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This document is part of a collection that serves two purposes. First it is a public archive for data and documents resulting from evolutionary, ecological, and behavioral research conducted by the Ketterson-Nolan research group. The focus of the research is an abundant North American songbird, the dark-eyed junco, *Junco hyemalis*, and the primary sources of support have been the National Science Foundation and Indiana University. The research was conducted in collaboration with numerous colleagues and students, and the objective of this site is to preserve not only the published products of the research, but also to document the organization and people that led to the published findings. Second it is a repository for the works of Val Nolan Jr., who studied songbirds in addition to the junco: in particular the prairie warbler, *Dendroica discolor*. This site was originally compiled and organized by Eric Snajdr, Nicole Gerlach, and Ellen Ketterson.

Context Statement
This document was generated as part of a long-term biological research project on a songbird, the dark-eyed junco, conducted by the Ketterson/Nolan research group at Indiana University. For more information, please see IUScholarWorks (https://scholarworks.iu.edu/dspace/handle/2022/7911).

Maternal effects and attractive plumage in dark-eyed juncos

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1. Maternal effects may have important consequences for the evolution of sexually selected traits.

Maternal effects:

- May influence both the strength and direction of the evolutionary response to sexual selection (Cheverud and Moore 1994)
- May help maintain associations between sexually selected traits and quality (Wolf et al. 1999, Qvarnström and Price 2001)
- Are commonly mediated via yolk testosterone in birds (Groothuis et al. 2005, Strasser and Schwabl 2004)

2. Do maternal effects explain variation in tail white, a sexually selected trait in dark-eyed juncos?

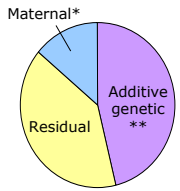
Tail white:

- White patch on the outer rectrices
- Measured as Σ (white area/total area)
- Found in both sexes, but males have larger patches
- Females prefer males more tail white (Hill et al. 1999)
- In nature, sexual selection favors larger males with whiter tails (McGlothlin et al. 2005)

Methods:

- Used pedigree of 397 nestlings with genetic parents (611 total birds, 1990-1996)
- Genetic parents determined using mini- and microsatellites
- Analyzed pedigree using restricted maximum likelihood (DFREML, Meyer 2001)
- DFREML uses all relationships among individuals to partition phenotypic variance into additive genetic, maternal, and residual variance components
- DFREML model corrected for effects of sex and hormonal treatment of local male (Ketterson et al. 2001)

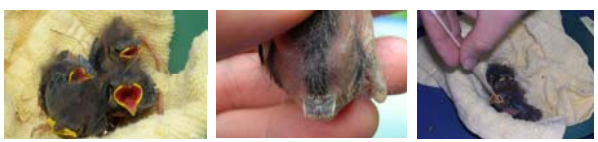
3. Maternal effects explained some variance in tail white.



- 13.8% of variation was maternal ($p < 0.05$)
- In comparison, size-related traits did not show significant maternal variation (wing length and tail length, maternal effect < 2%)
- A similar model showed no significant paternal effect

4. Is the maternal effect on tail white mediated by variation in yolk testosterone?

- Implanted females with testosterone filled (T-females, 47) or empty (C-females, 52) implants in April-May 2005
- In previous studies, T-females had twice as much yolk T as C-females (Clotfelter et al. 2004)

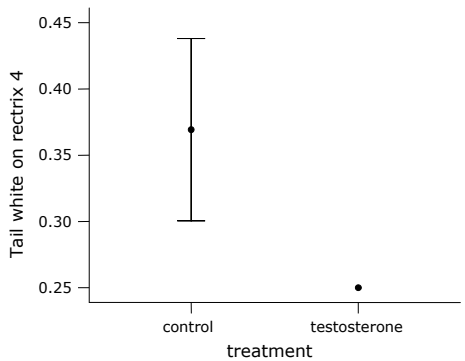


- Collected entire broods of nestlings at day 6
- Feather primordia develop in the egg, linear feather growth does not occur until after day 6

- Hand-reared 59 nestlings to independence
- Measured tail white when fully grown
  - Preliminary measurements estimated by eye in 5% increments (only rectrix 4, represents most variation, Wolf et al. 2004)
  - Final measurements to be made using MetaMorph image analysis

5. The effect of yolk testosterone on tail white is unclear.

- T implants delayed or suppressed breeding, so sample sizes were very uneven (20 C broods, 2 T broods)
- Extensive feather breakage and wear further reduced the available sample size (13 C nestlings, 1 T nestling)



- Due to small sample size, could not detect effect of maternal testosterone ($p = 0.64$)

6. Future studies will reexamine the role of maternal yolk testosterone for tail white development.

- In fall 2005, birds from this study will be induced to grow new feathers, allowing some inference from this year's experiment
- In 2006, females may be implanted later in the season or eggs may be injected with testosterone

Thanks!

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