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Drosophila husbandry and extension of lifespan mean and lifespan range.

Some modifications of routine culture conditions and careful operational procedures with small samples of Drosophila adults yield marked effects on mean and individual longevity, demonstrated by % surviving to 100 or more days (Table 1). The populations of the first seven listed groups are the unirradiated samples of seven radiobiological test series, with exposed and unexposed populations cultured similarly during any one investigation. (B. P. Sonnenblick and L. P. Gartner, Radiation Res. 31:612-13, 1967). Test 8 was an independent trial. The data then do not represent a pointed attempt to determine singularly optimal culture conditions, merely an attempt to reduce obvious hazards.

Table 1. Lifespan mean and % surviving to 100 or more days (Canton-S adults, D. melanogaster)

Test No.	$\bar{n}$	Temp. °C. Average	Mean Lifespan of $\bar{n}$ (Days)	No. Surviving to 100 or More Days	% Surviving 100 or More Days
1.	91	21.5 ± .5	44	0	0
2.	160	20.0 ± .5	46	0	0
3.	125	18.5 ± .5	49	2	1.6
4.	66	19 ± .5	64	2	3.0
5.	74	19 ± .5	68	4	5.4
6.	73	19 ± .5	77	15	20.5
7.	50	19 ± .5	68	4	8.0
8.	100	19 ± .5	81	23	23.0

Young Canton-S adults of D. melanogaster, mass bred after earlier pair inbreeding, were used. Temperature fluctuations must be kept minimal and averages are noted in the Table. Standard errors of the mean were prepared for samples by sex and were generally about three and a fraction days; with increasing radiation exposure the S.E. diminished markedly due to a saturation effect of the stress. Tests 4-8, with culture modifications, are compared with Tests 1-3 which were performed some years ago. Most determined efforts at care occurred in Tests 6-8, with 4 and 5 representing our earliest experience with these methods.

Modifications in preparation of standard media include absence of live yeast from surface of vials, no use of benzoyl benzoate, lessened water content of media, placing of cellucotton and preparation of cotton plugs so that adults cannot penetrate either. One etherization only was employed, five pair of flies per vial instead of two, as formerly, were used, and fresh food was supplied weekly with care taken in the passage of organisms to new vials. Vials were examined daily when possible. Relative humidity was low in the first three tests but maintained at 60-65% in later ones.

Whether any, or which, of these factors, acting singly or in concert with deliberately employed, small heterogeneous populations, account for the longevity results evident in the Table we cannot tell. The survivors to 100 or more days were 33 females and 9 males (of 223 individuals) in the last three tests. How would other strains respond to such arbitrarily selected conditions of culture and physical environment? We may note that a strain containing attached-X females and ring-X males, with mutant genotypes, reared simultaneously with Canton + individuals in the same incubator, and as described above for tests 6-8, consistently had 6% of the populations in the three trials (female-male ratio of 2.5:1) living over 100 days, with some of both sexes surviving more than 120 days.

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Allelic and non-allelic complementation in Drosophila metzii.

Complex isozyme patterns of octanol dehydrogenase have been observed using 1-octanol as substrate, with agar gel electrophoresis, in strains of D. metzii. True breeding lines 1Tr17e and 58B8, extracted from the Trinidad and Barro Colorado Island, Canal Zone, strains respectively, show a single strongly staining isozyme band at position # 3 with occasional faint bands at positions # 4 and 5 (designated pattern # 3; see Fig. 1a). Hybrids between these lines show the same pattern. In contrast, zymograms of lines 1Tr17h4d and 1T9g, extracted from the Trinidad and Turrialba strains, respectively, show strong staining at position # 6 with faint bands sometimes at positions # 4

and 5 (Fig. 1b). Hybrids of lines 1T9g or 1Tr17h4d and 58B8 show strong staining at positions # 3,4,6, and sometimes # 5 (pattern # 3-6). Also isolated from the Trinidad strain were the almost true breeding lines 1Tr17g17 and 1Tr17g13 with 5,6, or 7 isozymes in positions # 1 to # 6 or # 7 (designated pattern # 1-6; see Fig. 1c). 1Tr17g13 males in pair matings with 58B8 females produced F_1 hybrids usually with 5,6, or 7 isozymes. Fifteen such F_1 males back crossed individually with 58B8 females produced progenies of four patterns: 48 individuals with pattern # 3; 45, with pattern # 1-6; 57, with pattern # 3-6; and 43, with isozymes in positions # 1,2,3 (called pattern # 1-3; see Fig. 2.). This ratio does not differ significantly from that expected from a dihybrid cross (chi square, 2.38; 0.5 P 0.3). Thus 1Tr17g13 males are believed to have transmitted two structural genes for ODH, ODH^A and ODH^B, or more simply, genes A and B, located on nonhomologous chromosomes, to the fifteen F_1 males siring segregating back cross progenies. The F_1 male parents must have had the genotype Aa Bb; the 58B8 females, aa bb. Back cross progeny with the # 1-6 pattern were then Aa Bb; with the # 3-6 pattern, Aa bb; with the # 1-3 pattern, aa Bb; and with the # 3 pattern, aa bb. The same four segregating patterns were seen in similar back cross progenies in which strain 1Tr17e replaced 58B8. Successful prediction of complex ODH ixozyme patterns in crosses between strains of uniform pattern implies these to be the result of subunit composition (see Schwartz, 1962, Proc. Nat. Acad. Sci. U.S. 48: 750-756). Courtright, Imberski, and Ursprung, 1966, Genetics 54: 1251-60) concluded that the ODH molecule in D. melanogaster was a dimer. In D. metzii, a double heterozygote of genotype Aa Bb, is expected to produce ten combinations of dimer ODH molecules: AA, BB, Aa, Ab, aB, Bb, AB, aa, bb, ab, if both allelic and non-allelic complementation occur. If the last three combinations migrate to the same position, # 3, eight distinct mobilities might be expected, and seven have been observed. In 84 singly assayed individuals of the Darien strain of D. pellewae (Fig. 3), a sibling species of D. metzii, 27.4% possessed isozymes migrating to positions # 3-6 and were supposed to have had the genotype Aa bb; 26.2% had isozymes of pattern # 1-3 and were supposed to have been genotypically aa Bb; 35.7% showed a single isozyme at position # 3 and were presumably aa bb; 4.7% had a single isozyme at position # 1 and were apparently aa BB; while 3.5% possessed spaced isozymes at positions # 1, 3, and 6, and were thought to have been genotypically AA BB. The distribution of the dominant three groups of ODH isozymes; i.e., patterns # 3-6, # 1-3, # 3, as alternates in this unselected D. pellewae population implies that these represent a single functional enzyme system in vivo. The low frequency of individuals of presumed genotype AA BB indicates that non-allelic complementation involving A and B subunits may result in a poorly viable individual under crowded culture bottle conditions.

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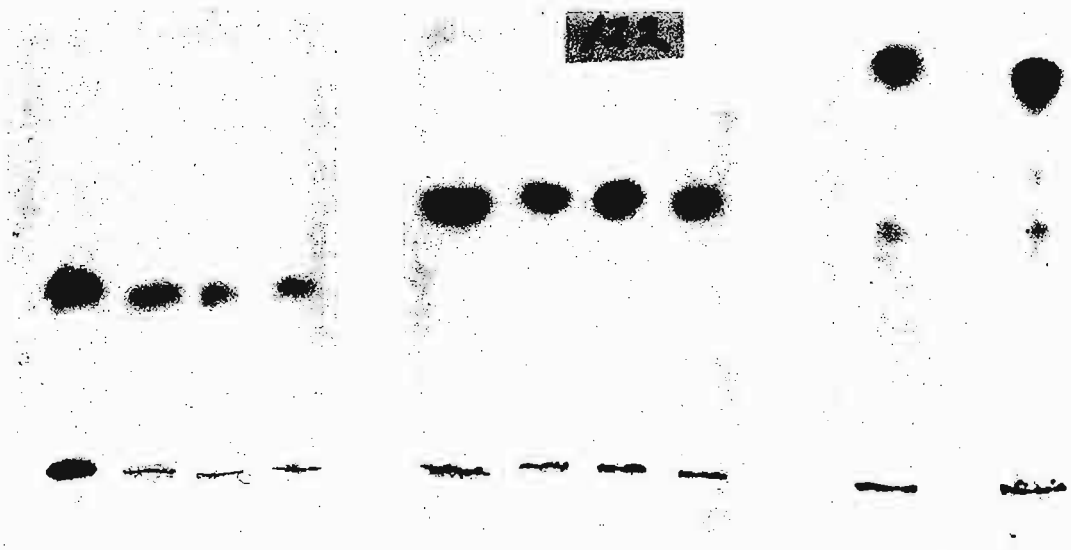


1a 1b 1c

Fig. 1.

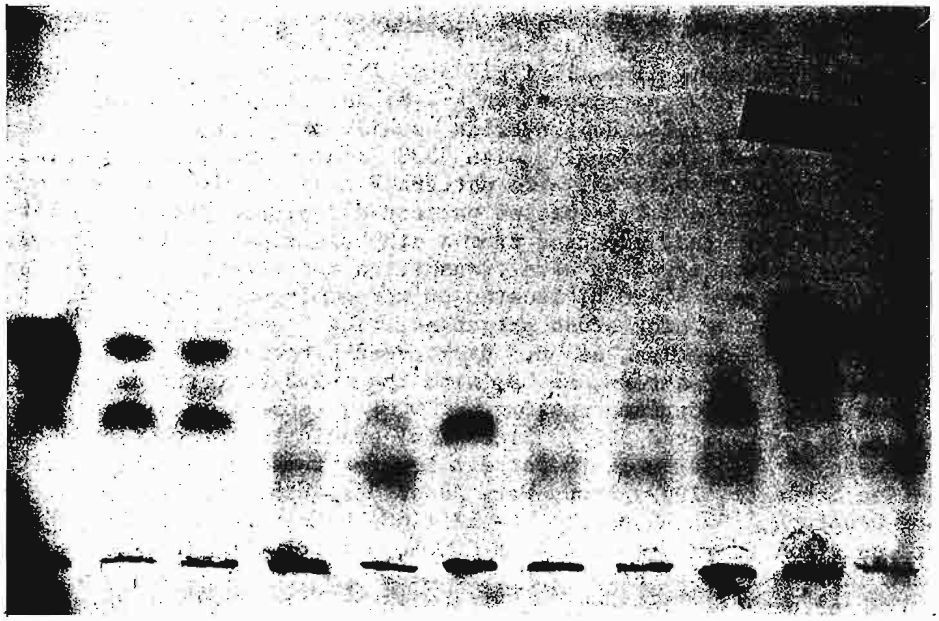
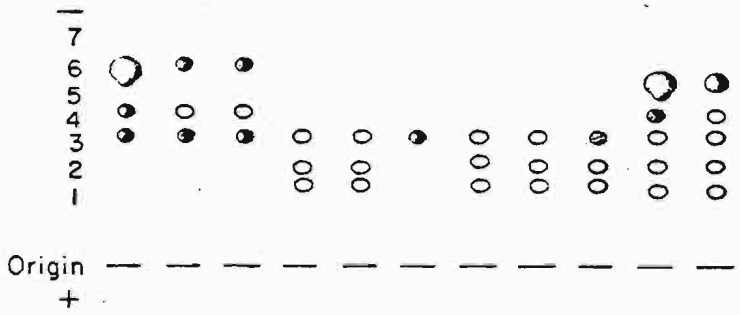


Fig. 2.



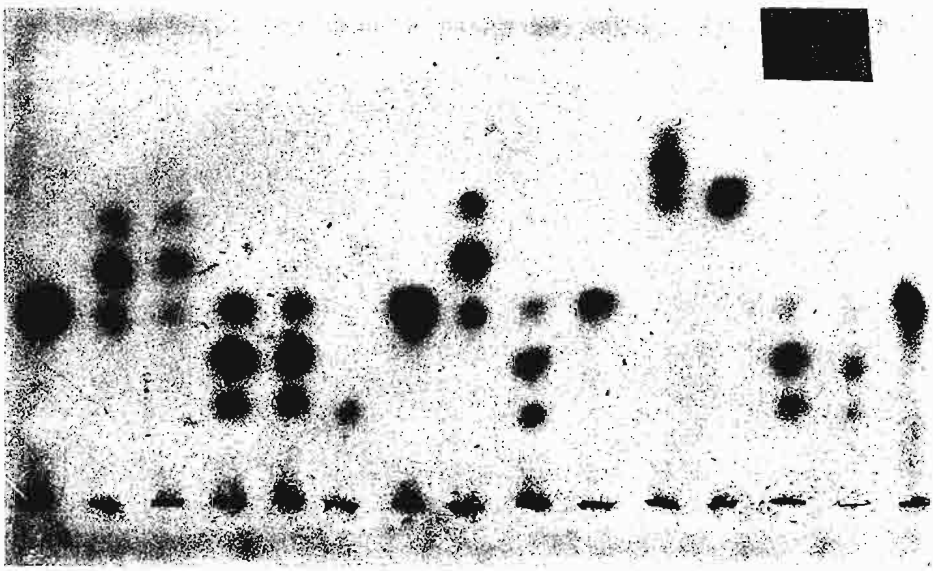


Fig. 3.