

Structure of the *Paramecium aurelia* Macronucleus as Revealed by Electron Microscopy

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The structure and organization of the macronucleus of ciliated Protozoa poses one of the most intriguing and as yet largely unsolved problems in cytogenetics. This nucleus, essential for the survival of the organism, divides amitotically, disintegrates during sexual reproduction and is replaced by a new one arising from a micronuclear product. Although the micronucleus possesses chromosomes, as it develops into a macronucleus, the chromosomal entities seem to disappear. What becomes of these chromosomes during macronuclear development and how this chromosomal material is organized in the adult macronucleus is still unknown. In *Paramecium* other investigators have shown this nucleus to contain Feulgen-positive material in the form of a coarsely precipitated network in stained preparations and to manifest two types of structures in living condition under phase contrast: large bodies believed to be nucleoli and a multitude of fine filaments at the limit of visibility of the light microscope (chromosomes?). Electron micrographs taken by other investigators confirm this general picture.

A more extensive and detailed EM analysis of macronuclear structure and organization by the present authors confirm and extend these observations; the largest bodies in the nucleus (0.5-1.0 micron) are certainly nucleoli; they have been observed under bright and phase contrast and can be shown to give typical reactions to nucleolar stains and enzyme preparations. They are largely Feulgen-negative; RNA positive. The other organized structures in the macronucleus consist of small particles or rodlets varying somewhat in size and shape (maximum width approx. 0.1 micron; variable length up to 0.6 microns (rare)). These are scattered randomly throughout the nucleus and are believed to represent randomly oriented cuts through chromosomal material. Ultrastructure has been observed within these granules in the form of alternating light and dark bands or dots, roughly 200A thick, strongly suggesting a microfibrillar chromosomal organization as recently described for higher forms. Further investigation of this ultrastructure is necessary. Comparison of prometaphase meiotic chromosomes of the micronucleus as seen by light microscopy with these presumptive macronuclear chromosomes permits a crude estimate of ploidy level to be established at approximately the 100-ploid level, a result in good agreement with other independent methods of estimation.