

2. Effect of heat treatment on crossover frequency (bridge and fragment frequencies) in inversion 5083 at early synizesis (probably zygotene) and mid synizesis (probably pachytene).

Plants heterozygous for the inversion were removed from a growth chamber at 25°C for three hour treatment of meiotic tassel tissue at 36°C, and the crossover frequencies of their microsporocytes were compared to controls in three types of chromosome region: (1) where a single initiation of pairing can provide a site for a crossover without subsequent spreading of synapsis (crossover within the inversion), (2) where two independent events of pairing initiation are required for two coincident crossovers (double crossovers within and proximal to the inversion) and (3) where spreading of synapsis over a short distance from a single event of pairing initiation may provide the requisite pairing for two coincident crossovers (double crossovers within the inversion). Significant difference was found between treated and control for type (1) when treatment was applied at early synizesis but not at mid synizesis; difference of borderline significance was found between treated and control for type (2) when treatment was applied at early synizesis but not at mid synizesis; difference of borderline significance was found between treated and control for type (3) when treatment was applied at mid synizesis but not at early synizesis. Results are consistent with the interpretation that crossover sites are established for the most part at events of synaptic initiation and that nearby second crossovers occasionally follow the spreading of synapsis to adjoining regions.

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3. Crossover interference for regions within inversion 5083 and proximal to it.

The normal crossover map distance proximal to inversion 5083 is probably about 70 units; the map extent within the inversion is about 19 units if its cytological extent per map unit is average for the long arm of chromosome 1. Production of a fragment only at anaphase I requires coincident 3-strand double exchanges within the inversion and proximal to it. Using the table of Haldane (1919) for conversion of map distance to recombination percentage and assuming a proximal map extent of 70 units and no

chromatid interference, the expected frequency of recombination in the proximal region is 0.46. Since a total frequency of exchange in the inverted region of 0.36 was found, with no interference between the two regions, the expected frequency of cells at anaphase I with fragment only is 0.17. The frequency found, 0.07, suggests a substantial interference to simultaneous double exchanges within and proximal to the inversion. Double crossovers within the inversion, however, apparently occurred with a frequency near that expected in normal sequence material of the same estimated length (0.01). Crossing over within the inversion and/or the reversal of pairing which accompanies it seems somehow to be frequently inhibitory to proximal crossing over although the proximal region seems usually to be synapsed regularly at pachytene for most of its length. It is suggested that pairing initiation in the inverted region (which is distal) is likely often to occur earlier than in the proximal region and that in these cases the synapsis of the proximal region may result from extension of synapsis from the other arm. As proposed in the preceding report, crossover sites may usually be established at synaptic initiation, with nearby second crossovers sometimes following the spreading of synapsis to adjoining regions. Pairing of the proximal region, following homologous pairing in the inverted region, may take place in a manner less favorable for crossing over.

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4. Experimentally produced meiotic abnormalities.

Induced meiotic abnormalities so far observed in this laboratory have included synaptic failure, failure of chiasmate association to persist until metaphase, irregular chromosome contraction at diplotene, presence of multiple nucleolar-like bodies at diakinesis, end-to-end association of diakinesis bivalents, cytokinetic failure at first and second meiotic division, tripolar spindles, distorted spindles, decondensation of chromosomes at metaphase and anaphase, and reorientation and abnormal separation of metaphase I bivalents such that sister centromeres may separate equationally at anaphase I. These abnormalities were apparently first induced while pieces of 3 x 5 index cards were positioned next to the meiotic tassel during heat treatment (for mechanical support).