A MAXIMUM LIKELIHOOD ESTIMATE OF DIZYGOTIC COTWIN GENETIC SIMILARITY: A GENETIC ANALYSIS OF QUANTITATIVE TRAITS

by

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ABSTRACT

MAXIMUM LIKELIHOOD ESTIMATE OF DIZYGOTIC CO-TWIN GENETIC SIMILARITY: A GENETIC ANALYSIS OF QUANTITATIVE TRAITS

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Classic twin methods assume equal environmental covariance for monozygotic (MZ) and dizygotic (DZ) twin pairs. That assumption constrains inferences drawn from such studies, especially when applied to traits that are social in content. As an alternate approach to these conventional methods, estimates of genetic similarity ($\hat{\pi}$) for DZ co-twins can be derived from genetic markers that assort independently at meiosis. The objective in this study was to consider whether sufficient variability of $\hat{\pi}$ existed across the sample, and if so, whether it related to within-pair variation for measured traits.

The study included 155 Caucasian male and female DZ twin pairs ages 13 to 30. Extensive analyses of blood, urine and saliva were performed on the co-twins and their parents, and the twins were assessed for several morphological, cognitive and behavioral measures. A computer program, GENSIM, was developed to calculate a maximum likelihood

estimate of genes identical-by-descent (IBD) for each twin pair utilizing Haseman's (1970) sib-pair probability tables.

The data revealed estimates of genes IBD, ranging from .92 to zero (mean = .515 $\pm$ .192). Larger within-pair variances were observed for the less genetically similar group for 14 of 16 morphological variables, reaching significance for weight ($p < .01$), left minimal wrist circumference ($p < .05$), height ($p < .03$), right middle finger length ($p < .01$), and right and left subscapular skinfold thickness ($p < .01$). Two of the measures of cognitive ability demonstrated similar results, with the DAT Space Relations Test significant at $p < .01$. Self-report ratings suggest that DZ co-twins who are uncertain or incorrect about their zygosity perceive themselves as more similar ($r = .38$), and belief regarding zygosity is significantly related to $\hat{\pi}$ ($r = .26$). Similarity of parental treatment was related to co-twin similarity in social experience, but it was independent of perceived co-twin similarity of behavior. Moreover, mothers' ratings of co-twin similarity of social experience and behavior were significantly related to $\hat{\pi}$ ($r = .31$).