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THE MECHANISM OF TEMPERATURE INDUCED REDUCTION OF TUMOR FREQUENCY IN A TUMOROUS STRAIN OF DROSOPHILA MELANOGASTER

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Hereditary melanotic tumors in Drosophila are formed during the larval stages by the aggregation of haemocytes and subsequent deposition of melanin, and are recognized as dark inclusions in the adult fly. The tumor incidence in a population is dependent upon the genotype and environmental variables such as the temperature during development. In one tumor strain studied, tu^{51f}, the tumor incidence, which was 30% when the flies developed at 21° C., increased 40% to 50% when the flies developed at 16° C. and dropped 20% to 25% when developing at 26° C. This strain differs from most others in that tumor pigmentation occurs in the late pupal stage.

In order to determine whether the temperature induced changes in tumor frequency were confined to any particular stage of development, a large number of eggs were collected at 21° C. and samples of the developing flies were transferred from this group at successive 24 hour intervals over a 312 hour period, to temperature chambers set at 16° C. and 26° C., and allowed to complete their development at these temperatures. The developing flies remaining in the originally collected group at the end of the sampling period were allowed to complete their development at 21° C. and thus served as controls. The latter group completed their development 60 hours after the last of the 24 hour samples had been taken, and had a tumor frequency of 30%, which is characteristic when this strain develops at 21° C.

There was a significant reduction in the tumor frequency (12%) of adults from eggs or larvae transferred from 21° C. to 26° C. during the first 180 hours of development, a period which extends from the egg through the end of larval life, while the tumor frequency of flies transferred when in the pupal stage was not significantly different from that of the controls. The sensitivity period to the lower developmental temperature did not coincide with that found in the heat-treated series. Adults from developing flies transferred to 16° C. during the first 130 hours of development (from the egg to the early third larval instar) had a significantly higher tumor incidence than the controls (68%), and the tumor incidence in flies transferred between 130 and 205 hours of development (early third instar to the early pupal stage) was not significantly different from the controls. However, the tumor frequency of flies transferred to 16° C. after developing at 21° C. from 205 hours to the end of the experimental period (early to mid pupal stage) was significantly lower than the controls (9%).

Determination of the number of larvae undergoing development

in the tested series has indicated that selection cannot account for the observed frequency changes, while the reduction of tumor frequency observed when only the pupal stage develops at 16° C., which is after haemocyte aggregation but before pigment formation, suggests that the cold induced reduction of tumor incidence is due to the inhibition of pigmentation, and hence recognition of the tumors, and not due to inhibition of the aggregative phase of tumor formation. Evidence from other experiments indicates that the reduction of tumor frequency induced by the higher developmental temperature is also an apparent reduction due to an inhibition of tumor pigmentation.