BRISTLE FORMATION CONTROLLED BY THE ACHAETE LOCUS IN GENETIC MOSAICS OF DROSOPHILA MELANOGASTER¹

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IN *D. melanogaster*, the genetic control of differentiation at specific sites is conveniently studied by the use of genetic mosaics. In wild-type flies, a definite number of macrochaetae or bristles is formed at specific sites of the thorax. Certain mutant genes are quite specific in their effects on bristle formation. The effect of *achaete* (*ac*), for example, is primarily restricted to removal of two bristles, the anterior and posterior dorsocentrals.

Earlier studies (STERN 1954a,b) have shown that bristle development is cell autonomous in mosaics. That is, in gynandromorphs in which the site of a posterior dorsocentral bristle is in *ac* tissue, a bristle will usually not differentiate even when most of the surrounding tissue is *ac*⁺. Conversely, when the site of the bristle is *ac*⁺, differentiation is always initiated regardless of the amount and distribution of surrounding *ac* tissue. This was interpreted by STERN as indicating that the hypodermal layer of the imaginal disc possesses regions in which the site of bristle formation is predetermined. A cell with the wild allele is competent to respond to this "prepattern," but a cell with the *ac* allele lacks this competence.

The present study of bristles affected by the *ac* locus uses a technique of mosaic production different from the one employed by STERN, one which produces a comparatively high proportion of mosaics thus permitting a quantitative breakdown of the various types of mosaics recovered.

MATERIALS AND METHODS

Mosaic males were obtained from the cross $Dp(w^{vc})6094b/\gamma w f:=/Y$ females to $\gamma ac w^a ct^e f Y^S/Y^L$ males. These males carried an X with the short arm of the Y attached and $Dp(w^{vc})6094b$ which is a small ring X duplication which arose from $In(1)X^{e2}, w^{vc}$ (HINTON 1955). The euchromatic composition of the duplication is limited to loci immediately adjacent to heterochromatin on each side of the centromere. It carries γ^+ , *ac*⁺, and *w*⁺. This duplication has a high rate of mitotic elimination during cleavage divisions, presumably through formation of dicentric double loop configurations at anaphase, thus forming yellow and white mosaic areas. Although there is no evidence of position-effect variegation of

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yellow (HINTON 1955), there is white variegation as well as loss (BAKER, W. K., personal communication).

The X chromosome which carried *achaete* (*ac*, 0.0 +) was also marked by yellow (γ , 0.0) so that *achaete* areas were recognizable by the presence of yellow bristles and hairs. As mentioned above, only wild alleles at the tip of the X were carried by the duplication so that *f* (forked bristles) could not serve as a marker of *achaete* tissue, but it is not difficult to recognize *ac* areas by the γ marker alone. Since virtually 100 percent of the males from the above cross which did not carry the duplication had both anterior and posterior dorsocentral bristles missing, it was possible to score both bristle sites in mosaics.

RESULTS

From the above cross, some 1600 males carrying the duplication were examined. Of these, 110 mosaics were found in which at least one of the four dorsocentral bristle sites or an area near a dorsocentral site consisted of *ac* tissue. The number of mosaics for the area considered represents approximately seven percent of the duplication carrying males.

Ninety-one of these mosaics exhibited autonomy; that is, when the bristle site is *ac*⁺, a bristle always forms regardless of the amount of *ac* tissue surrounding the site. When the bristle site is *ac*, the result is less clear-cut. Two thirds of the autonomous cases have *achaete* areas uninfluenced by surrounding wild tissue. In most of these cases the wild tissue is not near the bristle site. However, 19 of the 110 cases were nonautonomous, in which dorsocentral bristles developed in *ac* tissue when *ac*⁺ tissue was close to the bristle site. Since virtually all γ *ac* males not carrying the duplication failed to differentiate bristles at the anterior and posterior dorsocentral sites, this cannot be due to lack of penetrance of the *ac* gene. STERN interprets this as being caused by spread of "*ac*⁺ substance" into the *ac* tissue and considers it of minor significance compared with the larger number of cases of autonomy.

It should be noted that 12 of the 91 autonomous cases had similar closeness of *ac*⁺ tissue to the bristle site with maintenance of autonomy, suggesting that distance over which substances must diffuse to the bristle site is not the only factor involved. Though nonautonomy is not infrequent, it is unrelated to the size of the *ac* area which may be a small patch at the bristle site or a large patch whose border passes through the bristle site. This again suggests, as brought out by STERN, that the alleles in question are not determining a pattern since area would be expected to be critical if such were the case.

Seven cases were observed in which a dorsocentral bristle differentiated in *ac*⁺ tissue at an abnormal site. In each instance this was near a bristle site occupied by *ac* tissue. This phenomenon was interpreted by STERN as evidence that the property of the prepatter is distributed over a gradient field which has its peak at the typical bristle site but is still responsive at lower levels radiating out from this site.

The results obtained from mosaic males carrying *Dp(w^{vc})6094b* are consistent

with STERN's observations on gynandromorphs and his interpretation that *ac* and *ac*⁺ are not establishing a regional singularity but are responding to a pre-pattern present in both genotypes.

LITERATURE CITED

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