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Position of the translocation break *T(2; 9)138Ca* in linkage group IX of the mouse

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SUMMARY

The translocation break *T(2;9)138Ca* is located about three map units from the *H-2* region on the non-centromeric side of the IXth linkage group. The recombination frequency in the *T-H-2* interval is increased in the presence of the *T138* translocation to about twice its value in the absence of the translocation.

1. INTRODUCTION

The *H-2* system is one of the most studied loci in the mouse. It is located in the IXth linkage group (Gorer, Lyman & Snell, 1948), some 14 map units from the centromere (Klein, 1971). In the same linkage group are also genes *T(t)*, *qk*, *tf*, *Fu*, *Ki* and *Low* (see Green (1966), for references). All of these loci have been mapped on one side (the centromeric side) of the *H-2* complex. The only gene known to be located on the non-centromeric side of *H-2* is *Tla* (thymus leukemia antigen which determines the presence or absence of the TL antigen in the thymus and leukemias) (Boyse & Old, 1969). For genetic studies of the *H-2* complex requiring flanking markers on both sides of the complex, the *Tla* locus is of limited value. The main obstacle in its use as an *H-2* marker is that it interacts with *H-2* and influences the expression of the *H-2* antigens (Boyse & Old, 1969). Because of the absence of other suitable markers, we have investigated the possibility of marking the non-centromeric side of *H-2* with a translocation break. The translocation *T(2;9)138Ca* (= *T138*) seemed to be the best candidate for a suitable marker (Carter, Lyon & Phillips, 1955). The *T138* break maps to the right of tufted (*tf*), i.e. in the vicinity of *H-2*, and the translocation homozygotes are fully viable and fertile.

2. MATERIALS AND METHODS

To determine the position of the *T138* break relative to *H-2* the following three-point cross was performed:

$$T\,H\text{-}2^{q}\,T138/+H\text{-}2^{a}+\times+H\text{-}2^{b}+/+H\text{-}2^{b}+.$$

The $T\,H\text{-}2^{q}\,T138$ chromosome was derived from the original *T138* homozygous stock kindly made available to us by Dr Mary F. Lyon, M.R.C., Radiobiological Research Unit, Harwell, Didcot. The $+H\text{-}2^{a}+$ and $+H\text{-}2^{b}+$ chromosomes originated from strains B10.A and C57BL/10ScSn respectively. The *H-2* type of the *T138* stock is indistinguishable from the $H\text{-}2^{q}$ type of strain DBA/1 (Klein, Klein & Shreffler, 1970). The progeny of the three-point cross was scored for the length of the tail (*T*), tested serologically for the *H-2* type and diagnosed for translocation heterozygosity. In the serological tests, two antisera

were used: (A.BY × AKR.M)F_1 anti-A, and (B10 × LP.RIII)F_1 anti-B10.BR. The former is known to contain antibodies against antigen *H-2.4*; the latter antibodies against antigens *H-2.23* and *H-2.32*. Antigens *H-2.4* and *23* are determined by chromosome *H-2*^{a} but not by chromosome *H-2*^{b} or *H-2*^{q}. Translocation heterozygosity was diagnosed in males cytologically by the presence of multivalent figures at metaphase I, in females by semi-sterility test. Cytological preparations were made from the testes by an air-drying technique (Evans, Breckon & Ford, 1964). The semi-sterility test was based on autopsy of pregnant females (Carter, *et al.* 1955).

3. RESULTS

The observed recombination frequencies are summarized in Tables 1 and 2. The *T138* break maps on the opposite side of *H-2* relative to *T*, and thus marks the noncentromeric end of the *H-2* region. This conclusion is in agreement with previous observation (Klein,

Table 1. *Progeny of three-point cross*
TH-2^q T138/+H-2^q+ × +H-2^b+/+H-2^b+

Phenotypes of progeny	Heterozygous parent ♀	Heterozygous parent ♂	Phenotypes of progeny	Heterozygous parent ♀	Heterozygous parent ♂
TH-2^q T138	12	20	*TH-2^b*+	1	1
+*H-2^a*+	15	25	+*H-2^a T138*	0	2
TH-2^a+	8	7	*TH-2^a T138*	0	0
+*H-2^q T138*	6	9	+*H-2^q*+	1	1

Recombination (%) ± S.E.

	♀	♂	Total
TH-2	32·6 ± 7·1	24·6 ± 5·4	27·8 ± 4·3
H-2 T138	2·3 ± 2·2	4·6 ± 2·6	3·7 ± 2·0

Table 2. *Recombination between Brachyury* (T) *and* H-2 *among the progeny of* TH-2^q T138/+H-2^a+ × +H-2^b+/+H-2^b+ *cross*

Heterozygous parent	*TH-2^q*	+*H-2^a*	*TH-2^a*	+*H-2^q*	Recombination
♀	50	42	25	24	34·7 ± 3·9 %
♂	33	44	17	20	32·4 ± 4·3 %
Total	88	86	42	44	33·0 ± 2·8 %

Bednářová & Šrám, 1968; Klein, Klein & Shreffler, 1970) in which an intra-*H-2* recombinant was obtained from an identical cross as reported in the present communication.* The recombinant was of the following type: *TH-2K^{q}H-2D^d*+/+*H-2^b*+, which means that it received the *H-2K* end from *H-2^q* along with *T*, and the *H-2D* end from *H-2^a* along with the non-translocated chromosome. This is consistent with the order:†

T...H-2K...H-2D...T138....

This distance between *H-2* and *T138* break is about 3 map units.

* The work was initiated at the Institute of Experimental Biology and Genetics, Czechoslovak Academy of Sciences, Praha, Czechoslovakia. Due to unexpected events, it could not be finished and was started anew at The University of Michigan.

† In the preliminary communication (Klein, Bednářová & Šrám, 1968), the order was erroneonsly given as *T...H-2D...H-2K...T*138.

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4. DISCUSSION

The recombination frequency between *T* and *H-2* in this cross was about 30 %, which is twice as high as the recombination frequency observed in the absence of the *T138* translocation (Gorer *et al.* 1948). The enhancing effect of the *T138* translocation on recombination was first demonstrated by Lyon & Phillips (1959) for the *T-tf* interval. The effect apparently extends beyond the *tf* locus toward the *H-2* region. Whether it extends also beyond the *H-2* region in the *H-2–T138* interval cannot be determined from the present experiment. The mechanism of the enhancing effect is not known.

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