Heterozygocity of the Major Histocompatability Complex predicts later self-reported pubertal maturation in males

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Introduction

- r/K selection theory involves a crucial trade-off between the number of offspring produced and the timing of reproduction (Walker et al, 2006).
- r-selected species reach sexual maturity rapidly and produce many offspring, to which they provide little parental care. This comes at a cost of a shorter lifespan relative to K-selected species who produce fewer offspring over a longer lifespan.
- In recent years there has been a growing interest in examining Life History theory as an individual difference variable within species, including humans.
- Yet to date, no research has directly examined trade-offs between somatic maintenance (e.g., general immunocompetence) and pubertal development.
- the "heterozygote advantage" hypothesis suggests that Heterozygosity at the Major Histocompatability Complex (MHC), the greatly polymorphic loci that control immunological recognition of pathogens, provides a selective advantage by enhancing resistance to infectious diseases.
- The present study examined whether MHC heterozygocity correlates with later reported pubertal development in males.

Method

Sample. 137 undergraduate men aged 18 to 39 (M = 22.7, SD = 4.7).

Pubertal Development. The Modified Pubertal Development Scale (PDS) (Doll et al., 2016; Petersen et al. 1988) asked participants to retrospectively report on their pubertal development. An example item is: "Do you think you began growing facial hair and shaving any earlier or later than most other boys?" Responses ranged along a 5-point scale from "much earlier" to "much later," and a sixth option of "don't know." Items covered relative timing of voice change, growth spurt, body and facial hair growth, skin changes, spontaneous erections, wet dreams, and development in general. We targeted relative pubertal timing and absolute timing (age or grade in school) separately, following previous research showing that perceptions of relative timing correlate highly with absolute timing, and because participants can better recall the timing of events relative to peers (Beltz & Berenbaum, 2013).

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Method (Continued)

Both the relative (α = .77) and absolute (α = .91) subscales demonstrated good internal consistency and were positively correlated with one another, r = .649, p = .001 (two-tailed).

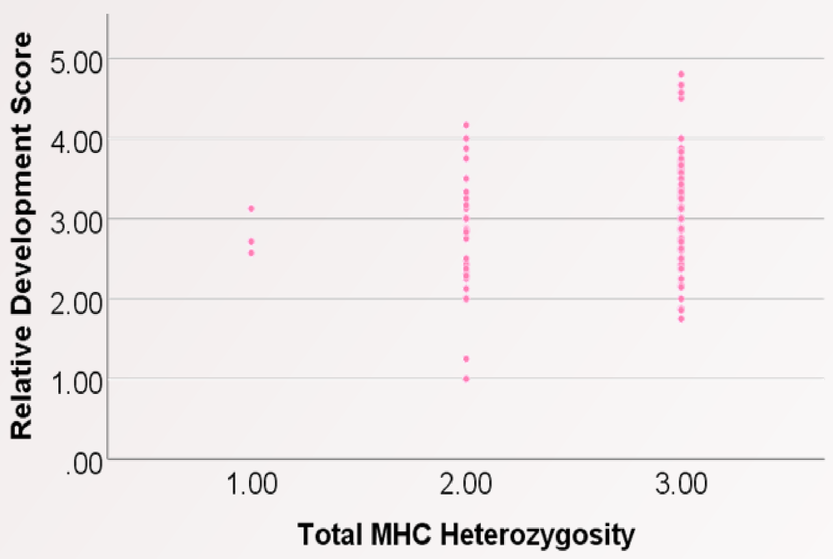
MHC Heterozygocity. Participants provided a whole-blood sample in an EDTA (to prevent clotting) vacutainer tube via venipuncture with a 21-gauge needle conducted by the PI (Arnocky) in the Human Evolution Laboratory. Samples were frozen at -80 degrees Celsius until mailed to the HLA typing Laboratory at Queen Elizabeth II Health Sciences Center in Halifax Nova Scotia. Here, DNA was extracted from the whole blood using a denatured PCR product.

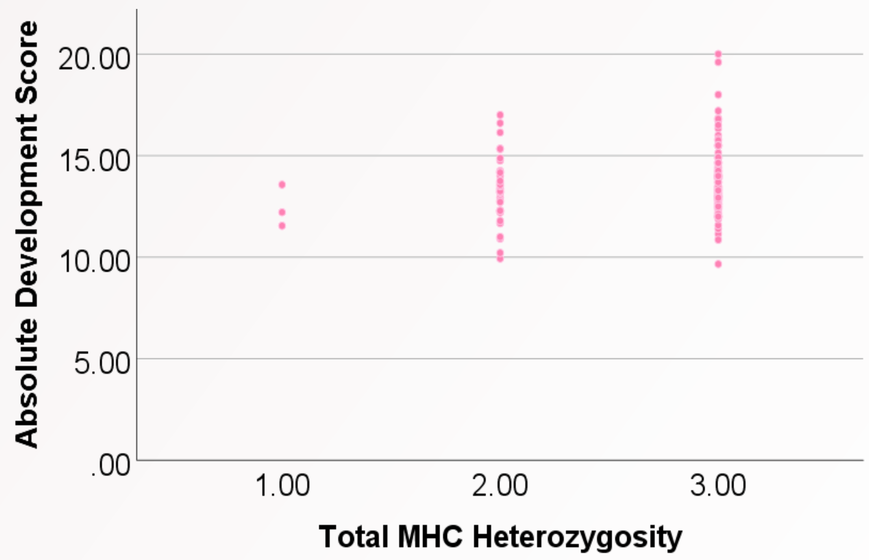
MHC heterozygocity at loci *HLA-A*, *HLA-B*, and *DRB-1* was typed by polymerase chain reaction (PCR) using allele-specific primers to amplify PCR products. The presence or absence of a PCR product in each reaction was determined by resolving the products on 1.5% agarose. We selected these particular loci because previous research has identified them to be among the most polymorphic in humans. For each marker, participants were scored with a '0' when they were homozygous and '1' when they were heterozygous. Total heterozygocity was summed across the three loci. Previous research has shown that male heterozygocity at these loci corresponds with female ratings of their facial attractiveness and attractiveness of their scent.

Results

MHC Heterozygocity. MCH heterozygocity correlated with participants' self-reported relative pubertal development scores in the expected direction, such that men with more MHC heterozygocity across the HLA-A, HLA-B, and DRB-1 loci reported slower pubertal development relative to their peers, r = .236, p = .006 (two-tailed). The relationship with absolute development was marginally significant, r = .156, p = .07 (two-tailed) in the same direction.

Figure 1. Scatterplot visualizing links between MHC heterozygocity and relative pubertal development (Left) and absolute pubertal development (Right)





Conclusion

Here we present the first evidence, from a sample of young Canadian men, that heterozygocity of the Major Histocompatability Complex (MCH), as a putative marker of robustness of the individual's immune systems, predicts self-reported delays in pubertal development relative to one's peers. This finding supports the potential for identifying individual differences in sexual maturation based upon examination of the MHC.

References

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