Another consequence of the "orientation hypothesis" is that no difference should be found in crossing over in the male and female gametes of elongate plants. The female values are based on diploid eggs while the male values come from haploid gametes. It might be argued that comparisons should not be made between two populations originating by different meiotic mechanisms. However, Rhoades and Dempsey (1966) found no difference in Lg-A_1 or Sh-Wx crossover frequencies in the haploid and diploid eggs from the same ear. Thus, a comparison of recombination in diploid eggs and haploid sperm of the same plant should also be legitimate.

The data show that neither of the above expectations is fulfilled. Recombination in elongate megasporocytes is not significantly higher than that found in haploid eggs from El el megasporocytes and is markedly lower than the value observed in El el microsporocytes. Moreover, the amount of recombination in diploid eggs from el el plants is much less than the value obtained from haploid male elongate gametes.

The significant differences between male and female recombination values in both El el and el el plants eliminate the hypothesis involving selective orientation. It may be concluded that the amount of recombination in the A_2-Bt region of chromosome 5 is intrinsically higher in male than in female meiocytes.

It may be noted that recombination in the haploid gametes of elongate microsporocytes is higher than in those of El el sibs. This is in agreement with the report last year (MNL 44:61-65) that crossing over is increased in elongate homozygotes.

P. M. Nel

2. Mechanism of diploid egg formation in elongate homozygotes.

Rhoades and Dempsey (Genetics 54: 502-522, 1966) were able to rule out somatic doubling of the genome in sporogenous cells and doubling in the gametophytic generation as mechanisms by which the unreduced eggs of elongate plants could arise. The remaining alternatives were: (1) suppression of the first meiotic division followed by a normal second division, (2) a normal first division with omission of the second, and (3) a normal first division with chromosomal replication occurring during interphase, followed by the second meiotic division. On the basis of genetic studies with a number of loci on chromosomes 2, 3 and 9, they concluded that their data were best explained by hypothesis 2 or 3. Both hypotheses have similar expectations in progeny tests, but second division omission was preferred since it is the simpler of the two.

The chromosome 5 backcrosses described in the preceding report permitted a more precise determination of the origin of diploid eggs because Bt is more proximally situated than the markers previously employed. The genotypic constitution of unreduced eggs produced by four F_1 plants is given below.

	Diploid egg genotype								Total
	A Bt / A Bt	a bt / a bt	A Bt / a bt	A Bt / A bt	a Bt / a bt	A Bt / a Bt	A bt / a bt	A bt / a Bt	
Uncorrected frequencies									
No. of eggs	112	136	72	7	6	48	42	2	425
Percentage	26.4	32.0	16.9	1.6	1.4	11.3	9.9	0.5	100.0
Corrected frequencies									
No. of eggs	159.3	136.3	103.7	9.1	12.0	62.8	56.7	2.6	542.5
Percentage	29.4	25.1	19.1	1.7	2.2	11.6	10.4	0.5	100.0

When no exchanges occur between a locus and its centromere, the diploid eggs from a heterozygous plant would be expected to show 0% or 50% homozygosity for the recessive allele depending on whether the first or second meiotic divisions, respectively, are omitted. With 100% single exchanges, the corresponding values are 25% and 0% (Rhoades and Dempsey 1966).

The corrected data in the table give 41% Bt Bt, 35.5% bt bt, and 23.5% Bt bt eggs. The high frequencies of the homozygous Bt Bt and bt bt classes are at variance with the hypothesis postulating suppression of the first meiotic division. However, difficulties also arise if the results are interpreted on the basis of second division failure. On this hypothesis, the 23.5% Bt bt eggs would be ascribed to exchanges between Bt and the centromere. For short regions the frequency of recombination between a locus and the centromere is 50 minus the percentage of the homozygous recessive class (Rhoades and Dempsey 1966). Thus, a map distance of 50.0 - 35.5 = 14.5 units (or 8.1 for the uncorrected data) would be obtained between Bt in the long arm and the centromere. The close linkage (1 map unit) of Bt with Bm in the short arm makes this highly improbable. Moreover, most or all of the exchanges between A_2 and Bt (cf. the preceding report) would have occurred between the Bt locus and the centromere, which is very unlikely.

Secondly, with omission of the second division, the genotypes A_2 Bt / a_2 bt and A_2 bt / a_2 Bt must involve double exchanges in the A_2-centromere and centromere-Bt regions. In view of the small amount of recombination between A_2 and Bt (12.6%-13.4%), double exchanges should be rare, and yet nearly one-fifth (19.1%) of the diploid eggs are A_2 Bt / a_2 bt. This genotype could be derived from two-strand and one-half of the three-strand double crossovers, while the A_2 bt / a_2 Bt eggs would come from four-strand and one-half of the three-strand doubles in the same regions. Since the A_2 bt / a_2 Bt class represents only 0.5% of the diploid eggs, there would have to be a very great excess of two-strand double exchanges. The high frequency of eggs heterozygous for Bt cannot be accounted for by omission of the second meiotic division.

If eggs classified as A_2 Bt / a_2 bt were in fact A_2 Bt / -- monosomics in which an A_2 Bt chromatid had been lost during meiosis, the resulting A_2 Bt / a_2 bt / a_2 bt plants would have been aneuploid instead of full tetraploids and these would have given the 1:1 segregation ratios for both pairs of alleles on which the genotype determinations were based. However, it is unlikely that this was the case. Among 12 progeny of an F_1 plant which were examined cytologically and used in the second backcross, only one had less than 40 chromosomes and the deficient chromosome could have been any one of the 10 chromosomes of the complement.

It is therefore proposed that diploid eggs are produced by the suppression of the first meiotic division in some cells and by omission of the second division in other meiocytes of the same ear. This hypothesis is supported by the close correlation between the observed distribution of A_2 genotypes within the Bt Bt, bt bt, and Bt bt classes and that expected on the basis of the known amount of recombination between A_2 and Bt. For example, if there is no crossing over between Bt and the centromere and if the Bt bt eggs come from first division elimination, the proportion expected to be homozygous at the A_2 locus is 13.4% on the basis of recombination between A_2 and Bt (corrected data) and 12.6% on the basis of the uncorrected crossover value. These percentages are in fair agreement with the frequencies of 16.6% and 14.9% derived from the corrected and uncorrected arrays of diploid eggs, respectively.

Similarly, if the Bt Bt and bt bt eggs arise through the omission of the second meiotic division, the expected proportions of homozygotes (A_2 A_2 + a_2 a_2) are 73.2% and 74.8%, depending on whether the corrected or uncorrected recombination values are used. The actual frequencies are in close agreement, namely 71.2% for the corrected and 73.4% for the uncorrected data. The small discrepancies can be attributed to a low frequency of crossing over between Bt and the centromere, and to sampling errors.

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1. Studies of inbreeding in autotetraploid maize.

The inbreeding influence on depression characteristics was studied for the five characters: yield (in centner per hectare), plant height, number of tassel branches, leaf area of an ear and ear length in progenies from successive selfing based on the diploid synthetic population Krasnodarskaya 1/49 and the tetraploid population Synthetic B developed by D. Alexander.

The seeds from each selfed ear were sown in 5 m^2 one-row plots in four replications: P; I_1; I_2; I_3; I_4; I_4; I_3; I_2; I_1; P and so on.