In early cleavage in Cecidomyiidae an elimination of chromosomes from somatic nuclei occurs, usually in the third, fourth or fifth division, depending on the species involved. The number of eliminated chromosomes (E chromosomes) is fairly constant. Metaphase of an elimination division is completely normal; all chromosomes split, and daughter chromatids separate. In anaphase the movement of all E chromosomes soon ceases, and they remain in the equator of the spindle. The other chromosomes (S chromosomes) reach the poles and are incorporated into daughter nuclei. After elimination is accomplished, all the somatic nuclei of the embryo have an incomplete chromosome set (2 S). Elimination fails to occur only in the nucleus of the mother germ cell, which at this time is already located in the pole plasm. In this nucleus all the chromosomes behave normally during the cleavage divisions, and it retains the full chromosome number (2 S + E), as do all of its descendants.

Experiments with the embryos of Wachtiella persicariae L. (Geyer-Duszyńska 1958, 1959), featuring the application of hair ligatures to the embryos, differential centrifugation of the embryos, destruction of various parts of the embryonic body by cauterization or destruction of single cleavage nuclei by irradiation with ultraviolet microbeams, have shown that the pattern of elimination is extremely constant. Whatever part of the embryo is destroyed, elimination always occurs in all somatic nuclei of the undamaged parts. If the nucleus of the mother germ cell is artificially retained in the somatic part of the embryo or shifted to this part, elimination occurs in this nucleus too. The only factor that inhibits elimination of E chromosomes and causes transformation of the elimination mitosis into a normal division is a homogeneous substance that stains deeply with hematoxylin. In untreated embryos this substance is localized in the meshes of the cytoplasmic
reticulum of the pole plasm, that is, within this region from which the mother germ cell will arise. If this substance is artificially removed from the pole plasm, the elimination of E chromosomes occurs in the nucleus of the mother germ cell. On the other hand, if shifted into the somatic part of the embryo, it is able to suppress elimination in any somatic nucleus present by chance in its vicinity and thus to transform the elimination division of this nucleus into a regular mitosis.

Somewhat similar suppression of elimination in somatic nuclei was obtained by Nicklas (1959) in paedogenetic embryos of Miastor sp. after centrifugation. The exceptional somatic nuclei retaining the full chromosome number were always located most posteriorly. Nicklas deduced that posterior cytoplasm has a property of active inhibition of chromosome elimination. It seems to me that this property is not ascribable to the posterior cytoplasm as a whole but to one of its constituents, namely, the polar granules. Nicklas has shown that the polar granules are composed of proteins and RNA. These granules are beyond doubt homologous to the homogeneous substance that stains deeply with hematoxylin in W. persicariae and to corresponding constituents present in pole plasm of other species of Cecidomyiidae. The experiments with centrifugation failed to provide information about their function, because in Miastor embryos the polar granules were not expelled from the posterior end as in embryos of W. persicariae.

Nicklas states that the chromosome elimination is a largely autonomous act of the chromosomes and can be prevented but not initiated by cytoplasmic factors. My experiments with W. persicariae showed that the process of elimination is completely independent of the presence or absence of any part of the embryonic body, except the homogeneous substance that stains deeply with hematoxylin, and that the cause of elimination must be sought in the sudden change, probably chemical, that occurs in the direct vicinity of the E chromosomes during elimination division. According to the hypothesis previously advanced (Geyer-Duszyńska 1959), this change is induced by a set of elimination genes, probably located in the E chromosomes and producing some substance that injures their centromeres. This injury could consist either of some morphological change in the centromere itself or of a change in the mitotic spindle that suppresses its function. Kraczkiewicz (unpublished) also has stated that elimination occurs as a consequence of defects in centromere function. Nicklas (1959) believes that the immediate cause of elimination must be sought in some failure in production of normal mid-anaphase tension, most probably because of the inactivation of chromosome fibers.

It seems that some decisive evidence on the actual mechanism of elimination could be obtained from the behavior of E chromosomes in