

## Ketterson / Nolan Research Group Collection

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>).

### License/Disclaimer Statement

By downloading this document or using any information contained therein, you agree to the license terms outlined at <https://scholarworks.iu.edu/dspace/handle/2022/15256>, which explain terms governing use, creation of derivative research, and requirements for citing the document.



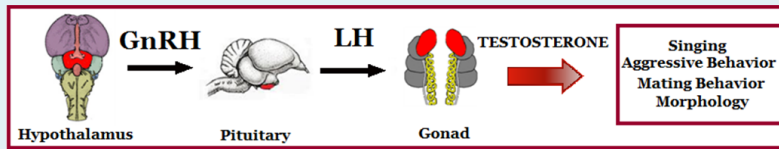
## Size, Sensitivity, and Signal: Examining sources of variation in gonadal testosterone production in two subspecies of the dark-eyed junco (*J. hyemalis*)

Sonya P. Jayaratna, Christine M. Bergeon Burns, Kimberly A. Rosvall, and Ellen D. Ketterson

Department of Biology and Center for the Integrative Study of Animal Behavior, Indiana University, Bloomington, IN, USA 47405



VIRGINIA



SOUTH DAKOTA



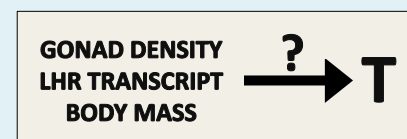
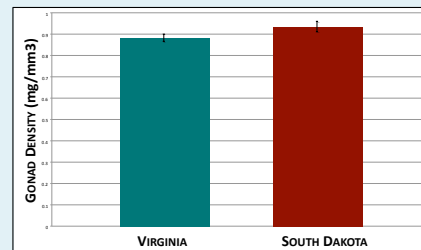
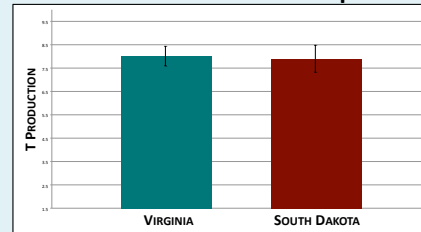
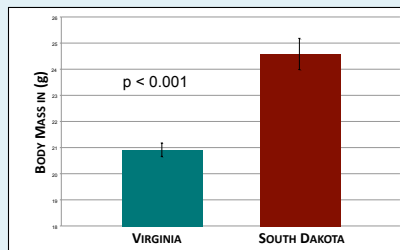
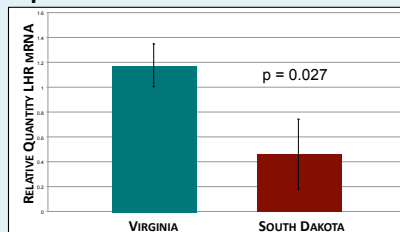
### Average quantity LHR mRNA and Body Mass Differ, T production and Gonad Size Do Not Differ Across Males of Both Populations

#### INTRODUCTION

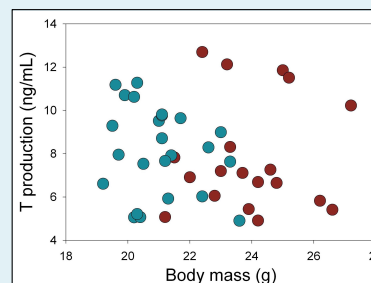
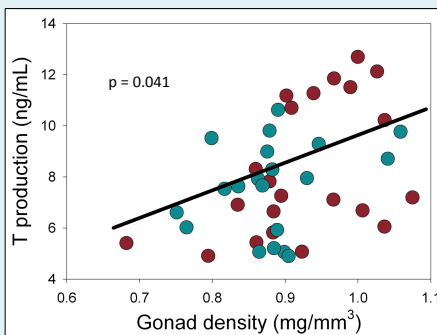
- We wish to understand the evolution of behaviors mediated by hormones. This requires more understanding of the evolution of hormone systems.
- Juncos breeding in South Dakota are larger, more ornamented, and more aggressive than juncos breeding in Virginia. They also appear to produce higher levels of testosterone (T).
- Variation along the HPG axis may contribute to individual or population differences in T.
- Specifically, can the size of the gonad, body mass, or relative amount of LH receptor (LHR) predict T production in response to LH? What relationships exist across subspecies?

#### METHODS

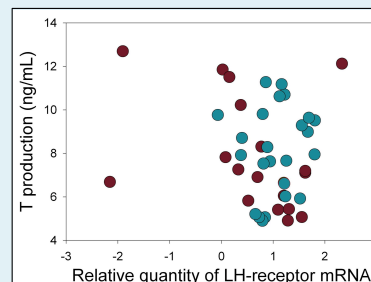
- Captured male juvenile juncos from VA (n=25) and SD (n=19)
- Administered three hormone challenges at maturity
- Assessed plasma T levels using EIA kit following LH injection
- Sacrificed and weighed individuals
- Collected and measured gonads
- Extracted mRNA and performed qPCR on cDNA to determine mRNA expression of LH-receptor in gonad
- Investigated predictors of T using multiple regression and determined population differences using MANOVA



#### Gonad Density is a Significant Predictor of T Production in Males



#### Body Mass and Quantity LHR mRNA Fail to Predict T Production in Males



#### CONCLUSIONS

- In nature, populations differed in T production, in a common garden they did not.
- A significant difference between these populations ( $p < 0.001$ ) is driven by body mass and LHR transcript quantity.
- Gonad density is a significant predictor of T production among individual males.

#### FUTURE DIRECTIONS

- We will investigate other points of variation along the HPG axis.
- Ongoing work will reveal sensitivity of the anterior hypothalamus to T and whether these populations differ in LH in response to GnRH.
- In the future we may examine sensitivity of the pituitary to GnRH. Also, qPCR studies may be performed to consider other genes in the gonad that could explain individual differences in T production.

#### ACKNOWLEDGMENTS

- LH-R primer sequence was provided by Demeseu Abebe and Donna Maney. Many members of the Ketterson lab provided valuable assistance for this project in the field, lab and aviary. We are especially thankful for contributions by Mark Peterson, Kaitlin Roth, and Rose Stewart. Funding provided by NSF, NIH, and the IU Center for the Integrative Study of Animal Behavior.

#### REFERENCES

- Hau, M. (2007). *BioEssays* 29(2): 133-144.
- Ketterson, E. D., J. W. Atwell, et al. (2009). *Integrative and Comparative Biology* 49(4): 365-379.
- McGlothlin, Joel W., Danielle J. Whittaker, et al. (2010). *The American Naturalist* 175(6): 687-701.