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Reply to Willerman on Mongoloid–Caucasoid Differences in Brain Size

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Willerman's (1991) critique is based on an apparent misapprehension of the notion of relative brain size That Caucasoids are three standard deviations above the Mongoloid mean in body weight, but only two standard deviations higher in cranial capacity shows unequivocally that Caucasoids have relatively smaller brains than Mongoloids It translates into a relative advantage for Mongoloids of 1460 cm^3 versus 1446 cm^3 when body-size variables are controlled That body weight is a substantial predictor of cranial capacity is not in dispute, it is obvious when comparisons are made across species, for example, humans compared to elephants It is for this reason that attempts are made to scale brains to bodies using techniques such as the encephalization quotient

Willerman (1991) raised several points in his commentary, some of which I agree with, although they are presented as if in refutation of my article (Rushton, 1991) Other points are based on a misreading of what I wrote For example, Willerman (p 363) claimed that "unmentioned in Rushton's article, the Caucasoids have substantially greater *absolute* cranial capacity than the Mongoloids" (his emphasis) However, I stated that this was the case quite clearly in the first line of the results section "The unadjusted cranial capacity estimates for 4 Mongoloid samples averaged 1343 cm^3 and 20 Caucasian samples averaged 1467 cm^3" (p 354)

That Caucasoids are three standard deviations above the Mongoloid mean in body weight, but only two standard deviations higher in cranial capacity shows unequivocally that Caucasoids have relatively smaller brains than Mongoloids It translates into a *relative* cranial capacity advantage for Mongoloids of 1460 cm^3 versus 1446 cm^3 when body-size variables are controlled Willerman carried out an ANCOVA on these data and the result was nonsignificant He failed to mention, however, the power of the test, the difference would have to have been about 100 cm^3 to be significant with such small samples If the overall sample size of 57,378 individuals had been available, the 14 cm^3 difference would certainly have been significant It is a pity that the data recoverable from the NASA technical reports provided only the mean for each sample and not also its

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standard deviation When the relative brain weights were examined as encephalization quotients (EQs), the Mongoloid–Caucasoid difference was statistically significant

Willerman appeared to have misapprehended the implications of relative brain size His position, that body weight is a substantial predictor of cranial capacity, is not in dispute This becomes obvious when comparisons are made across species, where some mammals, such as elephants, have larger brains than humans Much of this larger brain, however, goes to control their larger bodies Thus, brain mass is scaled to body size using techniques such as the EQ derived from the regression of cranial capacity on general body size (Jerison, 1973) Across species, these quotients predict performance on visual discrimination learning tasks (e g , "Pick the same object each time to get food") in the same way that IQs do within children More intelligent children, assessed by standardized tests, learn these strategies faster than less intelligent children, and primates and other mammals with larger EQs learn faster than those with smaller EQs (Passingham, 1982) Therefore, Jerison (1982) claimed that EQ was a measure of the "biological intelligence" of various species

Willerman objected to my extrapolation of the EQ from macroscale comparisons across species to microscale comparisons across subspecies (races) Willerman complained that I ignored Jerison's (1990) "unambiguously stated" conclusion that the EQ cannot be applied within *Homo*. Jerison's (1990) opinion, however, was merely that, when between-species relationships, such as the EQ, are applied within-species, "the correlation is much lower and may fall to zero within-species effects are still poorly understood" (p 361) Although the EQ method of controlling body size may not be ideal (with a large sample size, ANCOVA would be better), in my article the use of the EQ reveals relationships that require explanation, not dismissal

Willerman's finding that Panels A to D in his Figure 1 all have the same *slope* is irrelevant The important point is that the Mongoloid–Caucasoid *intercepts* vary by 14 cm^3 Thus, at any given weight, and on average, Mongoloids have 14 cm^3 more brain volume than Caucasoids

The difference between Willerman's position and mine is quite small For my part, I stated in the discussion "It must be emphasized that the results reported here were not statistically powerful and much more research is required before any firm conclusions can be reached" (pp 354–355) For Willerman's (p 364) part, he acknowledged that "trustworthy studies already have demonstrated racial differences using direct measures of endocranial volume or brain size (Beals, Smith, & Dodd, 1984, Ho, Roessmann, Straumfjord, & Monroe, 1980) " It is my view, in addition, that externally measured head size produces the same average racial ordering as internally measured brain cases and wet brains at autopsy, that is, Mongoloid > Caucasoid > Negroid (for further evidence, see Jensen & Sinha, in press, Lynn, 1990, Rushton, 1990)

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