Wright, C.P. Western Carolina University, Cullowhee, North Carolina. Oxygen consumption in glufultyrless-1, 1(1)EN7, a lethal mutant of Drosophila melanogaster.

Glufultyrless-1, 1(1)EN7 is a sex-linked lethal mutant of Drosophila melanogaster which was X-ray induced by Novitski (1963). Death in this mutant usually occurs in the pupal stage. Both weight and oxygen consumption measurements were made on individual male larvae and pupae from the first instar larval stage until the time when oxygen uptake ceased. Oxygen consumption measurements were made with small respirometers in a 25° water bath. A 20% NaOH solution was used to remove CO_2 from the respirometers, which caused movement of the NaOH drop. By measuring the volume of the droplet displacement, the oxygen consumption of a larva or pupa was determined. Control larvae and pupae were y, w, spl, sn males from the stock of Novitski (1963) in which the lethal mutant was induced. Experimental data were tested statistically against control data by use of the Mann-Whitney U nonparametric test (Tate and Clelland 1957).

Both weights and rates of oxygen consumption in 1(1)EN7 larvae (Table 1) were significantly less than those in controls (Table 2). Control larvae formed puparia at 110 ± 17 hours after oviposition. About 60% of 1(1)EN7 formed puparia at 195 ± 60 hours. The remaining

Table 1. Average weights and rates of oxygen consumption for 1(1)EN7 larvae

Age in hr. after oviposition	Fresh weight/ larva in mg.		Dry weight/ larva in mg.		O_2 consumption in cu.mm./ larva/hr.		O_2 consumption in cu.mm./mg dry wt./hr.	
	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.
30 hr.		did not weigh	4	0.0033 ± 0.0004	8	0.103 ± 0.006**	8	31.174 ± 1.847
48 hr.		did not weigh	4	0.014 ± 0.001	8	0.237 ± 0.025**	8	16.947 ± 1.786*
72 hr.	8	0.17 ± 0.01**	8	0.05 ± 0.01**	8	0.780 ± 0.076**	8	15.426 ± 1.204**
96 hr.	9	0.39 ± 0.06**	9	0.09 ± 0.01**	9	1.244 ± 0.159**	9	14.687 ± 1.828
120 hr.	6	0.76 ± 0.06	6	0.14 ± 0.01	6	1.881 ± 0.056	6	13.848 ± 1.039
144 hr.	4	0.89 ± 0.08	4	0.17 ± 0.03	4	2.064 ± 0.230	4	12.411 ± 0.895

* Significant at .05 level ** Significant at .01 level

Table 2. Average weights and rates of oxygen consumption for y, w, spl, sn control larvae

Age in hr. after oviposition	Fresh weight/ larva in mg.		Dry weight/ larva in mg.		O_2 consumption in cu.mm./ larva/hr.		O_2 consumption in cu.mm./mg dry wt./hr.	
	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.
30 hr.		did not weigh	4	0.0039 ± 0.0001	8	0.137 ± 0.004	8	35.192 ± 1.021
48 hr.		did not weigh	4	0.018 ± 0.001	10	0.390 ± 0.015	10	21.689 ± 0.851
72 hr.	10	0.29 ± 0.02	10	0.07 ± 0.01	10	1.456 ± 0.059	10	19.698 ± 0.236
96 hr.	9	1.36 ± 0.05	9	0.31 ± 0.01	9	5.108 ± 0.282	9	16.382 ± 0.441

1(1)EN7 larvae stayed in the larval stage showing increasing deterioration until death. Willis and Wright (1972) reported that histological abnormalities are observable in 1(1)EN7 larvae.

Throughout pupal development both fresh and dry weights of 1(1)EN7 (Table 3) were significantly less than in controls (Table 4). Dry weight was maintained at a fairly constant level, but fresh weight decreased steadily until at 152 hours after puparium formation 1(1)EN7 pupae were almost desiccated. Rates of oxygen uptake in 1(1)EN7 pupae (Table 3) followed to a certain extent the U-shaped curve of oxygen uptake in control pupae (Table 4). Controls emerged as adults at about 90 hours after puparium formation. Oxygen consumption in 1(1)EN7 decreased from 3 to 40 hours after puparium formation and then increased slightly until 80 hours, after which it decreased until none could be detected at 152 hours. Morphological development in 1(1)EN7 pupae reached its peak at 80 hours, with all pupae showing some adult structures such as head, legs or wings, but none of the pupae were completely developed. After this point a complete developmental breakdown occurred which resulted in death.

(Tables 3 and 4 on next page)

Table 3. Average weights and rates of oxygen consumption for 1(1)EN7 pupae

Age in hr. after puparium formation	Fresh weight/ pupa in mg.		Dry weight/ pupa in mg.		O_2 consumption in cu. mm./ pupa/hr.		O_2 consumption in cu. mm./mg. dry wt./hr.	
	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.
3 hr.	8	0.68 ± 0.04**	8	0.18 ± 0.01**	8	0.971 ± 0.112**	8	5.442 ± 0.548**
20 hr.	8	0.68 ± 0.02**	8	0.23 ± 0.01**	8	0.276 ± 0.071**	8	1.243 ± 0.324**
40 hr.	8	0.57 ± 0.07**	8	0.19 ± 0.01**	8	0.130 ± 0.017**	8	0.715 ± 0.131**
60 hr.	8	0.53 ± 0.04**	8	0.18 ± 0.01**	8	0.177 ± 0.015**	8	1.001 ± 0.094**
80 hr.	8	0.50 ± 0.05**	8	0.15 ± 0.01**	8	0.230 ± 0.057**	8	1.426 ± 0.274**
104 hr.	8	0.30 ± 0.04	8	0.14 ± 0.01	8	0.062 ± 0.021	8	0.465 ± 0.150
128 hr.	8	0.22 ± 0.02	8	0.16 ± 0.01	8	0.033 ± 0.013	8	0.208 ± 0.072
152 hr.	8	0.13 ± 0.01	8	0.11 ± 0.01	8	0.000 ± 0.000	8	0.000 ± 0.000

* Significant at .05 level ** Significant at .01 level

Table 4. Average weights and rates of oxygen consumption for y, w, spl, sn control pupae

Age in hr. after puparium formation	Fresh weight/ pupa in mg.		Dr. Weight/ pupa in mg.		O_2 consumption in cu. mm./ pupa/hr.		O_2 consumption in cu. mm./mg. dry wt./hr.	
	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.	n	M. ± S.E.
3 hr.	10	1.38 ± 0.02	10	0.38 ± 0.01	10	3.092 ± 0.076	10	8.244 ± 0.187
10 hr.	10	1.19 ± 0.03	10	0.36 ± 0.01	10	2.213 ± 0.066	10	6.261 ± 0.211
20 hr.	10	1.16 ± 0.02	10	0.34 ± 0.01	10	1.114 ± 0.037	10	3.340 ± 0.162
40 hr.	10	1.17 ± 0.04	10	0.35 ± 0.01	10	0.842 ± 0.083	10	2.433 ± 0.097
60 hr.	10	1.16 ± 0.02	10	0.35 ± 0.01	10	1.266 ± 0.049	10	3.620 ± 0.098
80 hr.	10	1.14 ± 0.02	10	0.34 ± 0.02	10	1.864 ± 0.070	10	5.542 ± 0.194

References: Novitski, E. 1963, DIS 37:51-53; Tate, M.W. and R.C. Clelland 1957 Non-parametric and Shortcut Statistics in the Social, Biological, and Medical Sciences (Interstate) Danville, Illinois; Willis, D.E. and C.P. Wright 1972, DIS 48:32.

Thomasson, W.A. Chicago College of Osteopathic Medicine, Chicago, Illinois.

Juvenile hormone does not inhibit protein granule accumulation in larval fat body.

The fat body of many holometabolous insects, including D. melanogaster (1), accumulates large granules of protein during the hours before pupation. In the butterfly Calpodes ethlius this accumulation has been shown to be under the control of the molting hormone, ecdysone (2). Thomasson and Mitchell (3) have shown that in D. melanogaster, while ecdysone can induce granule accumulation, the granules appear too early for ecdysone to be the natural inducer. Furthermore, fat bodies incubated in vitro can form granules in the absence of ecdysone.

It was therefore speculated that the natural control might be an inhibition by juvenile hormone, with the granules appearing as soon as the juvenile hormone titer drops below a critical level. However, further experiments have now shown that addition to the cultures of "synthetic juvenile hormone (Calbiochem)" in concentrations as high as 0.06 mg/ml had no effect on granule formation.

The natural inducer in D. melanogaster therefore remains unknown. It is conceivable that the fat body responds to increasing protein concentrations in the hemolymph. Certain results reported in reference (3) are compatible with this possibility, though it was excluded as a possible mechanism in C. ethlius.

References: (1) von Gaukecker, 1963, Z. Zellforsch. 61; (2) Collins, 1969, J. Insect Physiol. 15; (3) Thomasson and Mitchell, 1972, J. Insect Physiol. 18.