(2) $\chi^2 \approx \frac{([x_1 - x_1'] - 0.5)^2}{x_1'} + \frac{([x_2 - x_2'] - 0.5)^2}{x_2'}$ can be replaced by the simpler approximate formula (2), where $x_1' = n_1([x_1+x_2]/N)$ and $x_2' = n_2([x_1+x_2]/N) = x_1 + x_2 - x_1'$ are the expected absolute frequencies belonging to x_1 and x_2, respectively. This approximation can be derived as follows. When the formula for χ^2 is expressed in its extended version instead of by formula (1), we obtain:

(3) $\chi^2 = \frac{([x_1 - x_1'] - 0.5)^2}{x_1'} + \frac{([x_2 - x_2'] - 0.5)^2}{x_2'} + \frac{([y_1 - y_1'] - 0.5)^2}{y_1'} + \frac{([y_2 - y_2'] - 0.5)^2}{y_2'}$

where y_1' and y_2' are the expected absolute frequencies belonging to y_1 and y_2, respectively. For low mutation frequencies the contribution to χ^2 from the non-mutated units, y_1 and y_2, is so small when compared with the contribution from the mutated units, x_1 and x_2, that it can be neglected. It is this omission which transforms formula (3) to formula (2). In addition, the numerical computation carried out with formula (2) is facilitated by the fact that in formula (2), $([x_1 - x_1'] - 0.5)^2 = ([x_2 - x_2'] - 0.5)^2$, as can be shown by a simple consideration. Furthermore, when formula (2) but not when formula (1) is used, one automatically learns whether there is an expected absolute frequency (x') smaller than 5, and, therefore, whether the application of the χ^2 test is legitimate. Formula (2) could be expressed also in other ways; however, the numerical computations are carried out best when this formula is used as it stands.

Example illustrating the application of formula (2):

$x_1/n_1 = 100/1000 = 10.0\%$ (experiment 1)
$x_2/n_2 = 40/50 = 8.0\%$ (experiment 2)
(a) $x_1' = 1000([100 + 40]/1500) = 93.3$
(b) $x_2' = 100 + 40 - 93.3 = 46.7$
(c) $([x_1-x_1']-0.5)^2 = ([x_2-x_2']-0.5)^2 = 6.2 = 38.4$
(d) $\chi^2 \approx 1.24$ [The exact value, computed with formula (1) or (3), amounts to $\chi^2 = 1.36$.]

When the two frequencies to be compared with each other (e.g., one belonging to the treated, the other belonging to the control sample) are based on equal (or almost equal) sample sizes ($n_1 = n_2$), formula (2) can be simplified, because in this formula both x_1' and x_2' can now be substituted for $\frac{1}{2}(x_1 + x_2)$. We then obtain formula

(4) $\chi^2 \approx \frac{([x_1 - x_2] - 1)^2}{x_1 + x_2}$

Example illustrating the application of formula (4):

$x_1/n_1 = 30/5000 = 0.600\%$ (treated sample)
$x_2/n_2 = 5/5000 = 0.100\%$ (control sample)
$\chi^2 \approx ([30 - 5] - 1)^2/(30 + 5) = 16.46$ (The exact value, computed with formula (1) or (3), amounts to $\chi^2 = 16.52$.

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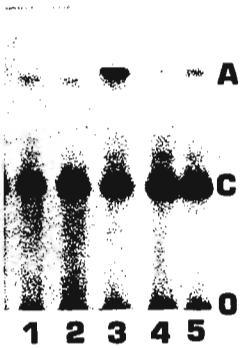
Triantaphyllidis, C.D. Aristotelian University of Thessaloniki, Greece. The esterase-A of D. auraria.

In three laboratory strains of D. auraria, an enzyme polymorphism of esterase A (Est-A) could be detected by means of starch gel electrophoresis. There exist two variants of Est-A with different electrophoretic mobility, which were called Fast and Slow (Fig. 1). To analyze the genetic basis of these electrophoretic variants, homozygous stocks for each of them were constructed. Then single-pair matings in many combinations were performed. The hybrids resulting from these crosses as well as the progenies resulting from the backcrosses and from F_1 x F_1 crosses were analyzed electrophoretically. The results showed that the two esterase A variants were controlled by codominant alleles at an autosomal gene. Heterozygous individuals show two electrophoretic zones, and there is no indication for the formation of a hybrid enzyme. As far as substrate specificity is concerned the two Est-A variants showed an α-naphthyl acetate specificity in an α-β mixture. Furthermore the Est-A zones show increased activity in the presence of 10 ml n-propanol in 100 ml



α-β-naphthyl acetate staining mixture. Also it is interesting that the Est-A zones have greater activity in the females than in the males (Fig. 1, no. 3).

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Fig. 1. Electrophoretic variants for the Est-A locus in D. auraria. 1-2: Est-A^S. 3-5: Est-A^F. O = origin, C = Est-C, A = Est-A.

Triantaphyllidis, C.D. Aristotelian Univeristy of Thessaloniki, Greece. Genetic localization of Est-C, Acph and w genes of D. auraria.

It has been established earlier that the esterase-C (Est-C) and acid phosphatase (Acph) variants of D. auraria are under the control of autosomal loci (Triantaphyllidis and Kastritsis 1976; Triantaphyllidis 1978). These two genes as well as the white eyes gene are unplaced on the chromosomes of D. auraria. For this reason crosses were made for their chromosomal localization. The results of crosses ♀ w x $+^w$ ♂ and ♀ $+^w$ x w ♂ showed that the w allele is recessive and sex-linked. On the other hand, in order to find if the Est-C and Acph loci are independent or linked, homozygous females of the form Est-C^S $Acph^{3-5}$ were crossed with homozygous males of the form Est-C^F $Acph^{1-3}$. Then heterozygous males or females Est-C^S $Acph^{3-5}$/ Est-C^F $Acph^{1-3}$ were backcrossed to Est-C^S $Acph^{3-5}$ females or males respectively. In the progenies of the first backcross only flies of the phenotypes Est-C^S $Acph^{3-5}$ and Est-C^F $Acph^{1-3}$ were found. Thus, the Est-C and Acph loci are linked in the same autosomal chromosome. In the progeny of the second reciprocal backcross 101 out of 254 offspring were recombinants (39.8%). Hence, the Est-C locus is about 40 map units away from the Acph locus. The existance of similar gene-enzyme systems in D. melanogaster (O'Brien and MacIntyre 1971) located in the third chromosome (positions 49.0 and 101.1 respectively) is a good indication that the Est-C and Acph loci are probably located in the same chromosome in D. auraria and the genes retained their ancestral position during the phylogeny of the two species. The difference between the two species with respect to the relative distances between the similar genes may depend on many factors. Work is now in progress in order to map the position of the cistron which codes for other gene-enzyme systems in D. auraria.

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References: O'Brien, S. and R.I. MacIntyre 1971, DIS 46:89-93; Triantaphyllidis, C.D. 1978, DIS 53:118; Triantaphyllidis, C.D. and C. Kastritsis 1976, Experientia 32:1277-1278.