5. A test for distributive pairing.

From genetic data, Rhoda Grell (PNAS 48:165-72) hypothesized the following sequence of events in meiosis: (1) Exchange pairing (synapsis between homologous loci prior to exchange), (2) exchange, (3) Distributive pairing (crossover elements remain associated, non-crossover elements pair with one another. Pairing at this time may involve non-homologous elements), (4) disjunction.

The above scheme is based entirely on genetic data; therefore it would be highly desirable to study the process at the cytological level in order to determine the stage at which each of the hypothesized events occurs. Since cytological preparations of meiotic cells in Drosophila are not suitable, studies with analogous situations in maize were undertaken.

Two chromosomes in addition to the diploid complement were incorporated into plants and disjunction of the chromosomes at anaphase was studied. Two different situations were studied and are described below.

A. Trisome 4 plants containing one B chromosome. Plants were synthesized which contained 2 normal chromosomes 4 plus one chromosome 4 which carried inversion 4a. In addition, these plants contained a B chromosome. These plants were made heterozygous for inversion 4a in order to increase the percentage of cells which would have one of the chromosomes 4 as a univalent (see MNL., 34:55-56). This is an analogous situation to that reported by Grell where she studied disjunction of a chromosome which was mostly heterochromatic (the Y chromosome) from a chromosome II carrying inversions.

If there were no interaction between the extra chromosomes at anaphase I, there should be equal numbers of sporocytes with eleven chromosomes going to each pole and sporocytes with twelve chromosomes going to one pole and 10 going to the other. Many cells would also be expected to contain univalents on the metaphase plate which are undergoing equational division. However, if the two extra chromosomes interact and disjoin from each other, there should be an excess of the class with eleven going to each pole. The following data were obtained from a plant of the above constitution:

Anaphase I Disjunction of Chromosomes (Number of chromosomes going to each pole)			
11-11	12-10	One or Two Lagging Univalents	Not able to score
94	94	84	30

Since there is no excess of the 11-11 class, it can clearly be seen that there is no tendency for the two extra chromosomes to disjoin from each other. Scoring was done at very early anaphase; therefore the frequency of sporocytes with one or two univalents is probably somewhat high.

Because of the apparent lack of homology between A and B chromosomes, it was felt that this might not be a completely valid test; therefore, the following situation was also studied:

B. Double trisomic plants.
Five plants were studied which were trisomic for chromosome 6, and contained two normal chromosomes 4 plus one chromosome 4 containing inversion 4a. Data on disjunction of chromosomes at anaphase I are presented below:

Anaphase Disjunction of Chromosomes (Number of chromosomes going to each pole)				
11-11	12-10	10-11 + 1 Lagging Univalent	10-10 + 2 Lagging Univalents	Not able to score
202	217	219	44	129

In these plants, there is an excess of the 10-12 class, which is not in agreement with what would be expected on Grell's hypothesis. Therefore, one must conclude that there is apparently little or no distributive pairing in maize under the conditions studied. Further tests with additional combinations are in progress.

These data appear to be in conflict with those found by Michel (see the Minnesota report in this newsletter). However they may be reconciled if (a) pairing at diakinesis does not necessarily result in disjunction of the non-homologously paired chromosomes from each other at anaphase or (b) the chromosomes analyzed in Michel's study contained small regions of homology, resulting in pairing. Further work will be necessary to resolve these differences.

David Weber

6. Conversion at the B locus.

It was reported in the 1963 Newsletter that a light-colored plant had appeared in the selfed progeny from a plant presumed homozygous for B Pl. This was originally thought to represent a converter allele at the Pl locus. Evidence now indicates that it is the B locus which is involved. Preliminary indication came from crosses with dilute purple (b Pl) and sun red (B pl) stocks. When