

5. A genetic factor which affects crossing over in chromosome 5.

In an effort to determine whether the mutant asynaptic affects crossing over when in heterozygous condition, F_1 plants of the cross $\underline{A}_2 \underline{Bt}_1 \underline{Pr} / \underline{A}_2 \underline{Bt}_1 \underline{Pr}; \underline{As}/\underline{as} \text{ } \overset{\circ}{\text{f}} \times \underline{a}_2 \underline{bt}_1 \underline{pr} / \underline{a}_2 \underline{bt}_1 \underline{pr}; \underline{As}/\underline{As} \text{ } \overset{\sigma}{\text{m}}$ were backcrossed as males and as females to $\underline{a}_2 \underline{bt}_1 \underline{pr}$ testers. Recombination values for the \underline{A}_2 - \underline{Bt}_1 and \underline{Bt}_1 - \underline{Pr} regions were calculated, those for the latter region being obtained by the method described in the above note on the action of elongate.

To ascertain their genotypes with respect to \underline{As} , the F_1 plants were also crossed as males to asynaptic testers which were either $\underline{As} \underline{as}$ or $\underline{as} \underline{as}$. Progenies of these crosses were planted in the field and scored for the presence of $\underline{as} \underline{as}$ plants by examining the tassels and the open-pollinated ears. If a progeny contained several asynaptic plants, its male parent was classified as being $\underline{As} \underline{as}$; where all the plants had a normal, \underline{As} phenotype, the male parent was considered to be $\underline{As} \underline{As}$, provided the progeny was of a sufficient size. Most of the progenies were large enough so that the probability of error in classifying an F_1 plant as $\underline{As} \underline{As}$ is less than 0.1% and in none of the cases reported in Table 1 is the level of probability greater than 0.5%.

The two sets of data on each line of the table refer to the same plant, used as a female on the left and as a male on the right hand side. The mean recombination values for $\underline{As} \underline{as}$ plants are lower than those for their $\underline{As} \underline{As}$ sibs and the decrease percentage-wise is more striking in the females than in the males. The distribution pattern of the female total recombination percentages (column no. 5) also appears to be unimodal for the $\underline{As} \underline{As}$ group and bimodal for the $\underline{As} \underline{as}$ group. However, these distributions could be distorted and may not accurately reflect the corresponding characteristics of the populations due to the small sample sizes of 11 and 18 plants, respectively. Additional data, obtained by planting more F_1 seed from the original ear and repeating the backcrosses on a larger scale, should give a clearer picture of the two distributions.

The lower recombination in the $\underline{As} \underline{as}$ plants could be due to:

1. A factor segregating independently of \underline{as} .

Table 1
Comparison of recombination in As As and As as sibs.

Geno- type	F ₁ plants used as ♀♀				F ₁ plants used as ♂♂			
	No. of progeny	% Recombination			No. of progeny	% Recombination		
		<u>A-Bt</u>	<u>Bt-Pr</u>	Total		<u>A-Bt</u>	<u>Bt-Pr</u>	Total
<u>As As</u>	423	3.5	13.9	17.4	561	8.9	28.4	37.3
	435	3.9	14.6	18.5	310	26.5	30.5	57.0
	383	4.7	16.2	20.9	263	18.3	44.1	62.4
	374	5.9	18.6	24.5	522	19.3	27.6	46.9
	430	6.0	19.2	25.2	376	13.6	40.6	54.2
	432	8.1	18.6	26.7	598	20.9	36.4	57.3
	462	5.8	21.2	27.0	541	11.1	33.4	44.5
	402	9.2	19.4	28.6	605	25.5	40.2	65.7
	444	4.7	24.4	29.1	758	14.2	26.7	40.9
	476	5.5	24.0	29.5	668	19.8	35.3	55.1
	391	6.4	27.6	34.0	334	18.3	32.3	50.6
Wt. mean		5.8	19.9	25.7		17.6	33.6	51.2
<u>As as</u>	198	1.5	4.7	6.2	568	11.4	27.9	39.3
	350	1.4	8.0	9.4	212	8.5	26.5	35.0
	237	0.8	9.7	10.5	430	5.8	18.3	24.1
	252	0.4	10.5	10.9	622	11.6	28.8	40.4
	460	1.1	10.0	11.1	529	6.4	17.1	23.5
	415	2.4	8.9	11.3	732	15.4	28.9	44.3
	343	1.2	10.3	11.5	449	9.8	33.0	42.8
	463	1.7	10.4	12.1	356	12.9	29.9	42.8
	330	2.1	10.2	12.3	464	11.9	19.5	31.4
	354	2.8	12.0	14.8	543	15.7	31.1	46.8
	507	2.0	13.2	15.2	635	8.7	26.6	35.3
	336	1.2	14.3	15.5	550	20.7	31.6	52.3
	389	3.6	16.7	20.3	289	9.7	25.3	35.0
	484	2.7	18.6	21.3	246	15.0	36.9	51.9
	230	4.8	16.8	21.6	192	10.4	17.1	27.5
	459	3.3	19.6	22.9	640	14.8	29.7	44.5
	446	2.7	20.7	23.4	507	19.3	31.4	50.7
	311	4.8	20.6	25.4	470	16.0	28.2	44.2
					550	20.7	31.6	52.3
Wt. mean		2.3	13.4	15.7		12.9	27.6	40.5

2. A factor linked to as.
3. The asynaptic gene itself.

Recombination between as and a linked or independently segregating factor in the original As as parent would be expected to cause some of the A₂-Bt₁-Pr values in the As As class to be low and some of those in the As as class to be high. On the female side, where the differences in recombination are most pronounced, the six to eight As as plants with the highest total values might be interpreted as being recombinants. In the As As group, however, there is no clear indication of any of the reciprocal recombinants being present. The lowest two values are well above the mean of the would-be nonrecombinant class in the As as group. There is even less evidence of a reciprocal recombinant class when considering the following values for six plants which have a high probability of being As As but were not included in the table because the chances of error in classifying them as As As were slightly higher than the 0.5% limit used: 19.3, 23.0, 24.7, 24.8, 27.5 and 29.9.

Taken together, the available data thus give a strong indication that the factor causing reduced recombination in the A₂-Bt₁-Pr region of chromosome 5 is either linked to as on chromosome 1 or that it is as itself.

There are two additional observations in respect of the As as plants used as females that are at present still unexplained. In the first place, the range in progeny sizes is greater than that of their As As sibs and the mean number of kernels is lower, viz. 365 and 423 respectively. Secondly, there is an excess of the A₂ Bt₁ progeny class over the a₂ bt₁ class and this can be traced to about half of the first 12 As as plants listed in the table.

A similar experiment in which chromosome 3 was marked by Gl₆, Lg₂, and A₁ revealed little or no difference in recombination between As As and As as classes.

Paul M. Nel