J Autism Dev Disord (2008) 38:995–996
DOI 10.1007/s10803-008-0553-y

LETTER TO THE EDITOR

# How to Test the Extreme Male Brain Theory of Autism in Terms of Foetal Androgens?

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Published online: 8 March 2008


**Dear Editor**

We are writing to comment on Falter et al's recent paper in JADD, "Visuo-spatial Processing in Autism: Testing the Predictions of Extreme Male Brain (EMB) Theory" which attempts to test 2 hypotheses. The authors present intriguing data regarding the degree of overlap between sexually dimorphic cognitive tasks and tasks that are altered in autism spectrum conditions (ASC).

However, mental rotation is not an ideal task for testing the elevated foetal testosterone (fT) hypothesis of ASC. As the authors themselves note, mental rotation is not correlated with 2D:4D (Falter et al. 2006) and girls with elevated exposure to fT as a result of congenital adrenal hyperplasia (CAH) are not faster or more accurate at mental rotation (Hines et al. 2003, Malouf et al. 2006). Hines argues that sex differences in mental rotation may arise from sex differences in *neonatal* testosterone rather than *prenatal* levels. While it is possible that prenatal and neonatal levels are correlated, no-one has tested this experimentally.

Secondly, whilst targeting appears to be a better index of fT exposure, in that females with CAH perform better on this relative to control females (Hines et al. 2003), the task used by Falter et al. is quite different from that used in the CAH study and did not show a sex difference in their 2006 study. It is also possible that problems with motor coordination (dyspraxia) in the ASC group (unrelated to fT exposure) affected their abilities on this task.

Thirdly, the embedded figures task was significantly related to 2D:4D in a larger sample of adults (Falter et al. 2006), but this relationship was not seen in the current study (probably due to low power). There is only one published report using a similar task in girls with CAH, who were masculinized on this task (Resnick et al. 1986).

It is difficult to find any cognitive measure which we can be certain is a proxy measure of fT exposure. If we are to use a cognitive task in this way, the focus should be on tasks where multiple different methodologies implicate fT, including studies of females with CAH, males with androgen insensitivity, correlations with digit ratio, and correlations with amniotic testosterone levels (Baron-Cohen et al. 2005).

Converging evidence is also needed when physical proxies are used. Digit ratios, while a promising measure, must be interpreted with caution given recent studies suggesting the ratios may not be stable in children (McIntyre et al. 2006), large variation with ethnicity (Manning et al. 2004), and the possibility that individual differences in 2D:4D may also reflect genetic differences unrelated to fT (Paul et al. 2006).

Rebecca Knickmeyer is supported by an NIMH training grant (T32 MH019111-13), a National Alliance for Autism Research (NAAR) Biomedical Grant, and the Foundation of Hope for Research and Treatment of Mental Illness. Simon Baron-Cohen, Bonnie Auyeung, and Emma Ashwin's work is supported by the Nancy Lurie-Marks Family Foundation and the Medical Research Council (MRC) UK. In addition Bonnie Auyeung is supported by a scholarship from Trinity College, Cambridge.

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