Tail length is more variable than any other of the body measurements. Weight is much more variable than any of the other body measurements.

In amount of variability there seems to be no important difference between the mice of different ages or those of different sexes, nor is any important difference in variability found to occur between those mice captured in the field and then kept in the laboratory and those bred in the laboratory, nor between those killed in the field and those reared in the laboratory. Neither does there seem to be any significant differences between the mice of the stocks from Buena Vista, La Veta, Bonito Canyon, and Clouderoft. I interpret this to indicate that the differences in the numbers of field-caught parents employed in producing these several stocks have not

TABLE XI
 VARIABILITY OF BODY MEASUREMENTS IN *Peromyscus maniculatus rufinus*

Stock		body length %	tail length %	Coefficients of variation		ear %	weight %
				hind foot %	hind foot %		
Buena Vista, Colorado							
	♀	4.54 ± .47	6.31 ± .66	3.58 ± .37	4.49 ± .47	19.02 ± 1.88	
	♂	5.90 ± .75	5.41 ± .74	2.93 ± .37	5.58 ± .71	22.60 ± 2.88	
	♀	4.96 ± .26	6.23 ± .33	3.43 ± .18	4.04 ± .22	18.69 ± .99	
	♂	5.13 ± .27	5.57 ± .31	2.92 ± .16	4.53 ± .24	18.17 ± .97	
D-line F ₃ + F ₃							
	♀	4.88 ± .49	4.54 ± .47	3.59 ± .36	4.15 ± .41	16.20 ± 1.61	
	♂	4.31 ± .48	7.81 ± .88	2.90 ± .32	5.33 ± .58	12.44 ± 1.36	
E-line F ₂ + F ₃ + F ₄							
	♀	3.89 ± .50	5.77 ± .83	3.23 ± .39	2.81 ± .34	14.46 ± 1.72	
	♂	4.49 ± .57	5.11 ± .73	3.80 ± .48	3.06 ± .39	13.22 ± 1.69	
La Veta, Colorado							
	♀	5.21 ± .45	7.95 ± .70	3.03 ± .26	5.16 ± .45	16.75 ± 1.46	
	♂	4.78 ± .31	6.80 ± .47	3.16 ± .21	5.59 ± .37	22.51 ± 1.47	
Bonito Canyon, New Mexico							
	♀	4.20 ± .36	7.26 ± .62	3.29 ± .28	3.82 ± .33	21.94 ± 1.88	
	♂	4.17 ± .30	6.10 ± .44	3.90 ± .29	4.73 ± .34	29.11 ± 2.09	
Cloudercroft, New Mexico							
	♀	3.99 ± .48	7.39 ± .91	2.95 ± .35	3.51 ± .42	21.43 ± 2.56	
	♂	4.26 ± .56	7.88 ± 1.13	2.38 ± .31	2.84 ± .38	21.45 ± 2.84	
	♀	4.75 ± .29	6.34 ± .39	3.19 ± .19	4.32 ± .26	19.59 ± 1.18	
	♂	4.90 ± .29	7.53 ± .46	4.16 ± .25	4.16 ± .25	25.69 ± 1.54	
Field-caught							
	♀	3.59 ± .42	6.86 ± .82	3.43 ± .40	4.88 ± .56	19.85 ± 2.30	
	♂	2.47 ± .29	6.55 ± .76	3.35 ± .39	2.88 ± .33	16.87 ± 1.95	
Wild-killed							
	♀	4.50 ± 1.07	6.70 ± 1.60	1.72 ± .41	2.97 ± .71	17.53 ± 4.18	
	♂	4.09 ± .59	8.47 ± 1.22	3.95 ± .57	4.51 ± .65	6.56 ± .94	

introduced important differences in the amount of variability, and that the several stocks are therefore comparable.

There is an indication of a decrease in variability in certain measurements of the 2 inbred lines of the Buena Vista stock. The D-line mice of the second and third inbred generations have slightly smaller coefficients of variation for weight than the non-inbred stock. The differences are of possible statistical significance, being $1\frac{1}{2}$ times their probable errors for the females and $3\frac{1}{2}$ times for the males. The E-line mice of the second, third, and fourth inbred generations have smaller coefficients of variation for the length of ear than the non-inbred mice of the same stock, and the differences are of considerable significance, being 3 times their probable errors for both females and males. The weight of the E-line mice is slightly less variable than in the non-inbred animals, being 2 times the probable error for the females and $2\frac{1}{2}$ times for the males. While none of this decrease in variability in the inbred lines is of great statistical importance, it probably indicates a slight decrease in variability due to inbreeding. This decrease would be expected if we assume that the characters under consideration are produced by the operation of a considerable number of genetic factors, some of which would be lost in inbreeding.

Of course some of the variability in these mice must be due to environmental influences, and this environmental variability would not be decreased due to inbreeding. The proportion of the variability of these mice due to environmental influences and the proportion due to genetic differences has not been determined.

DISCUSSION

The stocks of *Peromyscus maniculatus rufinus* here considered differ from the stocks of *Peromyscus maniculatus bairdii*, previously described, in a number of important characters. *P. m. rufinus* as compared to *bairdii* has a much longer tail, longer hind foot, and larger ear. Body length and weight are, however, not very different in some of the stocks.

P. m. rufinus has a much longer femur, and the skull is larger in every dimension. *P. m. rufinus* also is much lighter in color than *bairdii*, as is shown by higher tint photometer readings both for the dorsal stripe and for the side.

Differences between the four stocks of *rufinus* here compared are not very great when contrasted with the considerable differences between *rufinus* and *bairdii*. Although there is therefore a considerable amount of uniformity throughout the part of the subspecies here investigated, there are important differences in body dimensions and in pelage color between the four stocks of *rufinus*.

Part of the differences noted between the four stocks of *rufinus* might possibly be due to the securing of inadequate samples of the populations. It has been shown that in the Buena Vista stock there is a considerable amount of genetic variability, and presumably some variability in hereditary characters occurs in every population. The number of mice serving as parents for the La Veta and for the Buena Vista stocks was undoubtedly too few. Further, there was some inbreeding in both of these stocks. On the other hand, the numbers of parents in the Clouderoft and in the Bonito Canyon stocks was relatively large, and in neither of these stocks was there any inbreeding. Yet the amount of variability in the four stocks, as shown by the coefficients of variation, seems not to be appreciably different. I take this to indicate that the Buena Vista and La Veta stocks represent the populations at those localities about as well as the Clouderoft and Bonito Canyon stocks represent the mouse populations of their localities. If this is so, all the stocks are comparable.

Possibly the differences between the several stocks of *rufinus* are due in part to the collection of local varieties. It is true that the breeding stock collected at any location represents only the genetic characters of the local area where the stock was taken. I have always endeavored to secure each breeding stock from as small an area as possible, and always from the same type of habitat. In some instances the whole breeding

stock was taken within a few hundred yards, and in no instance was the area of collection greater in diameter than about one mile. It is quite possible that breeding stocks taken from locations separated by a few miles or taken from different types of habitat in the same region might show somewhat different characters.

That local races do occur in *Peromyscus* has been demonstrated by Sumner,⁴ who described such a local variation in *Peromyscus maniculatus rubidus* from a small peninsula along northern California.

The chance occurrence at some localities of particular complexes of genetic characters may in part account for the production of local varieties. Probably some genetic characters are neither very useful nor very harmful to the species, and therefore are not particularly acted upon by natural selection. We might expect then a certain amount of genetic variability from place to place due to chance alone.

Isolation quite likely is a factor involved in the production of the genetic differences which distinguish the several stocks of these mice. From Buena Vista, Colorado, to Cloudercroft, New Mexico, the distance is about 400 miles, and distance alone would operate to retard the intermingling of the genetic characters of the more distant stocks. Further, the range of the subspecies is not fully continuous the whole of this distance. The several mountain ranges are more or less separated, and the forest habitat of the subspecies is in places more or less interrupted.

Differences in environment between the several localities where the stocks were collected may in part be correlated with the differences found in the hereditary characters of the stocks. Previous authors have frequently called attention to the dark colors of animals living in climates with heavy rainfall or humidity, and to the light colors of animals living in arid habitats. It is interesting then to note that the two Colo-

⁴ Sumner, F. B., "The Rôle of Isolation in the Formation of a Narrowly Localized Race of Deer-mice (*Peromyscus*)," *Amer. Nat.* 51 (1917): 173-185.

rado stocks of *rufinus*, which have the lightest colors, were taken in much more arid types of habitats than were the New Mexican stocks, which are definitely darker in color. The Buena Vista stock was collected on a rocky mountain slope thinly covered by pinyon pines and junipers, and the La Veta stock was taken on a mountainside covered by dry brush, which had sprung up following a widespread fire. The Cloudcroft stock was secured in the heavy forest of fir and of Douglas fir near the summit of the Sacramento Mountains, and the Bonito Canyon mice were taken in small meadowlike clearings which were surrounded by heavy forest.

Possibly there are factors other than environmental influences, isolation, or the chance grouping of genetic complexes which are effective in producing the differences in the characters of the subspecies *rufinus* in the various parts of its range. Further, all the controlling factors are undoubtedly closely interrelated. The amount of information at present at hand is quite insufficient to determine the relative importance of the several factors mentioned, or even to demonstrate that any one of them is effective in the production of any of the differences found between the four stocks of *rufinus*.

SUMMARY

Data are given on the variability in the dimensions of the body and skeleton and in pelage color of *Peromyscus maniculatus rufinus* from two localities (Buena Vista and La Veta) in Colorado and from two localities (Cloudcroft and Bonito Canyon) in southern New Mexico.

The mice bred in the laboratory have on the average slightly longer hind feet than mice of comparable ages killed in the field or caught in the field and then kept for a year or more in the laboratory. The mice bred in the laboratory show no appreciable difference in color from those caught in the field and kept for a year or more in the laboratory.

There is a considerable amount of growth in these mice after they are over a year of age, but no difference in pelage color was found between the 1-year-old mice and 2-year-old mice.

Males have longer hind feet and are heavier in weight than females, but there is no apparent difference in color between the sexes.

Although there are some important differences between the several stocks in the averages of the external body measurements and of the weight, no geographical trend in these characters is evident. Femur length averages practically the same in all the stocks. In skull size, however, the Buena Vista, Colorado, mice are the smallest, and the two New Mexican stocks the largest, with the La Veta, Colorado, mice averaging close to the New Mexican stocks.

The color of the dorsal stripe shows a slight geographical trend, the New Mexican mice being darker and the Colorado mice lighter in color, but there is not a great deal of difference in the tint photometer readings between the Buena Vista and the Bonito Canyon mice. The color of the side is darker and nearly equal in the two New Mexican stocks and is lighter and nearly equal in the two Colorado stocks, so that in side color there is a distinct geographical trend.

A large amount of genetic variability is demonstrated to occur in the Buena Vista population. Two inbred lines from this stock differ greatly in body dimensions and in color from each other and from the average of the non-inbred Buena Vista stock. The amount of variation in average body and skeletal measurements in the several lines of this Buena Vista stock is greater than that between the Buena Vista stock and any of the three other stocks of *rufinus* available for comparison. The genetic variation in pelage color shown by the inbred lines is not so great, but is important.

No important difference in the coefficients of variation of the body measurements of the four stocks is detectable, but there is an indication of a decrease in variability in some measurements in the inbred lines.

The part played by environmental influences, by isolation, by chance, or possibly by other factors, in the production of the differences found between the four stocks of *Peromyscus maniculatus rufinus* cannot be determined from the present information.