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Additional study on the fine structure of maize microsporocytes

During the last year microsporocytes of a diploid maize inbred, maintainer of a cytoplasmic male sterile line, were examined with the standard techniques of electron microscopy. Particular effort was made to investigate the fine structures of bivalents, centromeres, the secondary constriction region, nucleolus and knobs of various chromosomes if available. At pachytene stage the synaptonemal complex was easily identified. By frontal view the diameter of the complex was approximately 2200 Å.

Since the role of the synaptonemal complex in crossing over has been a subject of dispute, I had paid special attention to the finding of the existence of cross-elements in the complex. Up to the present, even though a large number of bivalents had been examined no cross-elements of any kind were definitely identified. If the synaptonemal complex is responsible for laying the ground for physical exchanges or crossing over between the two homologues, evidence of the formation of cross-elements between the two lateral elements should be expected. In view of this, once again the theory that the synaptonemal complex plays an important role in meiotic crossing over is questioned.

Chromosome 6, the nucleolar chromosome, is easily identified under both light and electron microscopes. It was observed that contrary to expectation, there was no synaptonemal complex beyond the secondary constriction region. Only darkly stained chromatin was shown in this region. As expected, synaptonemal complex was found in the rest of chromosome 6. In the centromere of this chromosome, only a lightly stained area was clearly observed. No microfibrils of any kind could be recognized. The synaptonemal complex was discontinuous in both the centromere and the secondary constriction regions.

In addition to the normal nucleolus, small nucleoli or nucleolar bodies varying in size and number from cell to cell were always present. These bodies were without any nucleolar cup and were unattached to any chromosomes. No fiber-like structures were seen in them; however, granular substances embedded in the homogeneous matrix were invariably observed. The appearance suggests their close relationship with ribosomes. Both the nucleolar bodies and the regular nucleolus possessed vacuoles which also varied in number and size but were always spherical in shape.

In the nucleolus of this inbred maize, two levels of structure could be revealed. One was the amorphous structure, the other, the fibrous. Fibers of the latter were about 350Å in diameter, and varied a great deal in length.

On the short arm of chromosome 9 there was a large terminal knob. This knob was frequently isolated and readily identifiable. No particular organizational characteristics were seen in the knob under the electron microscope. However, there were many fine fibrils radiating from the terminal region of the chromosome, and these fibrils measured less than 100Å in diameter. These fibrils are probably the basic components of the knob.

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Variations of maize anther callus in vitro

Since last summer 3950 maize anthers from 16 varieties have been cultured on defined medium. Callus growth from 201 anthers was observed. Morphological characteristics of these calli varied a great deal, from a size as small as 1-2 mm in diameter to as large as 3-5 times the original anther size. The small calli grew out from a part of the anthers, while the large ones grew out from the whole anthers. In the early stage of growth most of the calli were pale in appearance. When they were about two weeks old, they began to change from pale to brown. Chromosome constitutions of these calli have not yet been determined. However, it is expected that they vary from haploid to polyploid and aneuploid.