Addendum:

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1. Further tests of distributive pairing in 2N+2 *Zea mays*.

A. Univalent frequencies in 2N+1 plants.
Anaphase I data from 2N+2 plants (plants containing two chromosomes in addition to the diploid complement) were reported by the author in the 1966 News Letter. The two extra chromosomes were found to go to the same pole as frequently as to opposite ones at anaphase I; therefore distributive pairing was not detected in these plants. Data are now available on the univalent frequencies in very closely related plants containing one extra chromosome. The data are presented in Table 1.

The frequency of cells containing univalents at diakinesis in 2N+1B, In4a/N and 2N+4, In4a/N/N plants was found to be 100 and 32.7 per cent respectively. The product of these two values (32.7 per cent) is the expected frequency of cells containing a univalent B and a univalent chromosome 4. In the remaining cells (67.3 per cent) the two additional chromosomes would be expected to disjoin independently giving equal numbers of 11-11 and 10-12 disjunctions. Thus, one-half of 67.3 per cent, or 33.65 per cent of the cells should be included in each class (11-11 and 10-12). If distributive pairing were 100 per cent efficient in maize, 66.35 % (32.7% + 33.65%) of the cells should have had 11-11 disjunctions, and 33.65% should have had 10-12 disjunctions. This obviously was not the case. It was calculated that the results were significantly different from those expected if efficiency of pairing were 50 per cent or greater.

B. Diakinesis in 2N+2 plants.
In order to determine whether two heterologous univalents would pair at diakinesis, plants containing two extra nonhomologous chromosomes were examined cytologically. The results are presented in Table 2. If distributive pairing occurred prior to diakinesis, one would expect to find association of the heterologous univalents as a pair at diakinesis in cells where neither extra chromosome was involved in a trivalent configuration. This obviously is not the case, for no cells were found which clearly contained 11 bivalents at this stage. Therefore, distributive pairing does not occur before diakinesis in these plants.

2N + 4 + 1B, In 4a/N/N plants in Table 2 were slightly different in origin from the plants reported in the 1966 News Letter, and for this reason, their univalent frequencies are not directly comparable.

C. Metaphase I studies.
In the stocks used, the chromosomes at metaphase I were not well separated on the equatorial plate. As a result, it was not possible to score positively the number of bivalents, trivalents, and univalents in many of the cells. However, when 2N+4+1B, In 4a/N/N plants were analyzed at metaphase I, one or more univalents were seen in essentially all of the cells. Therefore, nonhomologous univalents were rarely, if ever, associated at metaphase I. One cell was scored as having 11 bivalents, but the

Table 1

Frequency of trivalent and bivalent-univalent configurations at diakinesis in 2N+1 plants

Chromosome constitution	Number of plants	No. of cells with 10 bivalents, 1 univalent	No. of cells with 9 bivalents 1 trivalent	Total	% of cells with 10 bivalents, 1 univalent
2N+1B, In4a/N	1	176	1 questionable cell	177	99.4%
2N+4, In4a/N/N	4*	338	695	1033	32.72%
2N+6, In4a/N	4**	208	845	1053	19.75%

*Heterogeneity $X^2 = 0.72$ $.9 > P > .8$ DF = 3

**Heterogeneity $X^2 = 1.92$ $.7 > P > .5$ DF = 3

Table 2

Frequency of different pairing configurations at diakinesis in 2N+2 plants

Chromosome constitution	Number of plants	No. of cells with 11 bivalents	10 bivalents 2 univalents	9 bivalents 1 trivalent 1 univalent	8 bivalents 2 trivalents	Total
2N+4+6, In4a/N/N	1	1 questionable cell	12	68	94	175
2N+4+1B, In4a/N/N	3	0	77	274	0	315

Table 3

Frequency of different pairing configurations at metaphase I in 2N+4+1B, In4a/N/N plants

No. of plants	No. of cells with 11 bivalents	10 bivalents 2 univalents	9 bivalents 1 trivalent 1 univalent	1 univalent, otherwise unscorable	no univalent seen otherwise unscore-able	Total
3	1 questionable cell	144	110	403	14	672

classification was uncertain since it was of poor quality. The data are presented in Table 3.

Clearly, distributive pairing does not occur in these plants or it occurs with a very low frequency which is far lower than that found by Grell. These results are not compatible with those obtained by Michel (1966 News Letter and unpublished thesis). The reason is not known.

David Weber

2. Studies of the distribution of unpaired chromosomes in the progeny of plants hyperploid for a B and a ring chromosome.

An independent test of the distributive pairing hypothesis involved a study of the distribution of chromosomes in the progeny of plants containing two unpaired chromosomes. The two extra chromosomes were the B chromosome and the Wd ring.

Neither the B nor the ring chromosome affects the viability of the gametophyte or decreases the vigor of the sporophyte. Since both are found as univalents in essentially 100 per cent of the cells at diakinesis, the hyperploid plants provide an extremely efficient system for testing the distributive pairing hypothesis. The ring was detected genetically, and the B, cytologically (in root tip preparations).

Transmission of the ring is variable since it may be lost or structurally modified in somatic cells. Therefore, sectors may occur which contain no ring. Since ears often contain one or more ring-deficient sectors, absolute transmission frequencies of the ring in plants with and without one B chromosome are meaningless. B chromosomes, on the other hand, are not lost from somatic cells; their transmission is regular. Plants containing one Wd ring and one B were backcrossed as female parents to diploid plants.

If the ring and B chromosome pair and disjoin by distributive pairing, the frequency of B chromosomes would be much lower in the progeny with the ring than in plants without the ring. On the other hand, if the two chromosomes behaved independently, the frequency of B's should be the same in both classes.

The frequencies of B chromosomes in sibling plants with and without one ring chromosome are presented in the following table:

Frequency of B chromosomes in ring-containing and ring-deficient offspring from crosses of female parents possessing the Wd ring and a B chromosome by diploid males (pooled data from 2 plants)

Seed constitution	2 B's	1 B	0 B	Total	Per cent plants with 1 B chromosome
no ring	0	39	37	76	51.3%
ring present	1#	34	37	71 + 1#	48.6%
Total	1#	73	74	147 + 1#	

X^2 value between ring-containing and ringless plants + .330, .5>P>.3, DF = 1

#This plant is not included in the totals and calculations since its origin is uncertain.