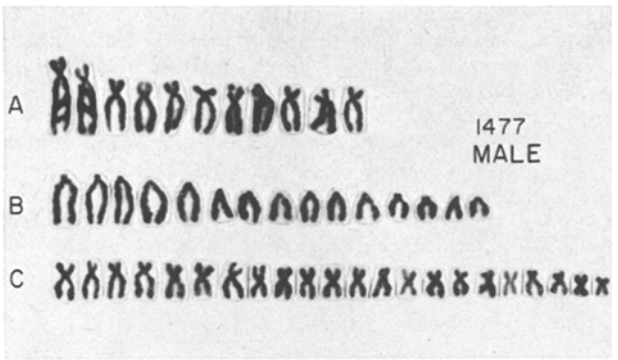

Fig. 2. Animal 1477 is male and has 15 acrocentric chromosomes (B Group). The difference between the A and C Groups of chromosomes seems distinct.

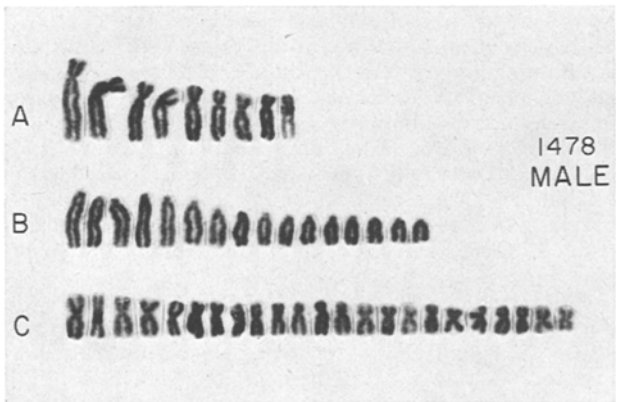

Fig. 3. Animal 1478 is male and has 16 acrocentric chromosomes (B Group). The distinction between the smallest A Group chromosome and largest C Group chromosome seems clear on morphology but less clear on size alone.

Acrocentric chromosome numbers related to sex of the 14 sibling deer mice

Sex	Number of acrocentric chromosomes				
	12	13	14	15	16
Male	–	–	1	2	2
Female	1	1	3	4	–

simply due to the inheritance of homologous chromosomes of different morphology from each of the parents. However, this probably would not be the case because of the difficulty in identifying homologous chromosomes when they have a different morphology.

HSU and ARRIGHI[4] have suggested that errors in pairing could account for an apparent greater polymorphism than actually exists, since they had no difficulty in establishing homologous pairs. While we do not rule out such possible errors in our own studies, we feel that the acrocentric chromosomes can be readily distinguished from the non-acrocentrics and have limited the polymorphism to differences in the number of acrocentrics. Thus, our presentation probably represents the minimal variation because it seems likely the chromosome changes probably also affect the other chromosomes. Although HSU and ARRIGHI[4] feel confident in assigning the sex chromosomes in the animals they studied, we have some reservation about this on the basis of our own studies as well as the lack of firm evidence that the sex chromosomes are not involved in the polymorphism. Clearly, more extensive and detailed mitotic and meiotic studies as well as autoradiographic chromosome studies should help to resolve these questions.

These results more firmly establish the existence of chromosome polymorphism in *Peromyscus maniculatus* which has now been observed to include sibling animals[6].

Zusammenfassung. Früher wurde bereits ein Chromosomenpolymorphismus in nicht verwandten *Peromyscus maniculatus*, wahrscheinlich durch perizentrische Inversion bedingt, gezeigt. Es wird nun nachgewiesen, dass dieser Polymorphismus auch unter Geschwistern vorkommt.

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Polymorphism in the Somatic Chromosomes of *Neotoma micropus* Baird, the Plains Woodrat[1]

In their karyological survey of the rodent genus *Neotoma*, BAKER and MASCARELLO[2] examined 33 specimens of the plains woodrat, *Neotoma micropus* Baird, and found several individuals whose karyotypes varied from the one described for the species by HSU and BENIRSCHKE[3]. We have examined 67 additional specimens and in the present communication, data from 100 specimens are presented.

Material and method. All specimens were collected from natural populations. Data concerning localities are given in Tables I and II. Voucher specimens of animals are deposited in the Texas Tech University Collection of Mammals. The method used to prepare slides were

[1] Supported in part by an American Philosophical Society Grant from the Penrose Fund and a Texas Tech University Faculty Grant.

[2] R. J. BAKER and J. T. MASCARELLO, Cytogenetics *8*, 187 (1969).

[3] T. C. HSU and K. BENIRSCHKE, in *An Atlas of Mammalian Chromosomes* (Springer-Verlag, New York 1968), vol. II.

those described by BAKER[4] for bone marrow tissue and by HSU and ARRIGHI[5] for lung tissue. As many as 100 spreads were scored from a specimen and although the diploid number occasionally varied below 52 (probably because some chromosomes were lost during preparation), cells with 52 chromosomes always contained the same number of large biarms as found in other cells of that specimen. In 3 cases, chromosomes of bone marrow and lung tissue were studied from the same animal and both tissues revealed identical karyotypes. No spreads were found to have more than 52 chromosomes.

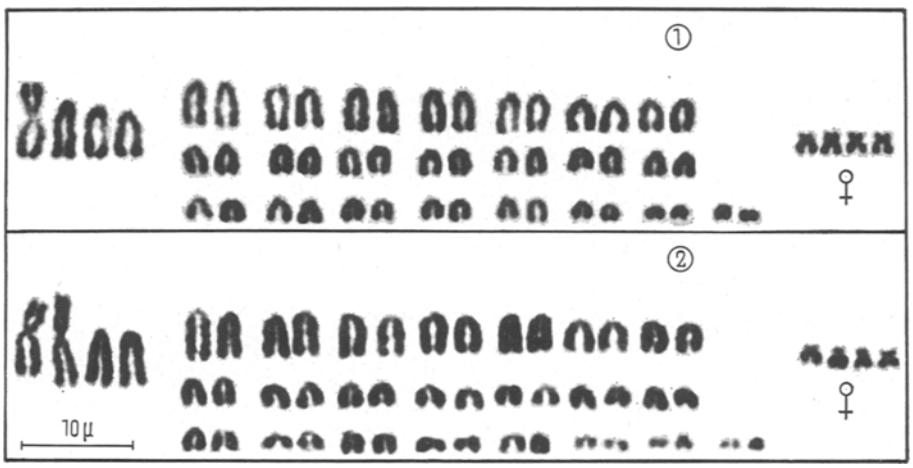
Results and discussion. The diploid number of the 100 specimens was invariably 52 and no mosaics were found. 4 different female and 3 different male karyotypes were found. Complete karyotypes of 2 females are shown in Figures 1 and 2. The most frequently found female and male karyotype were identical to those shown by HSU and BENIRSCHKE[3], except for the morphology of the Y chromosome[2]. The most common female karyotype consisted of 4 large, and 4 small biarmed chromosomes, and a graded series of 44 acrocentric elements. The most common male karyotype was 3 large and 4 small biarmed chromosomes, a medium-sized subtelocentric and a graded series of 44 acrocentric elements.

Briefly, this polymorphic system involves a reciprocal variation between the number of biarmed and acrocentric chromosomes. In females the number of large biarmed elements varies from 1 to 4 and in males from 1 to 3. Although it appears that the X chromosome(s) are involved in this polymorphism, the sex determining system seems to be the classical XX/XY.

Since a medium-sized subtelocentric was found in all male karyotypes (sample size = 42) and such an element was never found in the karyotypes of females, we believe the subtelocentric to be the Y. This element is shown in the partial karyotypes of 3 different males (Figure 3, a, b, and c). The morphology of one X is acrocentric in at least 1 case (Figure 1) as that female has only 1 large biarmed element in the general size range of the mammalian X. HSU and BENIRSCHKE[3] indicate that 1 pair of the large biarmed elements is the X chromosome. In Tables I and II the frequency of large biarmed elements in the karyotypes of different geographic samples of the plains woodrat is presented. The maximum number of large biarmed elements in females is 4; however, the maximum number of large biarmed elements found in males is 3 plus the Y. These data suggest 1 pair of the large biarmed elements in females with 4 large biarmed chromosomes is the X chromosomes.

Where 4 biarmed elements are present, these elements are distinctly larger than the largest of the acrocentric elements[2,3]. When there is a reduction in the number of large biarmed elements there is a corresponding increase in the number of acrocentric chromosomes; however, there are no acrocentrics as large as the large biarmed chromosome(s). The same is found in males. In Figure 3

[4] R. J. BAKER, in *Biology of Bats* (Ed. W. A. WIMSATT; Academic Press, New York), vol. I, in press.
[5] T. C. HSU and F. E. ARRIGHI, Cytogenetics 7, 417 (1968).



Figs. 1 and 2. Complete karyotypes of 2 female *Neotoma micropus* Baird. Note that the number of large biarmed chromosomes varies from 1 to 2. See HSU and BENIRSCHKE[3] for another karyotype of this species. Both specimens were collected from a natural population, 1 mile south of Post, Garza Co., Texas.

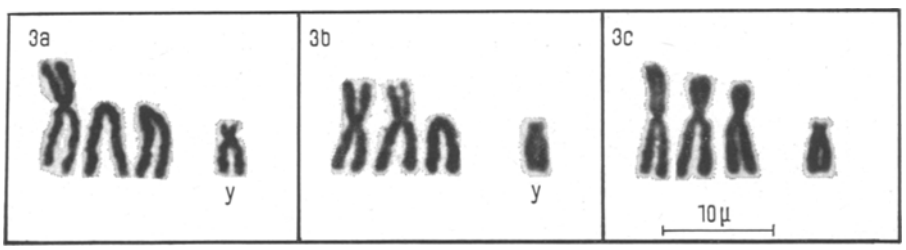


Fig. 3 (a, b, and c). Partial karyotypes of 3 male *Neotoma micropus* showing the Y chromosome plus the 3 largest chromosomes of their respective karyotypes. All 3 specimens were collected from a natural population, 1 mile south of Post, Garza Co., Texas.

(a, b, and c), partial karyotypes (the 3 largest elements plus the *Y*) of 3 males are presented. Note the discrepancy between the sizes of the biarmed and the acrocentric elements. Also in some specimens all of the biarmed elements seem to be the same size; however, in some specimens there is considerable difference in their size (Figure 3, c).

Tables I and II summarize the frequency of distribution of the number of large biarmed chromosomes from the localities studied. Chromosomal polymorphism occurred in all populations. Also, specimens taken from the same nest and litter-mates of the same sex varied in number of large biarmed elements in their somatic cells.

All 100 specimens appeared healthy with no obvious phenotypic differences among them. Fertility in females apparently was unaffected since pregnant females were found to have karyotypes with 2, 3, and 4 biarmed chromosomes.

Chromosomal polymorphism (intrapopulational variation) has been found in a variety of mammalian species. The most common type of such polymorphism is probably the Robertsonian variation, i.e., changes in the diploid number but not in the fundamental number[6–14]. Another type of polymorphism involves supernumerary chromosomes[15,16]. The third type involves changes of fundamental number but not diploid[4,17–21]. In *Rattus*[17] the longest pair of autosomes may be acrocentric or subtelocentric, but the total length, irrespective of the centromere position, remains the same. Thus, the most logical interpretation is that a pericentric inversion was clearly involved.

Table I. Total number of large biarmed chromosomes in karyotypes of females

Locality	Number of large biarmed elements 0	1	2	3	4	Total
A	0	1	4	7	15	27
B	0	0	2	5	9	16
C	0	0	0	2	9	11
D	0	0	0	2	2	4
Total	0	1	6	16	35	58
%	0%	1.7%	10.3%	27.6%	60.4%	

Diploid number of all specimens was 52.

Table II. Total number of large biarmed chromosomes in karyotypes of males (*Y* not included)

Locality	Number of large biarmed elements 0	1	2	3	Total
A	0	1	7	15	23
B	0	1	10	3	14
C	0	0	2	3	5
D	0	0	0	0	0
Total	0	2	19	21	42
%	0%	4.8%	45.2%	50%	

Diploid number of all specimens was 52.
(A) 1 mile southeast of Post, Garza Co., Texas; (B) 18 miles east of Brownsville, Cameron Co., Texas; (C) 6 miles south of Kermit, Winkler Co., Texas; (D) 16 miles north of Hollis, Harmon Co., Oklahoma.

In *Neotoma micropus* the pericentric inversion hypothesis becomes less attractive. Although one can always find a corresponding number of long acrocentrics in specimens with decreased numbers of large biarmed chromosomes, the lengths of these extra acrocentrics do not match that of the biarmed elements. Conversely, the acrocentrics did not correspond to a single arm of the biarmed elements. Possibly, both inversions and translocations were operative here. Another supposition is that the discrepancy in length is due to degree of contraction.

The Post population is separated from the Brownsville population by approximately 500 air miles, from the Harmon Co. population by 150 air miles, from the Kermit population by 150 air miles. Since polymorphism was found in all populations, it is not an isolated local phenomenon. The wide distribution of populations exhibiting this polymorphism suggest that there is natural selection favoring a polymorphic chromosomal system. The origin of such a system would of necessity be quite old to explain its wide distribution. Chromosomal polymorphism favored by natural selection has been described in white-throated sparrows[22].

Zusammenfassung. Die somatischen Chromosomen von 100 Ratten (Wildfänge), *Neotoma micropus* Baird (Cricetidae), zeigen ein nicht-Robertsonsches polymorphes System mit 2 verschiedenen homologen Chromosomenpaaren. Sie stellen 4 verschiedene Rattenpopulationen mit Polymorphismus dar.

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