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Experimental modifications of the larval nutritive medium in Drosophila melanogaster, and learning process of the imago.

It has been shown that serotonin (5-HT), a chemical mediator synthetized from tryptophan, is present in each larval instar and in the imago of Drosophila melanogaster. In the latter, the 5-HT level in the head is twice that of the whole body. By HPLC, we found about 18 µg of 5-HT for 1 mg of fresh head (18 µg/mg) and about 8 µg/mg in the body.
-- Larvae fed with a synthetic nutritive medium (from Hinton 1951) containing 0.3 g/l of para-chlorophenylalanine (p-CPA): an inhibitor of serotonin synthesis;
-- Larvae fed with a similar medium without an amino acid: the D-L tryptophane.
Both being rehabilitated after the pupal instar, have been observed from a learning point of view.

The tarsal reflex (a proboscis extension in response to a sugar stimulation of the foreleg tarses, refer to Holliday, DIS 59) is normally inhibited, if each extension is followed by a negative reinforcement (a bitter stimulation of quinine on the tarses, in the paradigm of Medioni et al. 1978).

As shown in Figure 1, the treated flies (p-CPA or deprivation group) persist to extend the proboscis in response to a sugar stimulation in spite of the presence of quinine.

Other experiments (habituation of the tarsal reflex itself, locomotor activity, taking-off, sexual behaviour) give arguments to a selective action of 5-HT on this kind of learning.

References: Holliday,M., M.Vargo & J.Hirsch 1983, DIS 59:140; Hinton,T., D.T.Noyes & J.Ellis 1951, Physiol.Zool. 24:335-353; Medioni,J., N.Cadieu & G.Vaysse 1978, C.R.Soc. Biol. 172:961-967.

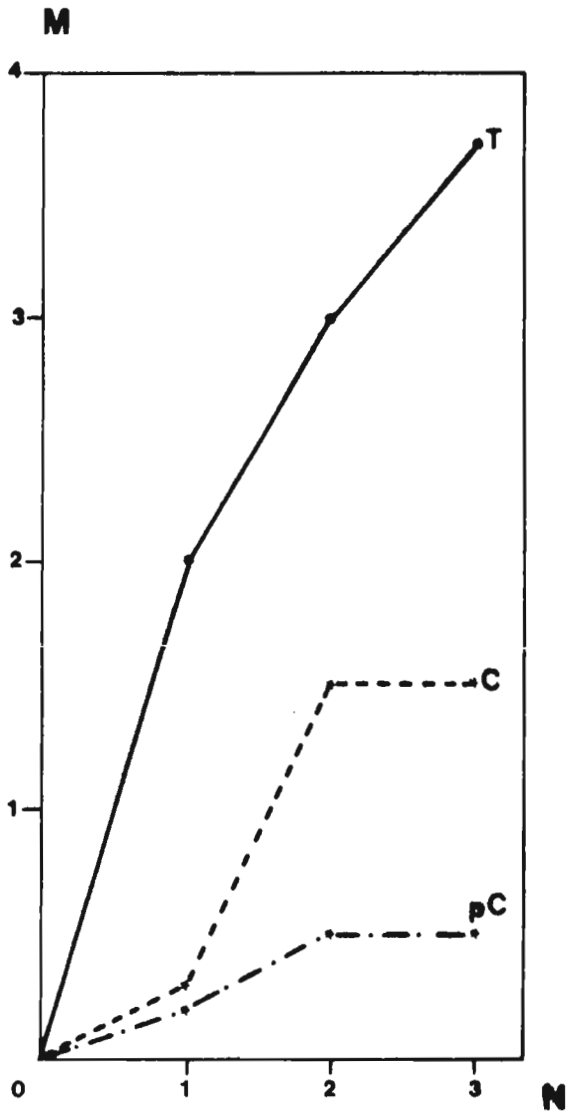

Fig. 1. Mean of eliminations (M) of each of the 3 blocks of 5 tests during the conditioning. T=test group; C=deprived group; pC=group treated with p-CPA.