3. The effect of a mutability factor on crossing over in an adjacent region.

McClintock has reported an effect of a mutability factor (Ds) on crossing over in 9S. In spreading effect cases in which both Sh_1 and Bz were inhibited by the mutability factor, crossing over within this region was not detected. In addition the segments on either side of the inhibited region exhibited a recombination rate which was normal in some cases and increased in others.

The following experiment deals with a mutability factor M, which is present at the A_1 locus and which might exert an effect on crossing over in the A_1-Sh_2 region. The control stocks contain a variety of alleles at A_1 and are derived from different genetic backgrounds. They are similar, however, in that none contain known mutability factors. The experimental stocks were all derived from a highly inbred strain containing the allele $a_1{}^{P}{}_{m}$. Thus, if genetic variability is a cause of varying recombination rates, these differences should be the more evident in the control. A mutability factor, M, is present at the A_1 locus in the parental stock and it persists in various states of inhibition and mutability at the locus in the derived stocks. This is demonstrated when the derived alleles revert, as they occasionally do, to the original $a_1{}^{P}{}_{m}$ condition.

Since crossing over within the A_1-Sh_2 region is low, a large total number of gametes has been scored, yet the number of recombinant gametes remains small. Thus, instances producing gametes which might be mistaken for crossover gametes should be taken into account. This mistake could be made if the A_1 allele in the A_1Sh_2 gamete mutated to the colorless level giving an a_1Sh_2 gamete. This mutation rate among the control stocks which contain stable alleles is negligible, and could not be an important factor in altering the control recombination rate. However, the experimental alleles were derived from a mutable locus, and although the alleles are true breeding, they are not always stable. Consequently, this mutation rate should be considered when the recombination rate is computed and a corrected rate should be given. Cases in which mutations of this type are occurring may be indicated by an unbalance in the two recombinant classes in favor of the a_1Sh_2 class, which resembles the mutant gametes. In the data given the numbers are so small that this unbalance could easily be accounted for merely on a chance basis. However, it is not believed to be a coincidence that all three alleles which show measurable mutation rates have an excess of the a_1Sh_2 recombinant class over the A_1sh_2 class. Table 1 shows recombination, mutation, and corrected recombination rates for these control and experimental stocks.

Table 1. Crossing over within the a_1-sh_2 region in stocks carrying various A_1 alleles.

		Recombination Rate			
		Total Gametes	Recombinant Gametes		Percentage of Recombination
Allele	Origin	Scored	A sh_2	a Sh_2	
A	A-standard	4,495	4	5	.200
A	A-standard (repulsion)	13,079	17(A Sh_2)	8(a sh_2)	.191

A^b	A^b: Ecuador	4,937	3	4	.142
$A^{d\text{-}st}$	A^b: Ecuador by crossing-over	8,770	4	12	.182
$A^{d\text{-}6}$	A^b: Ecuador by crossing-over	6,625	5	6	.166
Control value for stable alleles		37,906		68	.179
A^R	From $a^p{}_m$ - mutation to true breeding alleles	4,030	2	4	.149
A_1	"	3,772	0	2	.053*
A_2	"	4770	6	5	.273*
A_4	"	3,761	8	7	.398*
$a^p{}_1$	"	8,547	3	3	.058*
$a^p{}_2$	"	9,001	18	16	.378*
$a^p{}_3$	"	13,900	9	22	.223
$a^p{}_4$	"	12,720	10	14	.189
$a^{PL}{}_{14}$	"	3,110	0	5	.161

	Mutation Rate			
Allele	Total Gametes Scored	Mutant Gametes (to the recessive a_1 allele)	Percentage of Mutation	Corrected Recombination Rate (Percentage)
A	---	---	---	---
A	---	---	---	---
Ab	---	---	---	---
$A^{d\text{-}st}$	---	---	---	---
$A^{d\text{-}6}$	---	---	---	---
A^R	14,469	7	.048	.101
A_1	20,226	5	.025	.028*
A_2	4,007	0	.000	.273*
A_4	---	---	---	---
$a^p{}_1$	15,771	0	.000	.058*
$a^p{}_2$	2,096	0	.000	.378*
$a^p{}_3$	6,261	0	.000	.223
$a^p{}_4$	10,441	7	.067	.122
$a^{PL}{}_{14}$	---	---	---	---

*Significantly different from the control value at the .001 level.

The data illustrate that over half of the stocks carrying derived alleles show recombination rates which are different from the control values at the .001 level of significance. Both decreases and increases in the rate of recombination are indicated and these are not correlated with the deep or pale level of the particular A_1 allele.