LETTER

A genetic perspective on gender, culture, and mathematics performance

Both biological and social scientists have recently commented on the supposed greater variability of males in IQ tests and in mathematical achievement (1). Missing from these discussions is any consideration of possible genetic mechanisms that might be involved. To paraphrase Sir Arthur Eddington, "it is a good rule not to put overmuch confidence in the observational results . . . until they are confirmed by theory." But there is a theory that accounts for the observed results (2, 3). Given the mechanism of mammalian sex determination and the phenomenon of X inactivation, males will be more variable than females for any traits affected by genes located on the X chromosome. For any number of loci, the male variance is greater than the female by the fraction of loci that are on the X chromosome. If IQ were determined solely by genetic factors, the variance ratio between males and females could take any value between 1 and 2 depending on the proportion of relevant genes found on the X chromosome. The genetic explanation predicts that there should be female mathematicians as talented as any males or female dullards as untalented as any male. All that is required is a sufficiently large sample to permit such individuals to show up. Increased accessibility provides this larger population.

How well do the observed variance ratios for IQ in the UK (4) and mathematical ability (1) fit these models? All are consistent with the predicted range between 1 and 2. The observed IQ variance ratio falls between 1.07 and 1.17, depending on the component tested (4). In a study on the number of words per day used by males and females (probably measuring something quite different than IQ), the mean was statistically indistinguishable but the male variance was about 1.40 times greater (5). The finding that these ratios are less than the theoretical maximum implies that if genes are involved, not all are on the X chromosome and/or that nongenetic factors play a role; the greater the role of such factors the lower the difference in variance should be.

It is most unlikely that IQ and word usage are related to a single gene but are probably multigenic traits with major environmental influences. Studies on the possibly related trait of spatial ability, summarized in a review by David Boles (6) almost three decades ago, effectively eliminated a single major X-linked locus as responsible. More-recent studies considering a wider range of models have identified several traits affected by both X-linked and autosomal genes and environmental effects (3).

The questions proposed by Hyde and Merz (1) are examples of the ongoing debate about the relative roles of nature and nurture in human life. It should be clear that both are important. It might also be pointed out that the UK study (4) concluded that the difference in IQ scores related to sex was extremely small compared to the differences related to socioeconomic status.

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