Gehring, W. Yale University, New Haven Connecticut. A recessive lethal (l(4)29) with a homeotic effect in D. melanogaster.

During the examination of a group of fourth chromosome lethals kindly provided by B. Hochman, lethal pupae homozygous for l(4)29$^{b}$ were dissected and studied morphologically. Since some of those pupae die at a late stage when imaginal structures are already formed, it is possible to analyze the visible effects of the mutation on imaginal structures. Lethal flies show two kinds of homeotic transformations: 1) First and second antennal segments are transformed into leg structures; 2) second and third legs are partially transformed into first legs. The effects on the antenna can be summarized as follows: First and second antennal segments are reduced and replaced by a coxa and trochanter. Only a small portion of the second antennal segment forming the joint with the third segment is present. The third antennal segment appears normal but the arista is absent or reduced to a tiny undifferentiated vesicle. In addition, the palpus which is also formed by the antennal disk shows a disorderly arrangement of bristles and sensilla. Leg differentiation is affected in various ways. All three pairs of legs are distorted, segments are swollen and claws are missing. In the male all legs bear sex combs, those of the middle and hind legs often being incomplete. In both sexes the tibia as well as the basitarsus of all legs show transverse rows of bristles, which indicates a partial transformation of the second and third legs into forelegs. Whether the lethal effect and the described morphological alterations belong to the pleiotropic pattern of a single gene, or whether the mutation affects several genes, cannot be decided on the basis of the present genetic evidence. There are three mutants of this complementation group, l(4)29, 29$^{a}$, 29$^{b}$, which occurred spontaneously in wild populations. A brief examination of l(4)29 showed that this mutant had the same phenotype as l(4)29$^{b}$. The fact that recessive homeotic mutations are associated with a lethal effect is of interest with regard to studies on transdetermination[1,2] in cultures of imaginal discs. It might explain why homeotic mutations corresponding to several of the known transdeterminations have not yet been found.

The effect of various mutants known to produce a homeotic effect on the eye-antennal disk are summarized in Table 1. The table clearly indicates that the homeotic transformations are not random. Distal antennal structures are transformed into distal leg segments, while proximal antennal structures are replaced by proximal leg segments. The absence of both the arista and claws in l(4)29 provides further evidence for this proximo-distal correspondence. This may reflect an evolutionary homology of antenna and leg. However, other homeotic mutations like eyeless-ophthalmoptera, which induces the eye disk to form wing structures, apparently involve non-homologous organs.

Table 1. Homeotic transformations in various mutants affecting the eye-antennal disk.

| | Homeotic Mutants | | | | |
|---|---|---|---|---|---|
| Leg Structures Formed | ss[a] | l(4)29 | Antp | Ns | Head Structures Replaced |
| sternopleura | | | | + | prefrons + vibrissae |
| coxa | | + | (+) | + | 1st antennal segment |
| trochanter | | + | (+) | + | 2nd antennal segment |
| femur | | | + | + | 3rd antennal segment |
| tibia | | | + | + | 3rd antennal segment |
| tarsus | + | | + | + | arista |

\+ indicates leg structures formed and head structures replaced, respectively

1) Hadorn, E. 1966. Major Problems in Developmental Biology. ed. M. Locke, Academic Press, N.Y. 2) Gehring, W. 1968. Results and Problems in Cell Differentiation. Vol. 1, The Stability of the Differentiated State. ed. H. Ursprung, Springer, Berlin.