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SHORT PAPER
Map position of dysgenetic lens (*dyl*) locus on chromosome 4 in the mouse

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Summary

The autosomal recessive gene, dysgenetic lens (*dyl*) in the mouse has been mapped on chromosome 4. Two- and three-point crosses involving *b* (brown) and *Mup*-1 (Major urinary protein-1) indicate the following gene order: *dyl–b–Mup*-1. The approximate distance between *dyl* and *b* is 12 and between *dyl* and *Mup*-1 is 20 cM.

1. Introduction

Dysgenetic lens (*dyl*), a recently reported autosomal recessive gene in the mouse results in smaller eyes, corneal opacity, adhesion of the iris, cataractous degeneration and extrusion of the lens nucleus, following progressively after the failure of lens–ectoderm separation during embryonic development (Sanyal & Hawkins, 1979). The mutation arose spontaneously in mice of the strain BALB/cHeA, maintained in the Erasmus University, Rotterdam. Possible linkage with the brown (*b*) locus was indicated when crossings were made to transfer the mutant gene to another strain of mice. Systematic crossings were undertaken to test the linkage of the *dyl* locus with the *b*, and with the *Mup*-1 (Major urinary protein-1) locus. In this report, we show the location and map position of the *dyl* locus in chromosome 4.

2. Material and Methods

Mice from BALB/cHeA, C57BL/LiA and C3Hf-rd$^+$, a subline of C3HfHeA in which the *rd* (retinal degeneration gene has been substituted by the normal allele by repeated backcross (Sanyal & Bal, 1973), were used in this study. All animals were maintained by sib mating. After appropriate crossing each individual in a litter was screened for coat colour at the time of weaning. The phenotype with regard to the *dyl* gene was noted after examination with an ophthalmoscope or with a stereo dissecting binocular.

The *Mup*-1 phenotype was determined by the method of Wilcox (1975) after slight modification (Hilkens, unpublished). Samples of urine were collected from adult mice and stored frozen at −70 °C until use. The *Mup*-1 phenotype was determined by electrophoresis of the urine on cellogel (Chemetron, Milan) in T.E.B. buffer at pH 9·2. The electrophoresis was performed at 4 °C for one hour at a constant 300 V. After electrophoresis, the strips were immediately stained in Coomassie Brilliant Blue R250 (Merck). In BALB/c mice the codominant allele *Mup*-1^a determines the presence of a slow anodally migrating band, and in C57BL mice the allele *Mup*-1^b produces a faster migrating band. In the backcross population heterozygosity was detected by the presence of both bands.

Reciprocal crossings, using females and males of both genotypes, were made in all cases, but as there was no obvious difference between the two groups or between males and females, the linkage data have been presented together.

3. Results and Discussion

The *dyl* mutation occurred in the BALB/c mice. These animals are albino but carry the mutant allele *b* of the brown locus (chromosome 4) which produces a light brown colour in agouti *AA* or *Aa* mice. A programme was initiated to transfer the new mutation to the C3H line of mice which have wild-type dark brown colour (*BB*) through the cross–intercross method (Green, 1966). Segregation of the *dyl* and *b* phenotypes in the F_2 generation showed clear evidence of linkage Table 1).

Next, two series of experiments were undertaken. In one series (Table 2, I) brown mice with affected eyes (*bb dyldyl*) were recovered from the F_2 individuals mentioned above, and were mated to wild-type C3H mice (*BB*++). The resulting F_1 hybrids were backcrossed to mice of the mutant parental genotype

Table 1. *Segregation of dysgenetic lens* (dyl) *and brown* (b) *phenotypes in* F_2 *intercross of* F_1 cC bB dyl+ *heterozygotes derived from crossing of affected albino BALB/c and wild-type C3H mice*

	Number of progeny	
	dyldyl	*dyl*+ and ++
Albino (*cc*)	19 (5·2%)	64 (17·7%)
bb	47 (13·0%)	23 (6·4%)
bB or BB	19 (5·2%)	189 (52·4%)
Total	85 (23·5%)	276 (76·5%)

(BALB/c). In another series (Table 2, II), affected albino BALB/c mice (*cc bb dyldyl Mup*-1^{aa}) were mated to C57BL mice, and the resulting F_1 hybrids (*cC bB dyl*+ *Mup*-1^{ab}) were backcrossed to mice of the affected parental genotype (BALB/c). All offsprings from these two series were analysed for a two-point linkage test between *dyl* and *Mup*-1, and the coloured offsprings for linkage between *b* and *dyl*, and *b* and *Mup*-1, and also for a three-point linkage test between all three loci. Data from these tests and the recombination values are presented in Table 2. The absence of *dyl B Mup*-1^{aa} and +*b Mup*-1^{ab} individuals among the offspring clearly indicates that no double crossing over has occurred. Since the recombination values between the loci in the two series of experiments show some difference, the two groups of data have been treated together for linkage estimates according to the methods described by Green (1963). The results establish the following gene order: *dyl–b–Mup*-1, and the combined data show that the map distance between *dyl* and *b* is 11·7±1·1 and between *dyl* and *Mup*-1 19·7±3·0 cM.

Location of *dyl* in chromosome 4 thus provides evidence that the gene is not allelic to any of the located genes causing eye abnormalities in mice, since none of these has so far been listed in this chromosome or linkage group (*Mouse News Letter*, 1985).

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Table 2. *Results of two- and three-point linkage crosses with dysgenetic lens* (dyl), *brown*, (b), *and Major urinary protein 1* (Mup-1)

Experimental series	Site of recombination	Loci			Number of mice	% Recombination ±S.E.
		dyl	*b*	*Mup*-1		
I	None	*dyl*	*b*		256	
		+	*B*		274	
	dyl–b	+	*b*		49	12·3±1·3
		dyl	*B*		25	
II	None	*dyl*		*aa*	63	
		+		*ab*	84	
	dyl–Mup-1	+		*aa*	19	19·7±3·0
		dyl		*ab*	17	
II*	None	*dyl*	*b*	*aa*	32	
		+	*B*	*ab*	37	
	dyl–b	+	*b*	*aa*	3	7·3±3·3
		dyl	*B*	*ab*	3	
	b–Mup-1	*dyl*	*b*	*ab*	3	8·5±3·2
		+	*B*	*aa*	4	

* Taking the coloured offsprings only, excluding the albinos.

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