SUPPLEMENTARY MATERIAL

**Methods**

Antioxidants and androgens concentrations were log-transformed for all analyses. To take phylogeny into account, we used the phylogeny from Jetz *et al.* (2012) available on birdtree.org. This website does not provide one unique consensus tree, but samples trees from a pseudo-posterior distribution. We randomly extracted 25 different trees from the pseudo-posterior distribution, ran one model per tree and averaged the parameters over the 25 trees. For each model, the MCMC chains were run for 220 001 iterations with a burn-in interval of 20 000 to ensure satisfactory convergence. A total of 1000 iterations were sampled to estimate parameters for each model. We checked that autocorrelation levels among samples were lower than 0.1. We used poorly informative priors for the variances.

Note that the trees from Jetz et al. (2012) were extracted from the Ericson trees with 9,993 tips. They thus include species with no genetic data, and with random resolution of these tips with no genetic data. Note however that only 6 species from our dataset (*Apus caffer*, *Bostrychia hagedash*, *Parus cinerascens*, *Prinia flavicans*, *Vanellus armatus*, *Vanellus coronatus*) had no genetic data when these trees were built. Excluding these species, and building trees from the Ericson trees including only the 6,670 species with genetic data yielded results that were similar both qualitatively and quantitatively.

*Sample sizes*. Of the 112 species with carotenoid and vitamin E data, nine had no egg mass or clutch size data, resulting in a total of 103 species available for the analyses. With regards to the testosterone vs A4 relationships, we had data for 101 species, but no egg mass or clutch size data were available for three species, so the analyses were conducted on 98 species. Finally, for the analyses considering the relationship between carotenoid/vitamin E and testosterone/A4, we had data for 78 species, but lacked egg mass or clutch size for three of them, resulting in a total of 75 species used for the analyses.

**Phylogenetic tree used in the analyses (note that this is one of the 25 trees that were used, as all of them were highly similar).**



Table S1: Models testing for inter-specific associations between yolk concentrations in carotenoids and vitamin E, and between yolk concentrations in testosterone and A4 (a), and models testing for inter-specific associations between yolk concentrations in antioxidants (carotenoids and vitamin E) and androgens (testosterone and A4). Adult body mass, instead of egg mass, is included as covariable. We used the MCMCglmm R package and included phylogeny as random factor. See main text for details. pm = posterior mean; CI = credibility interval.

a.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Response variable | Explanatory variables | pm | CI | pMCMC | n |
| Carotenoid concentration | Vitamin E | 0.489 | [0.263; 0.710] | <0.001 | 106 |
|  | Clutch size | 0.053 | [-0.044; 0.147] | 0.286 |  |
|  | Adult body mass | 0.000 | [-0.000; 0.000] | 0.887 |  |
| Testosterone | A4 | 0.274 | [0.126; 0.426] | 0.002 | 99 |
|  | Clutch size | -0.030 | [-0.092; 0.035] | 0.357 |  |
|  | Adult body mass | 0.000 | [-0.000; 0.000] | 0.825 |  |

b.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Response variable | Explanatory variables | pm | CI | pMCMC | n |
| Carotenoid concentration | Testosterone | 0.094 | [-0.221; 0.408] | 0.557 | 76 |
|  | Clutch size | 0.089 | [-0.017; 0.194] | 0.103 |  |
|  | Adult body mass | -0.000 | [-0.000; 0.000] | 0.960 |  |
| Carotenoid concentration | A4 | -0.049 | [-0.301; 0.212] | 0.709 | 76 |
|  | Clutch size | 0.091 | [-0.015; 0.200] | 0.099 |  |
|  | Adult body mass | 0.000 | [-0.001; 0.001] | 0.964 |  |
| Vitamin E | Testosterone | 0.261 | [0.033; 0.488] | 0.028 | 76 |
|  | Clutch size | 0.067 | [-0.017; 0.152] | 0.121 |  |
|  | Adult body mass | -0.000 | [-0.000; 0.000] | 0.607 |  |
| Vitamin E | A4 | 0.065 | [-0.126; 0.257] | 0.507 | 76 |
|  | Clutch size | 0.072 | [-0.015; 0.159]] | 0.101 |  |
|  | Adult body mass | -0.000 | [-0.000; 0.000] | 0.697 |  |

Figure S1. Association between egg yolk concentration in testosterone and androstenedione (in pg.g-1) in 98 bird species. *p*MCMC comes from a model including clutch size and egg mass as covariable, and phylogeny as random variable (see text and Table 1 for details).

