parisons, types of crosses to use. It should be possible to compare the effects of various groupings of the multiple factors responsible for a given character, by using rings of 6 or rings of 8 made up in various chromosome combinations.

Crossovers were selected which should produce the following rings of 6: 2-9-10, 3-9-5, 3-9-10, 6-5-8 and 7-5-9, and 2-5-6.

-- C. R. Burnham,

<div style="text-align:right">

Assisted by Dr. P. Yagyu
O. L. Miller
K. Kasha
K. K. Batra
D. S. Borgaonkar*
</div>

* Present address: Stillwater, Oklahoma

4. Studies of chromosome pairing in maize by using interchanges involving the same two chromosomes.

Interchanges between chomosome 2 and 6, 3 and 6, and 6 and 9 were used. Four intercrosses belonged to type 1a (breaks in both chromosomes in opposite arms), eight to type 1b (breaks in one chromosome in opposite arms and in the same arm in the other chromosome), and five to type 2 (the breaks in both chromosomes in the same arm).

At pachytene in type 1a and type 2 intercrosses, homologous end segments of the chromosomes usually showed complete homologous pairing whether in an association of four chromosomes or in "pairs." The intercalary segments showed extensive non-homologous association or asynapsis. Likewise in type 1b intercrosses, the ends were associated in the ⊙ 4 configurations. In none did the centromeres play a significant role in the initiation of pairing. Usually in these intercrosses pairing begins at the ends, although it may start occasionally at other points. Genetic linkage tests and microspore quartet analyses show reduced or no crossing over in regions showing asynapsis or non-homologous pairing. Unusually high frequencies of adjacent-2 segregation from the associations of four chromosomes were found in two type 1a intercrosses. It is difficult to account for these values. In type 1a intercrosses, a new viable set of chromosomes should arise by simultaneous crossing-over in the two 'between-breaks' segments in the complex of four chromosomes. In this set the centromere-bearing 'between breaks' segments of the two non-homologues would have exchanged positions.

The diakinesis configurations observed in the three types of intercrosses may be summarized as follows:

Type of intercross	No. of crosses	Av. % Assoc. of 4	% of "pairs"	Range in % of "pairs"
Type 1a (see paragraph 1)	3	32.6	67.4	55.9-75.9
Type 1a	1	100.0	0	
Type 1b (see paragraph 1)	5	98.3	1.7	0.0-6.6
Type 2 (see paragraph 1)	8	10.0	90.0	73.0-100.0

In type 1b intercrosses "pairs" were rarely observed. In the exceptional type 1a intercross that showed no pairs one break in one parental interchange was in the satellite, and hence it regularly forms chains when heterozygous.

Those with the highest percentages of "pairs" are group 2 in which both breaks in both chromosomes are in the same arm. In those with the breaks in both chromosomes in opposite arms, the percentage of pairs is intermediate. There is some overlapping between type 1a and type 2. These results indicate that high frequencies of "pairs" do not necessarily indicate that both breaks are in the same arm in both chromosomes, an assumption that has been made by Hagberg (Der Zuchter 28:32-36, 1958) in barley interchanges.

-- M. Tabata

5. Cytological studies of asynaptic maize.

Rhoades and Dempsey (MNL 23) reported higher than normal single crossovers and much greater than normal double crossovers in the c-sh- wx and ws-lg-gl regions in both diploid and haploid eggs of asynaptic maize. Dempsey (MNL 33) later showed that on a basis of total ovules rather than seed set single crossovers in the same two regions are reduced in haploid gametes to about half the normal value but that double crossovers still remain higher in asynaptic plants. The increase in crossing over when based on number of seed set was interpreted as due to functional gametes being derived primarily from EMC's with more frequent chiasmata and therefore more regular chromosome behavior than occurred in aborting gametes. It should be pointed out, however, that if similar increases could be demonstrated for all genetic regions of maize chromosomes, EMC's giving rise to functional gametes in asynaptic plants would have had a higher chiasma frequency per EMC than occurs in normal maize, an event which would be highly unlikely in view of the chiasma frequencies demonstrated in as plants even if the counts are limited to cells with 10 bivalents present at MI. Although diploid as eggs containing crossover chromatids at first were presumed to come from EMC's with few or no chiasmata (Rhoades, Genetics 32), Dempsey (MNL 32) has presented evidence that such eggs contain both sister and non-sister centromeres and suggested that diploid gametes might arise by precocious dyad centromere separation and failure of Div II following a Div I in which both bivalents and univalents had divided. The studies reported here have been confined to microsporogenesis and pollen formation but are considered pertinent with respect to crossing over and the possible origin of diploid gametes in as plants.

(1) Origin of diploid gametes. Fourteen asynaptic plants were examined from diakinesis through the quartet or 1st microspore mitosis stage. Mean number of bivalents at MI ranged from 0 to 9.95 in separate plants. Pre-meiotic fusion giving rise to polyploid PMC's occurred in six plants with 1% the highest frequency and 8N the highest ploidy observed. Although cells resulting from premeiotic fusion were observed at all meiotic stages, the infrequent occurrence in as plants and the absence of fusion in cytological studies of megasporogenesis in asynaptic mutants of certain other species would seem to rule out syncytes as a source of diploid gametes. Extremely long and curved spindles and infrequently split spindles were observed in many of the plants at MI and AI. In no instance, however, was nuclear restitution observed due to failure of spindle formation or complete failure of chromosome movement toward the poles. Precocious separation of the centromeres of chromosome dyads was noted at AI in only one plant. However, Div II spindles and quartet formation were normal although unequal distribution of monads usually occurred. Complete or partial failure of cytokinesis frequently took place after Div II and less often following Div I in most of the as plants and was independent of degree of asynapsis or year of culture. Nuclear fusion following failure of cell division occurs during the microspore interphase or at the 1st microspore mitosis. In plants showing cytokinesis failure, division figures with 10, 20 and 40 chromosomes were observed at the 1st microspore mitosis. Size of the spores was proportional to the number of chromosomes. When placed on the silks of tetraploid maize