Effects of paternal deprivation on nestling zebra finches (*Taeniopygia guttata*)

Emily Giddens, Angela Riley, Dr. Jennifer Grindstaff
Department of Integrative Biology, Oklahoma State University

Howard Hughes Medical Institute

Introduction

- Early interactions between parent and offspring are critical for normal stress physiology and development in birds[1].
- Previous studies have analyzed the effects of maternal removal on offspring, but have not determined the impacts a lack of **paternal** interaction[2].
- Determining the short- and long-term effects of paternal deprivation on offspring will increase our understanding of the importance of bi-parental care and create paths for further research to determine how paternal deprivation affects other species.

Research Question

- How does a lack of paternal interaction during the developmental stage of zebra finches affect their behavior as adults?
- We predict that early removal of a father from a nest will increase negative impacts on the behavior of adult offspring.

Methods

- Zebra finches were randomly assigned to 1 of 2 groups:
  - Control group: nest of zebra finches with both parents present
  - Paternal removal group: father was removed at the hatching of the youngest offspring
- Nests were built in nesting boxes attached to the side of cages, and nest cameras were set up inside the cages to record parental behaviors[3].
- Daily videos were taken in increments of 1 hour every 2 days from post-hatch day 1 until day 18.
- Parental behaviors were quantified using Behavioral Observation Research Interactive Software[4].

Behavior	Definition
nest attendance	complete entrance into the nest
allopreening nestlings	grooming nestlings
feeding nestlings	feeding nestlings
brooding nestlings	sitting atop nestlings
nest visit	incomplete nest visit

Figure 1. Ethogram of parental behaviors, including nest attendance, allopreening nestlings, feeding nestlings, brooding nestlings, and nest visits.

Figure 2. Female zebra finch brooding nestlings.

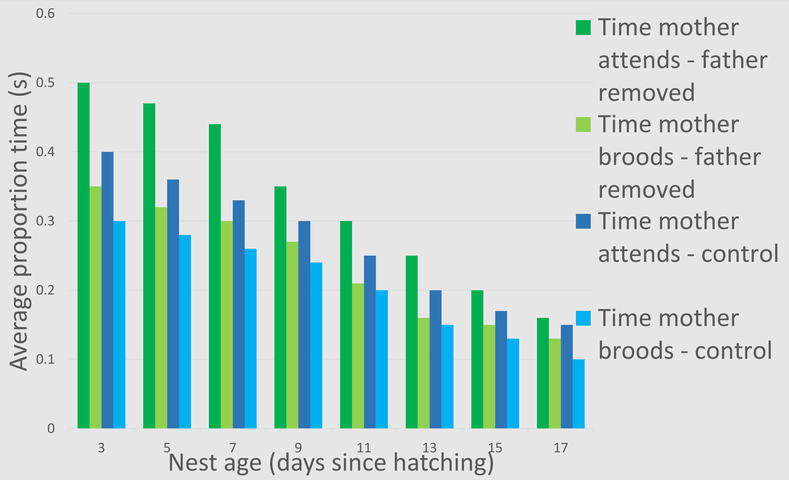

Figure 3. Predicted results of the average proportion time females spend attending to the nest and brooding over 8 recording periods.

Predicted Results

- We have recordings of 19 nests, but are still quantifying the behaviors in each video.
- We predict mothers will attempt to compensate for the loss of paternal care by increasing their care, as seen in Figure 3.
- We predict females will not be able to **fully** compensate, and as a result, young will have fewer interactions with a parent in male removal groups.
- The reduction in parental care is expected to impact the social behavior, learning ability, and stress of offspring.

Future Work

- Disruption of the parental pair bond increases the production of the hormone corticosterone (CORT) in response to a stressor in juvenile zebra finches with potential effects on physiology and behavior[3]. We will be able to test for these effects in our study.
- Previous avian studies have revealed that nestlings left unattended for longer periods of time during the nestling stage have higher baseline CORT levels[5].
- Once video behaviors are quantified during the nestling and fledgling stages, we will quantify CORT levels in blood samples collected from mothers and offspring to identify the physiological consequences of paternal deprivation on the stress physiology of zebra finches.

References

[1] Lundberg, S. M. Martinsson, I. Nylander, and E. Roman. 2017. Altered corticosterone levels and social play behavior after prolonged maternal separation in adolescent male but not female wistar rats. *Hormones and Behavior*, 87:137-144.

[2] Banerjee, S.B., A.S. Arterbery, D.J. Fergus, and E. Adkins-Regan. 2012. Deprivation of maternal care has long-lasting consequences for the hypothalamic–pituitary–adrenal axis of zebra finches. *Proceedings of the Royal Society of London B: Biological Sciences*, 279:759-766.

[3] Crino, O.L., K.L. Buchanan, B.B. Fanson, L.L. Hurley, K.O. Smiley, and S.C. Griffith. 2017. Divorce in the socially monogamous zebra finch: Hormonal mechanisms and reproductive consequences. *Hormones and Behavior*, 87:155-163.

[4] Friard, O. and M. Gamba. 2016. BORIS: a free, versatile open-source event-logging software for video/audio coding and live observations. *British Ecological Society*, 7:1325-1330.

[5] Rensel M. A., T.E. Wilcoxen, and S.J. Schoech. 2010. The influence of nest attendance and provisioning on nestling stress physiology in the Florida scrub-jay. *Hormones and Behavior*, 57:162–168.

Acknowledgements

This work was supported by a grant from the Howard Hughes Medical Institute. Special thanks go to the coordinators of Oklahoma State University's Life Science Freshman Research Scholars Program as well as to the faculty members in Oklahoma State University's Department of Integrative Biology. Thank you to Sierra Williams for assistance in bird care.