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During the course of this study, gene expression of nuclear genes and those encoded in the organelles were examined in dosage series of various chromosome arms of maize. The results indicate that most chromosome arms produce trans-acting effects on genes encoded elsewhere in the genome. The extensive nature of these effects led to the concept that gene regulatory mechanisms in higher eukaryotes are dosage dependent in that the stoichiometry of the individual components of regulatory complexes affect the efficiency of the whole. This type of system can explain the behavior of quantitative traits and of aneuploid syndromes in which dosage dependent behavior of the controlling genes is implicated. Thus, the major control of the phenotype in multicellular eukaryotes is basically a reflection of the regulatory hierarchy. Interactions of the dosage dependent regulatory hierarchy in hybrids lead to non-additive gene expression. This effect is a likely contributor to the molecular basis of heterosis. The publications assembled to date that resulted from this award follow.

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