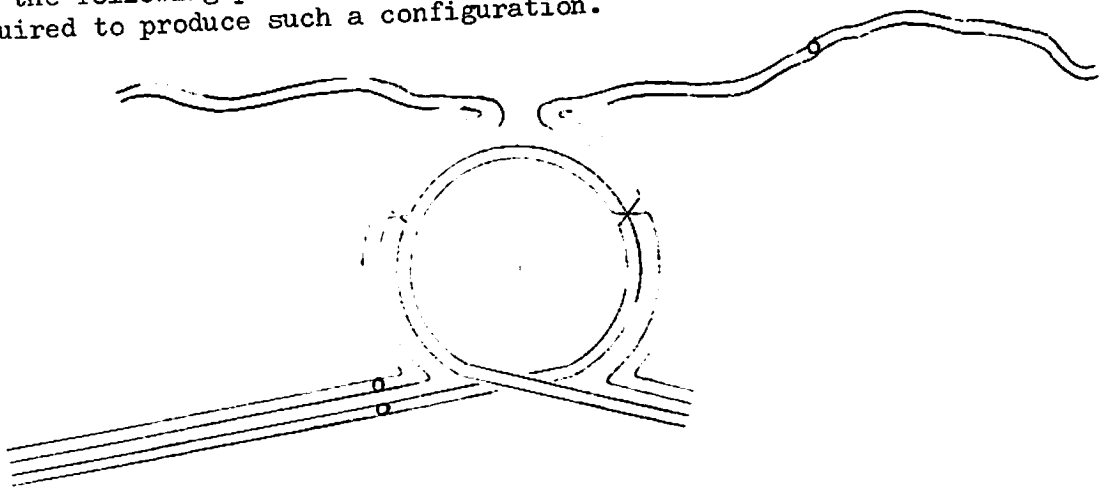
Differences in the values observed in the two classes of offspring were not statistically significant. Since both extra chromosomes should be found as univalents in essentially 100 per cent of the cells, this is a very sensitive test. The results are in agreement with the previous studies by this author, and favor the conclusion that distributive pairing does not occur in Zea mays.

David Weber

3. Evidence that recombination can involve both chromatids of one chromosome with chromatids of two differing chromosomes.

A very interesting configuration was observed in 2N+4+1B, In4a/N/N plants at anaphase I. Two cells were seen in which 3 chromosomes were joined by 2 bridges and 2 acentric fragments were released. The fragments were clearly smaller than B univalent chromosomes, and could not have been mistaken for them. Unless one hypothesizes chromosome breakage and reunion, the following pairing configuration and crossover positions would be required to produce such a configuration.



This exceptional anaphase demonstrates that recombination occurs at the four-strand stage (as earlier shown by single bridges and fragments in diploid plants containing a heterozygous paracentric inversion). It also shows that recombination can involve both chromatids of one chromosome with chromatids of two different chromosomes. Genetic evidence for the latter point comes from triploid Drosophila, but the author is unaware of any similar cytological demonstration of this point.

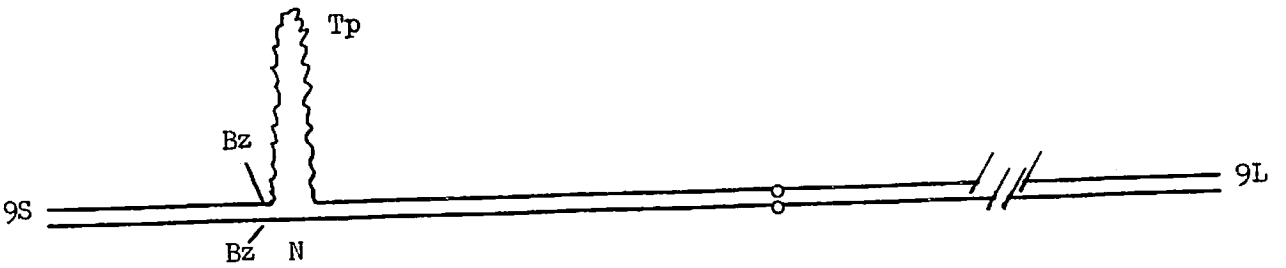
David Weber

4. On nonhomologous recombination.

The present study was initiated because a genetic system in Zea mays was available in which a well-marked segment was frequently involved in nonhomologous pairing and in which an efficient test for recombination between nonhomologous segments could be made. Nonhomologous recombination is defined as recombination between dissimilar nucleotide sequences.

Frances Clark Beard isolated a transposition from 3S into 9L. The transposed segment is about 1/4 the length of 9S. The cytogenetic behavior of

this transposition has been intensively studied by Rhoades. The insertion point of the transposed segment in 9S is just proximal to the Bz locus, thus the following pairing configuration is expected in plants heterozygous for the transposition (Tp9/N9):



However, when pachytene in Tp9/N9 plants was examined, the buckle caused by the transposition was not found in a constant position, but the buckle could occur at essentially any position in 9S. In many meiocytes, no buckle was seen since the loop was completely contracted. This pairing behavior has been confirmed by the author. The variable position of the buckle indicates that extensive nonhomologous pairing has taken place. One of the known configurations resulting from nonhomologous pairing is diagrammed below:

If illegitimate recombination took place between the nonhomologously synapsed segments as indicated above, one of the crossover products would contain a deficiency for the Bz locus, and the other, a duplication. Thus, if these plants were crossed by a bz tester, the deficiencies caused by the exceptional nonhomologous recombinational event should be detected as bronze kernels on otherwise purple ears.

The following cross was made:

$$\frac{Bz\ Tp}{Bz\ N} \quad X \quad \frac{bz\ N}{bz\ N}$$

No bronze kernels were obtained in a population of 327,000 kernels; thus nonhomologous recombination was not detected. Since one spontaneous mutation might be expected in a population of this size or larger, there would be little gained by a more extensive test.

Although the Bz data give no evidence for nonhomologous recombination, it is possible that such crossovers were present in the megaspore population

and that the deficiencies thus produced led to inviability of the female gametophyte. Data are available which indicate that such deficiencies are transmissible through the female gametes. These data will be presented in the 1968 News Letter.

Although deficiencies are transmitted much more readily through female than male gametes in plants, the reciprocal cross using a Tp9/N9 male parent was made to test the unlikely possibility that nonhomologous recombination is confined to microsporogenesis. From a population of 76,150 seeds, 9 bz kernels were obtained. Three of these seeds did not germinate. The remaining ones were all Bz/bz, therefore the phenotype expressed in the endosperm was not the same as that in the embryo, and loss of the Bz locus had occurred only in the endosperm. Therefore these were caused by a post meiotic event, and not by nonhomologous recombination during meiosis.

The Yg_2, Wx, and V_1 loci were examined in a similar manner. The results from all crosses are summarized in the following table:

Table 1

Tests for Nonhomologous Recombination in 9S

Maternal parent	Paternal parent	Population studied	Verified cases of nonhomologous recombination
Bz Tp/Bz N	bz N/bz N	327,000	0
bz N/bz N	Bz Tp/Bz N	76,150	0
yg N/yg N	Yg Tp/Yg N	10,180	0
Tp Wx/N Wx	N wx/N wx	14,472	0
Tp V/N V	N v/N v	22,300	0
N v/N v	Tp V/N V	25,220	0
Total		475,322	0

Deficiencies for the Yg locus have been shown by McClintock to be fully transmissible through the pollen side of plants; however, information on the other loci is not available. No cases were found where the recessive phenotype could be attributed to nonhomologous recombination between nonhomologously synapsed chromosomes. Since nonhomologous pairing in 9S is frequent in Tp9/N9 plants and since inviability of deficient gametes was ruled out for the Bz and Yg loci, it must be concluded that nonhomologous recombination does not occur in this material.

David Weber