Sources of variation in unexplored maternal hormone traits, the thyroid hormones: individual plasticity, heritability and among-population variation

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As maternal hormones profoundly influence offspring phenotype, the plasticity of maternal hormone transfer represents mothers’ capacity to influence their offspring non-genetically. Among all maternal hormones, thyroid hormones (THs) – triiodothyronine (T3, active form) and thyroxine (T4, prohormone) – are crucial for embryonic development but their ecological and evolutionary significance is poorly known. We used multiple unique datasets to study plasticity in maternal THs in eggs of a common ecological model, the great tit (Parus major). We studied 1) individual plasticity in egg THs using longitudinal data from a single wild population across four years; 2) heritability in egg THs using data from full-siblings from captivity; 3) variation within and among populations in egg THs across the species’ whole breeding range in Europe. We found significant between-individual variation in the average hormone level but not in plasticity of T3, and the opposite pattern for T4 in the wild population. T4 also showed significant individual variation in plasticity within clutches. T3, but not T4, was moderately heritable. There was larger variation in egg TH levels within populations than among populations, suggesting no signal for local adaptation. Together, these results suggest that selection may favour a stricter control of the biologically active form T3, while deposition of prohormone T4 may be more flexible and vary with environmental conditions. Whether the plasticity of maternal T4 facilitates anticipatory maternal effects, and which factors determine its variation, however, requires further studies.