5. Chromosomal control of nucleolar composition in maize.

The composition of microsporocyte nucleoli of maize with different chromosomal constitutions was studied by the analysis of absorption spectra obtained from an ultraviolet microspectrophotometerer. The presence of ribonucleic acids (RNA) and proteins in the nucleolus was confirmed by the presence of two broad and overlapping absorption peaks around 2637Å and 2800Å. The former peak was removable by treatment of the tissue sections with cold perchloric acid. The amount of RNA per nucleolus was determined by measuring the absorbance and the diameter and thickness of nucleolus sections at 2637Å. Non-specific light loss and absorption due to proteins were corrected for by the use of blank slides which were subjected to cold perchloric acid extraction. By means of the above technique, the amount of RNA per nucleolus was found to be significantly different in the various strains of maize studied.

The size and the amount of RNA in the nucleolus were found to increase until mid-pachynema and then diminish and finally disappear at late diakinesis. The increase in volume was found to lag behind that in the RNA content. This observation, together with the observation that the RNA/protein ratio went down during the same period, was interpreted as indicating that during the growth of the nucleolus the RNA content increases faster than does the protein content, and that the synthesis or incorporation of proteins into the nucleolus is dependent upon RNA. The RNA content of the nucleolus was found to have doubled at some time between mid-leptonema and zygonema, an increase which was thought to be the result of the reduplication of the nucleolar organizer during leptonema.

A linear relation was established between the RNA content of the nucleolus and the number of extra nucleolar organizers present on supernumerary B chromosomes. The extra organizers did not change the RNA/protein ratio of the nucleolus. Extra heterochromatin in the supernumerary B chromosomes was found to increase the RNA content of the nucleolus only very slightly. Extra euchromatin was believed to have no appreciable effect on nucleolar composition since the RNA content of nucleoli from triploid plants, like that of nucleoli from plants trisomic for the nucleolar chromosome, was only three-halves as much as in their respective normal diploid siblings. The entire nucleolar chromosome is probably involved in nucleolus formation since changes in the RNA content, though not in the RNA/protein ratio, were found in plants carrying a translocation involving the nucleolar chromosome.

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