Lints, F. A.[1] and E. Zeuthen[2]. Oxygen consumption of the egg in wild and inbred strains of Drosophila melanogaster.

In order to verify a hypothesis correlating negatively the duration of life to the metabolism and more precisely to the rate of oxygen consumption (Lints, 1963), a series of experiments on the oxygen uptake of Drosophila melanogaster was started. Using the gradient-diver method (Løvlie and Zeuthen, 1962) measurements were made on fertilized eggs--from egg-laying to the emergence of the larva--of two strains, Abeele wild and Abeele inbred F99 and F100.

The eggs were collected from parents of different ages; however, male and female of a given experiment were equally old. Neither the weight, nor linear measurements of the egg was taken. Oxygen consumption was read twice an hour during the entire development of the egg, except for the two or three hours immediately after egg-laying where for technical reasons readings were not possible. The rate of oxygen consumption is expressed in µl/egg/hour. With the 10 to 15 µl divers used, (and for the observed gas consumptions ranging from 2 to 5 x 10^{-2} µl/hour) the absolute error of the method is of the order of 6 x 10^{-4} µl/hour. All the experiments were run at the temperature of 25°C.

The essential results are as follows: for a mean duration of 19.75±0.56 hours the mean total O_2 consumption of the Abeele wild strain is 0.599±0.042 µl, while it has a value of 0.616±0.025 µl for a mean duration of development of 19.80±0.92 hours in the inbred strain. The difference between the consumptions from egg-laying up to emergence was tested by means of the analysis of covariance of total O_2 consumption in relation to parental age, and it is not significant (Table 1).

The figure shows the mean rate of O_2 consumption for the two strains studied. Each of these curves can be best described by two regressions of rate on time: one starting at egg-laying up to the tenth hour of development; a second starting from the latter point up to the emergence of the larva; i.e., for the last 9 hours of development. The onset of the fairly steep increase in the consumption rates in the second part of the embryogenesis seems to correspond with the first muscular movements which occur around the 10th to 8th hour before emergence (Poulson, 1950); at that time the regression coefficients rise from 0.0026 to 0.0161 for the wild strain, and from 0.0080 to 0.0152 for the inbred one.

The difference between the regression coefficients rate on time for the first ten hours of development is highly significant ($t = 3.2$; $0.001 < P < 0.01$); however, for the same period there is no significant difference for the means. In the second part of embryogenesis the difference between regression coefficients is statistically not significant, and the difference between means gives a t value of 1.5 ($0.1 < P < 0.2$). Indeed, a close examination of the figure shows that, while starting at a somewhat lower level the consumption rate of the inbreds from the fifth hours after egg-laying, and continuously up to emergence is a little higher than that of the wild strain, and this accounts for the small (not significant) difference in total consumption.

The hypothesis relating duration of life to respiration rate postulated a higher O_2 consumption for inbreds. The data here supplied neither fully support, nor contradict the hypothesis. Indeed, on the one side, after 20 hours of development the total consumptions are statistically not different although a little higher for the inbreds; but, on the other side, at least in the first ten hours of development, the slopes of the rate curves are significantly different, the increase in rate being much higher for the inbreds. One would need to know the evolution of the rate curves during the next steps in development, i.e., during the larval and pupal stages, and the respiration rates during adulthood. More precisely one should establish whether the small, but regular difference in rate in favor of the inbreds is maintained.

More experiments of the type reported here are being performed with eggs of other strains, taking into account differences in egg size and weight. The experiments will be extended to include later developmental stages (larval, pupal, and imagos). A complete report of the present data will be published in the "Comptes Rendus des Travaux du Laboratoire Carlsberg."

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Table 1

Item	Abeele wild	Abeele inbred	Difference t	Difference p
Number of observations	6	10	--	
Duration of development (hours)	19.75 ±0.56	19.80 ±0.92	--	
Mean total consumption (ul)	0.599±0.042	0.616±0.025	0.9*	0.3-0.5

	Abeele wild			Abeele inbred			Differences** means		between regression coeff.	
	b	t	p	b	t	p	t	p	t	p
Regression: rate on time (10 first hours)	0.0026	2.3	0.05-0.10	0.0080	6.2	<0.001	0.7	0.50	3.2	0.01-0.001
Idem: 9 last hours	0.0161	8.6	<0.001	0.0152	10.0	<0.001	1.5	0.1-0.2	0.3	--
Regression: total consumption on parental age	0.0084	1.3	0.2-0.3	0.0018	0.3	--	--***	--	0.7	0.50

*Difference tested by means of the covariance analysis of total O_2 consumption in relation to parental age.

**Differences tested by means of the analysis of variance.

***See item: difference between mean total consumption.

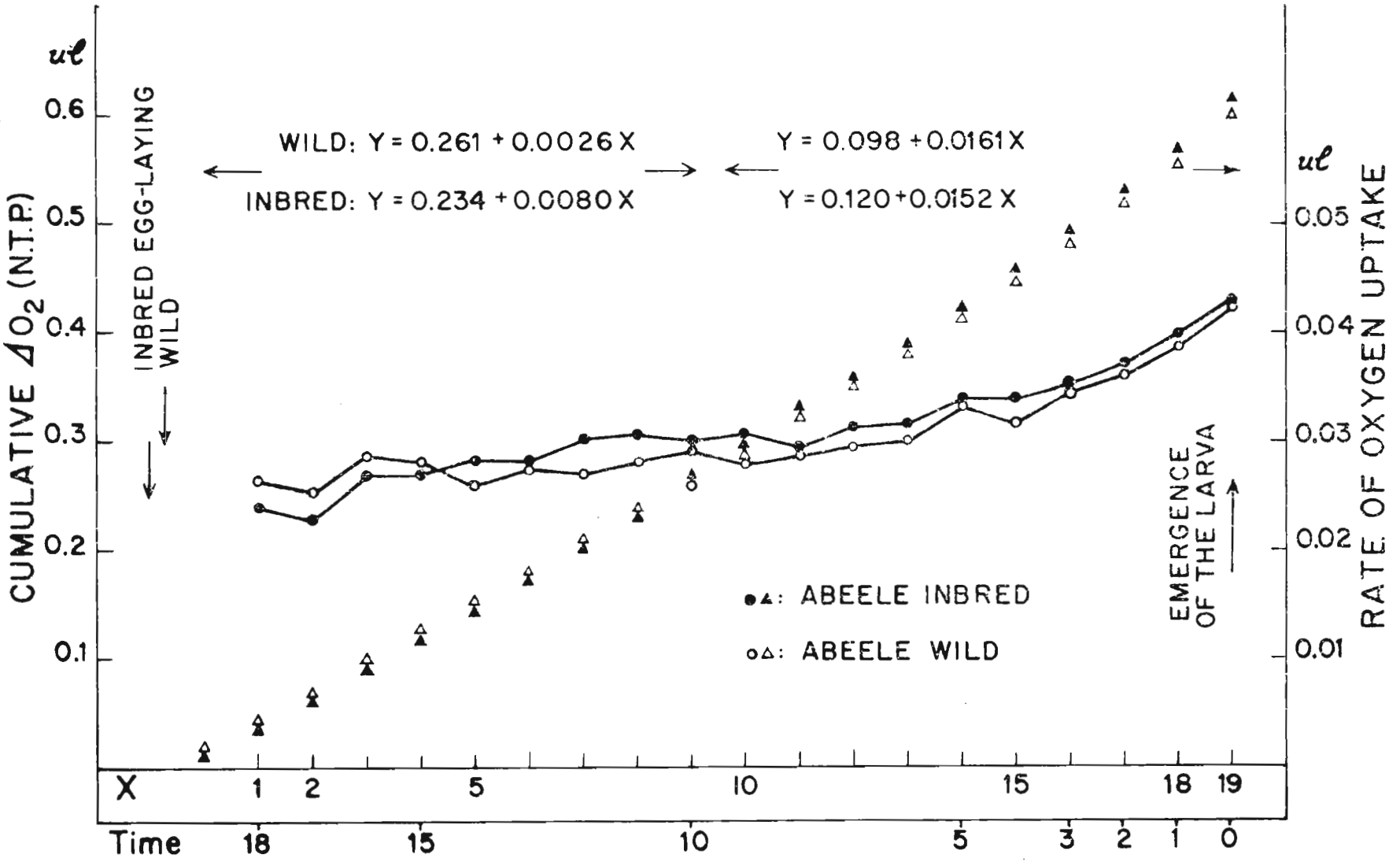

Figure 1.--Curves delineated by circles: The rate of oxygen consumption (right ordinate) is plotted against the observation number (abscissa, upper scale), the time between two observations being exactly one hour. The rate curve shown for each strain is a mean calculated from the several different curves which were observed experimentally, and made to coincide on the time axis at the moment of emergence of the larva. (This is, in fact, the only biologically defined point in time, since Drosophila females can retain the egg in the uterus for a variable period, and hence the exact time of fertilization cannot be determined).

Curves delineated by triangles: Cumulative oxygen uptake ($\Sigma \Delta O_2$ N.T.P.--left ordinate) is plotted against time in hours (abscissa, lower scale), the origin of time being the moment of emergence of the larva. The first point on each cumulative oxygen uptake curve was calculated by means of the appropriate regression formula.

References: Lints, F. A., 1963: De l'influence de la formule caryo-cytoplasmique et du milieu sur les relations entre longévité et vitesse de croissance chez Drosophila melanogaster. Bull. Biol. Fr.-Belg., 97, 605-626.

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Khan, A. H. University of Cambridge, England. Tests for hydroxylamine mutagenesis in Drosophila.

The mutagenic effect of hydroxylamine has been tested on mature spermatozoa of Drosophila using an adult feeding method. Treatment was in one-pint bottles, the bottoms of which were covered with a double thickness of filter paper. The filter paper was kept lightly soaked with the hydroxylamine solution (containing 5% glucose) during the period of treatment. Fifty newly-hatched Oregon-K males, were starved for 12 hours, and placed in the treatment bottles for 24 hours during which time the treatment solution was their only source of nourishment.

Treated males were examined by the Muller-5 (Basc) method for the frequency of sex-linked lethal mutations. A single three-day brood was examined by individually mating one treated male to two Muller-5 virgin females.

The chemical was highly toxic, killing all males at a 0.4% treatment. The survival at 0.3, 0.2 and 0.1% concentrations of hydroxylamine was 65.0, 82.5 and 97.5% respectively. The sex-linked lethal results listed in Table 1 show that hydroxylamine is not mutagenic in Drosophila under these conditions.

Table 1.--Sex-linked recessive lethal frequencies in Drosophila males after adult feeding treatments with hydroxylamine.

Concentration of hydroxylamine (%)	0.1	0.2	0.3
Duration of treatment (Hrs)	24	24	24
Survival (%)	97	82	65
No. males examined	45	33	28
Average no. chromosomes examined/male	9	10	13
No. chromosomes examined	411	345	364
No. lethals	0	1	0
Lethals (%)	0.0	0.28	0.0

Lee, P. Y. and V. A. Strangio. University of Melbourne. Brood sensitivity to the induction of polygene mutations.

Males from a highly-inbred wild type D. melanogaster stock were irradiated with 500r X-rays and then mated individually to three virgin females from the same stock. Four broods were established from successive matings, each three days in duration. Sternopleural bristles were counted in F_1 females only (see Mukai et al., 1963). Although pooled data from all four broods indicate a significantly increased variance of the bristle number distributions in females from the irradiated series, the preliminary results have so far failed to reveal a detectable sensitivity pattern.