twins, (b) that some of the cases are of the translocation mode, (c) that another mode of twinning exists (uniovular dispermatic twins), and (d) that an assumption of the test is violated. It is shown that explanation (c) is an equally likely predictor of the test result.

If uniovular dispermatic twins exist, it is estimated that they would constitute only about 1% of a random sample of twins, and their incidence in the general population is estimated to be about 9.6×10^{-5}. It is suggested that this alleged form of twinning be considered as a mutational event, rather than as a " mode " of twinning.

These estimations suggest that twin methodology would not be appreciably biased if alleged uniovular dispermatic twins were included in the test sample.

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THE PROBLEM OF GENOTYPE × ENVIRONMENT COVARIANCE IN THE ESTIMATION OF HERITABILITY FROM MZ AND DZ TWINS

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It is commonly, but incorrectly, assumed that the presence of genotype × environment covariance must necessarily reduce the heritability (h^2) as estimated from twin data, when the formula used to obtain h^2 makes no assumption about G × E covariance or assumes that it is zero. But, in fact, G × E covariance does not always reduce the genetic variance, and it can be shown under some conditions, an increase in the G × E covariance implies a greater genetic variance. The effect of G × E covariance on h^2, as estimated from data on MZ and DZ twins, depends jointly upon the degree of assortative mating and the degree of environmental correlation between MZ twins and between DZ twins. A method, based on the solution of a pair of simultaneous quadratic equations, is proposed for estima-

ting the range of h^2 from twin data under varying assumed values for assortative mating, the environmental correlations between MZ and DZ twins, and the G × E covariance. The solution of three simultaneous equations permits direct estimation of the genetic variance, environmental variance, and G × E covariance, under varying reasonable assumed values for assortative mating and the MZ and DZ environmental correlations. Examples of the method are based on intelligence test scores of MZ and DZ twins.

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ANALYSIS OF TWIN DATA AND ESTIMATION OF HERITABILITY EFFECTS

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In a statistical sense, the objective of twin research is to partition the variance on some criterion measure among genetic and environmental factors. Although certain elaborate models have been developed, these models do not supply a convenient test statistic to show which factors make a significant contribution. Consequently several procedures drawn from analysis of variance have been adapted for use with twin data. The general case is illustrated below.
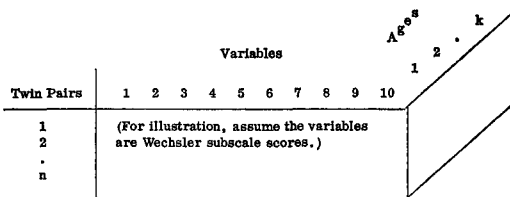
This design provides for the analysis of data that has been collected at successive ages, as in longitudinal studies; and it also pro-

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