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Bournias-Vardiabasis, N. and M. Bownes. City of Hope National Medical Center, Duarte, California, and University of Edinburgh. Cell death in the tumorous head mutant of Drosophila melanogaster.

The tumorous head mutants of Drosophila melanogaster not only show homeotic transformations of head to genitalia and antenna to leg, but also have numerous duplications and deficiencies of head structures. Often the eyes are reduced or missing, and the palpi and head bristles can be absent or duplicated. The appearance of these defects suggested that they may result from cell death. Therefore, we have investigated the relationship between cell death observed in the eye-antennal disc and the adult abnormalities of the head.

Late third instar eye-antennal discs of six stocks were examined for cell death using a trypan blue/neutral red staining procedure. The dead cells were identified by their dark blue coloration.

Oregon R, tuh-1a; $\frac{Ubx^{130}}{TM1}$, and y tuh-1b; mwh jv showed occasional small areas of cell death (Fig. 1a) of the eye antennal discs stained from tuh-1a; tuh-3, y tuh-1b; tuh-3 and tuh-3 stocks 26%, 16%, and 21% showed cell death in the presumptive eye facet region, the vibrissae region, the antenna arista region, or the palpus rostrulhaut region (Fig. 1a). This suggests that the cell death is the result of the activity of the tuh-3 gene in these mutants and the cell death is located so that, according to eye-antennal disc fate maps, the defects seen in the adult could result from it.

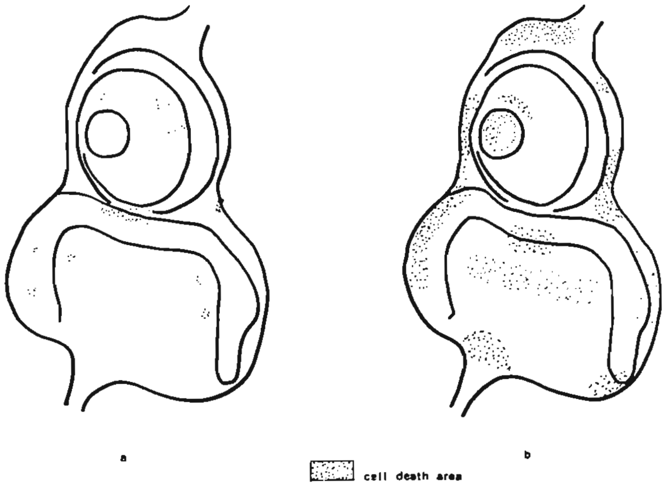

Fig. 1. Cell death areas (stippled) in whole mounts of eye-antennal discs of (a) Oregon R, (b) tuh-1a, tuh-3, y tuh-1b; tuh-3 and tuh-3 late third instar larva.

A comparison of the percentage of tumorous head eye-antennal discs showing cell death and the percentage of abnormalities found in the adult which may be attributable to cell death, from the same fly population, showed that there was a strong positive correlation between these two observations (Table 1) ($p = 0.05$). Temperature did not affect the frequency of cell death in discs.

In conclusion, many of the aspects of the tumorous head phenotype probably are the result of cell death in the eye-antennal disc. Thus, the tuh-3 gene is not only responsible for some embryonic lethality and homeotic transformations, but also for cell death in the eye-antennal disc of the larva.

Table 1. Relationship between cell death in the eye-antennal discs and adult abnormalities in the head of tumorous head adults.

Abnormalities probably due to cell death	Number of abnormalities scored
Antennal and arista missing	20
Eye reduced	326
Eye missing	16
Head to palpus	15
Palpus missing	85
Rostralhaut to palpus	16
Palpus malformed	51
Total abnormalities attributable to cell death	529

Total number of all types of abnormalities scored in the population	1367
Percent of abnormalities probably caused by cell death (a)	38
Expressivity for total population (i.e., number abnormalities per half head) (b)	1.45
Calculated percent of discs that should show cell death (a/b) if our assumptions are correct	26
Actual percent of discs showing cell death	27

Bownes, M. and M. Seiler. University of Essex, Colchester, England and University of Freiburg, Germany. UV irradiation of Drosophila embryos.

Using UV irradiation it is possible to cause polarity reversals in the eggs of some insects. In Smittia double-abdomen embryos, where the head and thorax are replaced by a second abdomen in mirror image symmetry to the original position of the abdomen, can be induced with 100% efficiency (Kalthoff, 1971). In Drosophila, however, double abdomens could not be induced by UV and the only reorganized embryos were ones containing 8 abdominal segments occupying the whole egg with no head or thorax and no loose tissue at the anterior (Bownes and Kalthoff, 1974). The maternal effect mutation bicaudal (bic) of Drosophila leads to the production of similar embryos (Bull, 1966; Nusslein-Volhard, 1977). It is possible that since bicaudal mothers can produce this defect in the organization of pattern in the embryo that eggs laid by these mothers would also be sensitive to UV irradiation-induced polarity reversals. Eggs were collected from both bic/vgB mothers which normally produce some bicaudal eggs and bic/bic mothers which rarely produce bicaudal eggs when homozygous, but often produce them when hemizygous. Eggs were UV irradiated at the anterior pole at the nuclear multiplication stage using 285nm wavelength. As can be seen in the table the proportions of abnormal embryos are not altered very much by the different genetic backgrounds, although the number of undifferentiated and abnormal embryos is significantly increased in all cases by the UV. Furthermore, no bicaudal embryos and no increase in the number of abdomen-only embryos were observed. Thus the genetic instability in these flies which causes them to produce double abdomens does not make them more responsive to UV irradiation. One possible explanation for this is that the bicaudal mutation alters the initial establishment of positional information whereas UV ir-

Survival of UV-irradiated eggs laid by females with different genotypes

Genotype	Experiment	Total	% Hatched	% Undifferentiated	% Abnormal
OrR	control	264	76	17	7
	UV irradiated	632	12	34	54
OrK	control	226	75	22	3
	UV irradiated	259	31	35	35
bic/bic	control	1128	81	14	5
	UV irradiated	1680	29	30	41
bic/vgB	control	264	29	60	11
	UV irradiated	536	1	77	22