

SHORT PAPERS
Position effect suppression of
ribosomal RNA genes in *Drosophila melanogaster*:
non-autonomous in gynandromorphs?

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SUMMARY

Baker (1971) presented genetic evidence that the inviability of *In(1)sc^{L8}/O* and *In(1)sc^{S1}/O* males in *Drosophila melanogaster* is due to position effect suppression of ribosomal RNA cistrons. Although *sc^{L8}/O* and *sc^{S1}/O* males are inviable, *sc^{L8}/sc^{L8}* and *sc^{S1}/sc^{S1}* females are viable. We therefore asked the following question: Is *sc^{L8}/O* or *sc^{S1}/O* viable when part of a gynandromorph? In other words, is position effect suppression of rRNA genes autonomous or non-autonomous in gynandromorphs? In this paper preliminary evidence is presented which suggests that position effect suppression of rRNA cistrons is non-autonomous. The evidence is that *sc^{L8}/O* or *sc^{S1}/O* (male) parts of gynandromorphs are not only viable but normal in appearance.

It is now reasonable to state that the *bobbed* (*bb*) locus in *Drosophila melanogaster* is the site of genes coding for 18 S and 28 S ribosomal RNA (rRNA) molecules (Ritossa, Atwood & Spiegelman, 1966). It is also almost certain that *bb* is synonymous with the nucleolar organizer (NO) region (Atwood, 1969; Ritossa *et al.* 1966). *bb* (= NO) is located in the heterochromatic part near the base of the X chromosome (Lindsley & Grell, 1968; Baker, 1971). There are several inversions of the X chromosome in *D. melanogaster* that have their left (= distal) breakpoint near the tip and their right (= proximal) breakpoint to the right of the NO region in the heterochromatin (Lindsley & Grell, 1968). The result is that, in the rearranged chromosome, the NO is transported far away from its heterochromatic location to a euchromatic site. The situation is the opposite with respect to the euchromatic genes that originally were located immediately to the right of the left breakpoint. Some such inversions are the *scute* inversions, namely *sc⁸*, *sc^{J1}*, *sc^{L8}*, *sc^{S1}* and *sc^{V2}* (Lindsley & Grell, 1968; Baker, 1971). Since these inversions move the NO, the site of rRNA cistrons, to a euchromatic location, Baker (1968) suggested that the activity of rRNA genes is subject to position effect. He later (1971) showed that this indeed is the case. Using *In(1)sc^{L8}* and *In(1)sc^{S1}*, he demonstrated convincingly that the inviability of *sc^{L8}/O* and *sc^{S1}/O* males is due to position effect suppression of rRNA genes.

Although *sc^{L8}/O* and *sc^{S1}/O* males are unable to survive, surprisingly enough, *sc^{L8}/sc^{L8}* and *sc^{S1}/sc^{S1}* are viable and normal in appearance (Baker, 1971). However, these females are sterile (Lindsley & Grell, 1968). *sc^{L8}/sc^{4L} sc^{8R}* and *sc^{S1}/sc^{4L} sc^{8R}* females are also viable and normal (Baker, 1971). (The *sc^{4L} sc^{8R}* chromosome is completely deficient for the NO.) Now, the logical question is: Is *sc^{L8}/O* or *sc^{S1}/O* (male) part of a gynandromorph viable? In other words, is position effect suppression of rRNA cistrons autonomous in gynandromorphs?

In order to answer the above question, I made the following two kinds of crosses (for a description of symbols see Lindsley & Grell, 1968):

- (a) $R(1)w^{vc}/y w In(1)d1-49 1z^s \times In(1)sc^{L8}, sc^{L8} w^a cho^2 car,$
 (Females) (Males)
- (b) $R(1)w^{vc}/y w In(1)d1-49 1z^s \times In(1)sc^{S1} + S, y sc^{S1} B.$
 (Females) (Males)

$R(1)w^{vc}$ is a ring-X chromosome which is lost during the first cleavage division in a high proportion of the embryos. If this happens in an XX zygote, the result would be a gynandromorph. The embryos that would potentially give rise to gynandromorphs are $R(1)w^{vc}/In(1)sc^{L8}, sc^{L8} w^a cho^2 car$ from cross (a) and $R(1)w^{vc}/In(1)sc^{S1} + S, y sc^{S1} B$ from cross (b). Under normal conditions, $R(1)w^{vc}/In(1)sc^{L8}, sc^{L8} w^a cho^2 car$ embryos would develop into wild-type females whereas $R(1)w^{vc}/In(1)sc^{S1} + S, y sc^{S1} B$ would develop into females that have intermediate *Bar* eyes. Gynandromorphs are identified by the presence of male and/or mutant tissue in the appropriate flies. The mutant phenotype among gynandromorphs in cross (a) is most readily recognizable in the eye region, by the presence of *white-apricot* eye colour. However, the mutant phenotype among gynandromorphs in cross (b) is identified all over the body by the presence of *yellow* body colour, and in the head region by the presence of extreme *Bar* eye shape.

I found five gynandromorphs among 23 $R(1)w^{vc}/sc^{L8}$ flies from cross (a) and three gynandromorphs among 19 $R(1)w^{vc}/sc^{S1}$ flies from cross (b). The male (sc^{L8}/O or sc^{S1}/O) parts among the above gynandromorphs were distributed in the following manner:

Cross (a)

- (1) Right wing, right foreleg, and right thorax.
- (2) Most of left eye, left foreleg, left thorax, all of posterior abdomen including external genitalia, and left wing.
- (3) Most of right eye, right thorax, left foreleg, right foreleg, left wing, and left abdomen.
- (4) Most of right eye, right thorax, and right wing.
- (5) Left foreleg, left thorax, and left wing.

Cross (b)

- (1) Whole head, left foreleg, left wing, and left thorax.
- (2) Whole head and left foreleg.
- (3) Perfect left (male)-right (female) gynander.

An examination of the male areas of the gynandromorphs revealed neither cellular death nor a *bobbed* phenotype (short thin bristles and cuticular etching).

The above observations, namely the appearance of gynandromorphs bearing live and normal sc^{L8}/O or sc^{S1}/O tissues, lead me to suggest that position effect suppression of rRNA cistrons is non-autonomous in gynandromorphs. However, since my observations are based on a small number of flies, this report should be considered preliminary.

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