GENE EXPRESSION AND DEVELOPMENTAL RATE

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In *D. melanogaster* the genes *sc, D, L* and *vg* were used to demonstrate the extragenic transmission of factors which change the expression of these genes. Many environmental conditions such as composition of the food influence the developmental rate which in turn can be shown to be primarily responsible for changing the expression of the genes. Genetic modifiers may act indirectly on the expression of these genes by changing the degree of fertility which, through relative crowding, may change the developmental rate.

There is a parental effect which is presumably due to the size of the egg determining the developmental rate, environmental influences producing larger or smaller flies and thus determining the expression of the genes in the following generation.

There is a grandparental effect which can be shown to be transmitted through the sperm and which usually determines the expression of the genes more strongly than the parental effect.

The results can best be explained on the assumption that the various influences change the rate of reproduction of heterochromatic DNA in relation to euchromatic DNA and that, through extragenic transmission, these changes persist for at least two generations.

Introduction

In a previous publication (MAMPELL, 1965) it was shown that the expression of certain genes depended on the developmental rate. Some genes in *Drosophila melanogaster* such as *scute, Dichaete* or *Lobe* show stronger expression of the mutant gene with faster developmental rate, others such as *vestigial* show stronger expression of the mutant gene with slower developmental rate. There usually is a threshold region beyond which there is no noticeable change any more in the morphological expression of the gene.

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These genes show a sex difference in their expression, the male expressing the mutant gene more strongly in \textit{sc, D} and \textit{L}, the female expressing the mutant gene more strongly in \textit{vg}. This sex difference in expression was shown to be primarily due to the presence of a Y chromosome in the male and its absence in the female, because the expression of the mutant gene is changed in XO males to become more like that of the female.

These genes are commonly described as temperature sensitive. The effect of temperature could be correlated with the effect temperature has on speeding up or slowing down development because other influences on the developmental rate such as crowding or addition of certain substances to the food have the same effects as temperature. Those environmental influences mimic the effect which the addition or subtraction of the Y chromosome has on the expression of the genes. Since the subtraction of the Y chromosome does not noticeably change the developmental rate it can be supposed that the effect goes in the other direction, that is, that the developmental rate changes the amount of a substance associated with the Y chromosome such as heterochromatin which in turn changes the expression of the genes.

The effects of the treatment as well as the effects of the Y chromosome are transmitted extragenicly, presumably through the cytoplasm of the germ cells. It was not clear so far whether these parental effects were more maternal which is usually the case with parental effects, or more paternal which was the case I described for one of the mutator genes (Mampell, 1946). More data bearing on this point will be presented in this paper.

**The Interaction of Environmental Factors**

The composition of the food may have a profound effect on the expression of various genes. In these investigations the addition of salts such as sodium chloride, monosodium glutamate or sodium bicarbonate (in approximately half the lethal amounts) delayed development by one to three days at temperatures between 23° and 29°. This change in the developmental rate in turn may affect the expression of the genes markedly at certain temperatures. The cultures tested for the effects of these salts must be as strictly comparable as our knowledge of various other influences on the