

## 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>).

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# Seasonal Changes in Immunity and Possible Mediation by Testosterone in Dark-eyed Juncos.



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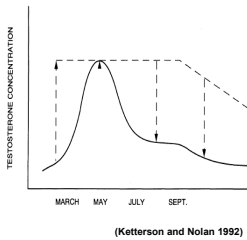
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## Introduction

- Measuring components of the immune system can give insight into life-history strategies and possible trade-offs.
- Immunoglobulin G (IgG) is the most important circulating antibody and can serve as a proxy for immune function.
- Testosterone (T) mediates numerous secondary sexual characteristics that directly influence reproductive success.
- In some animals, experimentally elevated testosterone decreases survivorship.

## Testosterone Levels Vary across the Breeding Season

- Testosterone levels are highest during the pre-breeding period, during territorial establishment and pair-formation.
- T levels drop as the breeding season progresses.



## Experimentally Elevated Testosterone Suppresses Immune Function

- Prolonged elevation of T in Dark-eyed Juncos suppresses cell-mediated (PHA) and humoral (Sheep Red Blood Cell) immune responses.
- Testosterone may act to direct energy reserves towards reproduction and aggression and away from self-maintenance.
- Experimentally elevated T leads to faster loss of mass in males suggesting an energetic trade-off

## How Do Basal Testosterone Levels and Basal Immunoglobulin-G Levels Co-vary Across the Breeding Season?

## Testosterone and IgG levels across the Breeding Season

### Study species:

The Dark-eyed Junco (*Junco hyemalis*) is a socially monogamous songbird that breeds at high elevations in the Appalachian mountains (>1000 m).



### Sampling across the breeding season:

- Juncos were mist netted from mid-April thru early August 2004 near Mountain Lake Biological Station, Giles co. VA.
- Blood was drawn from the alar vein and centrifuged to separate plasma from RBC.
- Plasma samples for both T and IgG were stored separately and frozen (-20°C) until they were assayed.

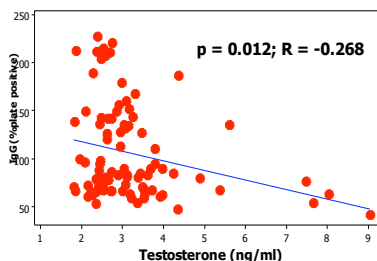
### Measuring IgG:

- Plasma was analyzed for IgG using an Enzyme-Linked Immunosorbant Assay (ELISA)

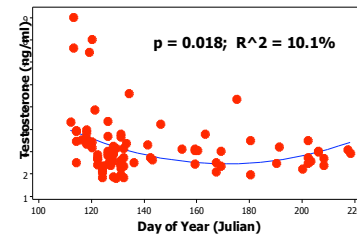
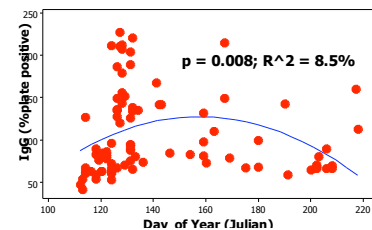
### Measuring Testosterone:

- Plasma T levels were measuring using a standard Enzyme Immunosorbant Assay (EIA).

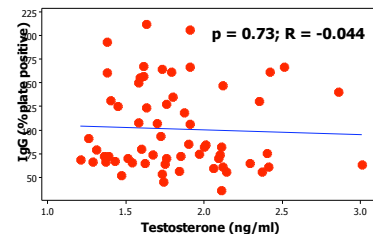
## Male IgG and Testosterone Levels Were Negatively Correlated



## Male IgG and Testosterone displayed opposite patterns across the Breeding Season



## Female IgG and Testosterone did not Co-vary



## Summary

- IgG levels in males were significantly negatively correlated with Testosterone.
- IgG varied seasonally with lowest levels early during territorial and pair formation, and highest levels during the middle of the summer when birds are raising their young.
- Testosterone levels displayed an opposite pattern with lowest levels during the middle of the season when young are reared, and highest levels early, during mate-formation and territorial establishment.
- This observational study of natural levels of T and an immune parameter (IgG) supports the hypothesis that testosterone is immunosuppressive

**Acknowledgements:** We would like to thank the Jackie Gaudioso and Charles Ziegenfus for assistance in the field, Jen Grindstaff for help with the IgG assay, and Jill Lodde for support and assistance.