No Multistrandedness in Mitotic Chromosomes of *Drosophila melanogaster*

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Abstract. Feulgen cytophotometric measurements of neuroblasts in the first and third instar larvae of *Drosophila melanogaster* reveal the same DNA content for metaphases with chromosomes of different size. The total absorbance of all measured metaphases gives the four-fold value of that of the spermatids. Accordingly there seem to be no reasons to retain the assumption of a multistranded structure for the large chromosomes of metaphases in the third instar larvae.

Introduction

The discussion of strandedness in regard to chromatids has been decided of late in favor of a single-stranded model (Swift, 1973). Unexplained in this context are the structural significance of the split in anaphase chromosomes and all those cases, in which differences in DNA content could be demonstrated in diploid metaphases of the same genome. In neuroblasts of *Drosophila melanogaster* Rudkin (1963) was able to show that metaphases from the third instar larvae contain four times the amount of DNA found in the first instar larvae. Gay *et al.* (1970) have investigated this phenomenon more closely with the aid of Feulgen cytophotometry. From these studies a relation has been shown to exist between the DNA content of sperms and of metaphases from the ganglionic cells of first instar larvae, which can be interpreted by a 1c:4c ratio. The larger metaphases from the brains of third instar larvae contained, nonetheless, twice the amount of DNA as compared to those of young larvae. These must then be attributed to the 8c class.

These findings are explained by Rudkin (1963) and Gay *et al.* (1970) on the basis of different strandedness of the chromatids. The mitotic chromosomes of third instar larvae are considered to be polynemic in contrast to chromosomes of young larvae.

This hypothesis is seemingly supported by an older cytological finding. Kaufmann (1934) observed in anaphases of neuroblasts of adult *Drosophila* larvae split chromatids which were evaluated as indicative of polynemy. For Sorsa (1973) polynemy, based on cytophoto-
metric data, is the basis of discussion for the multistrandedness of mitotic chromosomes from *Drosophila* as demonstrated by his whole-mount technique.

**Methods**

For the purposes of investigation the same Swedish-b-stock of *Drosophila melanogaster* was utilized as in the cytophotometric studies of Gay *et al.* (1970). In preparation and staining the methods of Gay *et al.* (1970) were used. Measurements of Feulgen absorption then were done at 560 nm with a Universal-Mikrospektalphotometer from Carl Zeiss, Oberkochen.

**Results and Discussion**

Measurements were carried out on spermatids, interphases and metaphases of the brain cells of first instar larvae and on metaphases of brain cells of third instar larvae as well as metaphases from leg discs of the third instar. These measurements are reproduced in the diagrams of Figs. 1–4. The metaphases from the brain cells of the first and third stages show the same differences in size as those of the chromosomes depicted in Gay *et al.* (1970). Within the same brain the size of the metaphases varied greatly. The measurements of metaphases from the brain cells of third instar larvae (Fig. 1) with a value of $40.45 \pm 1.03$ displayed no significant difference in comparison to values of $41.55 \pm 2.11$ in metaphases of the first instar larvae (Fig. 2) and of $41.13 \pm 1.32$ for metaphases from the leg discs of third instar larvae (Fig. 3). The interphases from brain cells of the first larval stages provided values grouped around 21 and 40 (Fig. 4). As a result they are in full agreement with metaphase values. The total absorbance of spermatids (Fig. 1) is recorded as $10.73 \pm 0.9$. In light of the foregoing it is proved that none of the investigated metaphases contained more than the four-fold DNA content determined for spermatids.

From these results it is obvious that the size differences of metaphase chromosomes from brain cells of *D. melanogaster* are not based on different DNA content, but rather due to different contraction conditions of the chromatids. The facts presented above allow no assumption whatsoever of a multistrandedness in chromosomes of the third instar larvae. The differences in DNA content shown up till now in the measurement of metaphase chromosomes most probably result from methodological causes. Personal investigations have revealed that because of the small size of their nuclei the DNA content of metaphases and interphases of first instar stages can only be accurately measured with a microspectral photometer when the method of complete scanning is applied.