CHROMOSOME FRAGMENTATION PRODUCED BY CROSSING-OVER IN TRILLIUM ERECTUM L.

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(With Plate IX and Six Text-figures.)

INTRODUCTION.

When prepared by appropriate methods the chromosomes of Trillium erectum L. are particularly favourable material for the study of chromatid relationships. They are very large and the five members of the complement are individually distinguishable. A disadvantage, from the point of view of tracing abnormalities through the meiotic division, is that the plants bear only one or two flowers and all the anthers in these are at similar stages in the division cycle. This handicap can be partially overcome when clonal relatives are available. Two adjacent plants collected near Ste Agathe, Quebec, were found to have identical cytological peculiarities and are without doubt one clone. Observations ranging from the heterotypic metaphase to the homoeotypic anaphase have been made on them.

In these two plants a fragment chromosome about 6 μ long was found at anaphase in a small proportion of cells. Trivalents were never observed, nor were there univalents at metaphase. The fragment was found to consist of only a single chromatid, and it lacks an attachment region. It therefore appeared that the fragment must arise de novo in meiosis and that it might be explicable on the basis of crossing-over in a reversed segment. For the sake of ease in description the observations will be presented in terms of this hypothesis, which was found to be completely satisfactory. Diagrams 1 and 2 illustrate the essential features. In so far as the observations coincide they are in agreement with those of McClintock (1933, pp. 201–8) on a similar fragment of Zea Mays. Her observations have the advantage of including prophase stages; these show the details of behaviour more clearly at later stages owing to the larger size of the Trillium chromosomes and the clearness of their internal chromatid structure. These and other observations in Trillium (Huskins and Smith (1935)), are in accord with the partial chiasmatype theory of crossing-over and are opposed to the "classical" interpretation. The
term chiasma is therefore used throughout this paper as the cytological equivalent of genetic crossing-over.

**Methods.**

The pollen mother cells were smeared, desiccated for 20 seconds, and then fixed in LaCour's 2Bd. After washing in water they were bleached

Text-figs. 1-6. Meiotic chromosomes of Trillium erectum stained to reveal chromonema structure and showing the origins of a chromatid fragment at the heterotypic anaphase. Magnification × 2900. For detailed description see text.

in H₂O₂ and 70 per cent. alcohol, equal parts, for two hours, and stained 15 minutes in 1 per cent. aqueous crystal violet. The slides were then rinsed in tap water, pH about 7-8, and plunged into 95 per cent. ethyl alcohol for 10 seconds. From this they were transferred to an 80 per cent.