

II. — Evaluation des influences génétiques et maternelles lors des expériences d'élevage et leurs effets sur le dispositif expérimental

PROBLEMS IN ESTIMATING MATERNAL EFFECTS

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The basic problems inherent in the estimation of maternal effects are considered. A maternal effect is defined as an effect contributed to the phenotypic value of an offspring by his dam. The two most important problems are the confounding of the maternal effect of the dam and her genetic contribution to the genotypic value of her offspring and the possibility of a negative genetic correlation between the direct and maternal effect. Further, maternal effects are a generation behind the direct in their expression, they are sex limited or expressed only by the female, and they are expressed late in the life of the female. The literature on maternal effect theory is reviewed. A general genetic model for the study of maternal effects is developed. Then, problems arising in the estimation of genetic variance and covariance using covariances between relatives are studied followed by the examination of problems arising in the estimation of maternal effects for genetic groups and their cross combinations. The importance of knowledge concerning maternal effects is related to the design of creative breeding programs.

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It is clear that maternal effects are important in the early growth of mammals. Although these influences tend to diminish with age, there is substantial evidence that maternal influences are important for adult traits. Negative correlations between direct and maternal effects are indicated for beef and swine. Changes in methods of measurement or husbandry may alter these relationship. In swine and beef a negative covariance exists between maternal effects in adjacent generations. Thus alternative rearing systems are needed for maximum selection efficiency. Data from crossbreeding studies suggest substantial maternal effects for milk production in dairy cattle with breed maternal effects accounting for 40 to 70 per cent of the differences between breeds. Although intrabreed maternal effects have not been estimated, they may substantially reduce the effectiveness of progeny testing. Maternal influences play an important role in determining litter size in swine. Elimination of these may result in moderate heritabilities and successful selection for litter size. It is clear that further studies of the biological systems constituting maternal influence are needed.

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For a trait with a direct and a maternal component (lamb growth) both the direction of selection and the total selection response are demonstrated if selection is based on the records of various relatives. Considerable deviations from the "direct trait" model were found. Calculations regarding the relative efficiency of selection based on station and fields record showed that testing stations should be mainly used for within sire line selection.