Preferential transmission in wild common shrews (*Sorex araneus*), Heterozygous for Robertsonian rearrangements

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Summary

Data from foetal and weanling studies suggest that Oxford race metacentrics *kq* and *no*, but not *pr*, are transmitted preferentially from Robertsonian heterozygote common shrews collected from the Oxford area.These results suggest a possible mechanism for the maintenance of the Robertsonian polymorphism in that area.

In Robertsonian heterozygotes for a particular arm combinaton equal transmission of the metacentric chromosome and two homologous acrocentrics would be expected. However, data from man and mouse suggest that this is not necessarily the case. In man, Boué (1979) and Hamerton (1970) provide evidence from prenatal diagnosis and family studies, respectively, that there is preferential transmission in favour of the 13q14q Robertsonian metacentric over the acrocentric state in both male and female heterozygotes. By contrast, studies of spermatozoa from a 14q21q Robertsonian heterozygote man suggest preferential transmission in favour of the acrocentric chromosomes 14 and 21 (Balkan & Martin, 1983). In female laboratory mice there appears to be preferential transmission in favour of the acrocentric condition over a variety of feral-derived metacentrics (Gropp & Winking, 1981), while the Robertsonian metacentric (9·12) in female laboratory-bred, but feral-derived, Peruvian mice is apparently favoured over the acrocentric state (M. J. Harris, M. E. Wallace and E. P. Evans, personal communication).

This paper describes the relative transmission of metacentrics and two homologous acrocentrics from Robertsonian heterozygote common shrews (*Sorex araneus*) collected from nature. The Robertsonian heterozygotes were derived from the Oxford area where there is Robertsonian polymorphism for arm combinations *kq*, *no* and *pr* of the Oxford karyotypic race, *ko* of the Hermitage karyotypic race and *jl* found in both races (Searle, 1984*c*). (The chromosome nomenclature follows Halkka *et al.* 1974, with each chromosome arm designated by a letter of the alphabet, where *a* is the largest chromosome arm and *u* is the smallest.) The study involved the karyotypic analysis of foetuses from wild pregnant females (by the method described in Searle, 1984*a*) and young (at weaning) of wild individuals crossed in captivity (see Searle, 1984*b*). In the foetal studies, transmission was determined in those cases where, from the karyotypes of the foetuses and mother, it was possible to infer the karyotype of the father. It was assumed that the foetuses were the product of a single mating. None of the karyotypes of 107 foetuses from 15 pregnant females is incompatible with this assumption. Successful multiple matings in the common shrew appear unlikely given that males produce a solid copulatory plug (Brambell, 1935).

Adequate data for analysis were obtained for the three Oxford race arm combinations *kq*, *no* and *pr* (Table 1). The results for foetuses and weanlings did not differ significantly for any of the combinations, so these categories were combined. There were insufficient data to consider males and females separately. Overall, significantly more *kq* and *no* metacentrics were transmitted than expected by chance, while the metacentric *pr* was transmitted at a frequency close to expectation. This suggests preferential transmission in favour of the *kq* and *no* metacentrics. Clearly, further data are desirable to confirm this result. However, the concordance of the foetal and weanling data for both the arm combinations *no* and *pr* (there were very few weanling data for arm combination *kq*), strengthens the result. It would be particularly valuable to obtain adequate information on transmission from males and females separately. Given the differences in germ cell development between the sexes, one may expect differences in transmission.

These findings suggest a possible mechanism for the maintenance of the Oxford race arm combinations *kq*

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Table 1. *Transmission of metacentrics and the two homologous acrocentrics from Robertsonian heterozygotes*

Arm combination	Data source	No. available for karyotypic analysis[a]	Transmission frequency[b] Twin-acrocentric	metacentric	χ_1^2	P
kq	Foetuses	59 (2)	19	38	6·33	< 0·05
	Weanlings	12 (3)	5	4	0·11	n.s.
	Total	71 (5)	24	42	4·91	< 0·05
no	Foetuses	49 (2)	23	38	3·69	0·05–0·10
	Weanlings	17 (0)	4	13	4·76	< 0·05
	Total	64 (2)	27	51	7·38	< 0·01
pr	Foetuses	79 (2)	62	53	0·70	n.s.
	Weanlings	29 (1)	15	13	0·14	n.s.
	Total	108 (3)	77	66	0·85	n.s.

[a] Numbers in parentheses show where a karyotype was attempted but not obtained.
[b] When both mother and sire were Robertsonian heterozygotes, data on transmission could be obtained from both parents.

and *no* in the Oxford area. The frequency of the acrocentrics *k*,*n*,*o* and *q* in the area of hybridisation between the Oxford and Hermitage races (20–30 km south of Oxford) is very high and there is good reason to believe that these acrocentrics are favoured there (J. B. Searle, in preparation). However, the frequencies of the metacentrics *kq* and *no* increase rapidly north of the Oxford–Hermitage hybrid zone (J. B. Searle, in preparation). This suggests that the metacentrics *kq* and *no* are favoured away from the area of hybridisation and preferential transmission provides a possible selective force. The selective forces involved in the maintenance of the polymorphism of arm combination *pr* are different from those of *kq* and *no* (J. B. Searle, in preparation), so it is of interest that there is no suggestion of unequal transmission for this arm combination.

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