Do the Sexiest Dancers Have the Largest Little Brains?: Association between display complexity and brain volume, CB volume and in manakins (Pipridae).

Glendin Pano, Claire Giuliano, Justin Houck, Steven R. Wilkening, Willow R. Lindsay, Lainy B. Day

A81

INTRODUCTION

- Male manakins (Pipridae) attract their mates through acrobatic displays that differ in complexity.
- Display complexity is positively related to relative brain weight in manakins (1).
- The relationship of brain volume (Br Vol) to complexity has not been analyzed.
- The Cerebellum (CB) is a major motor control and coordination center. It is subdivided by deep grooves called folia.
- We hypothesize that sexual selection for display complexity across male Pipridae, drives the evolution of bigger brains due to enlargement of motor areas. We also examine the contribution of body weight to variance in complexity.

METHODS

- Brain tissue was collected from 41 breeding males of 12 manakin species and a closely related fly-catcher (n=3 for most species).
- The vol of the CB and Br were measured using stereology.
- GLM with was run to obtain corrected marginal means for Brain Volume (body weight covariate) and CB volume (Brain Volume minus cerebellum volume covariate. The adjusted dependent variables were then regressed against display complexity using PGLS to correct for phylogenetic signal.
- A stepwise regression was also run to compare predictive power of adjusted Br Vol , adjusted CB Vol, and Body weight.
- While GLM is generally considered a better method for correcting allometry than residual analyses, we conducted both types of analyses to obtain allometrically scaled brain and cerebellum volumes.

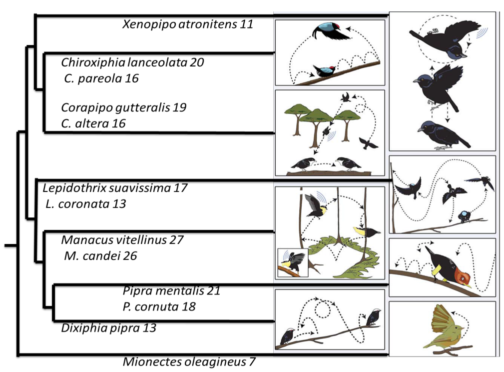
SUMMARY

Brain volume and CB volume are positively related to display complexity. CB vol is robust to methods of correcting for allometry.

Body weight is also positively related to display complexity and may account for more variation in display complexity than Br Vol or CB Vol.

DISCUSSION

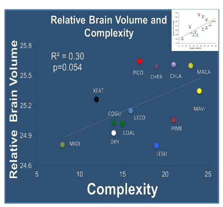
- This study is the first to demonstrate a relationship between acrobatic display complexity and brain volume or cerebellar volume in a group of manakins.
- Our data showing a positive relationship between brain volume and complexity support previous findings that demonstrate a significant positive relationship between display complexity and brain weight.
- These results support previous findings that cerebellar volume is related to display complexity in oscine passerines (2), suggesting this finding is quite robust.



Phylogenetic relationships and complexity display scores of 12 manakins and a closely related flycatcher. Display complexity score was based on the sum of 5 elements:

1. Displays: 40 unique display elements
2. Cooperation: 0 = none, 1 = simple, 2 = complex
3. Lekking: 1 = yes, 0 = no
4. Display arena Complexity: 1-3
5. Mechanical sound production: total repertoire (0 – 5)

RESULTS



Display complexity showed a marginally significant positive relationship with brain volume. Inset: Regression analysis of relative brain weight against display complexity shows a significant positive relationship.

Regression: Relationship between complexity and relative CB adjusted for both BrWT and HemiBrmin CB volume. GLM margianl means were based on h Residual analyses showed that CB vol was significantly correlated with complexity.

Residual analyses did not support a relationship between adjusted brain volume and complexity (p=0.81), but Cb volume had a strong relationship with complexity regardless of methodology.

GLM, PGLS adjusted $R^2 = 0.24$, $t = 2.16$, $p < 0.05$

Residuals, PGLS adjusted $R^2 = 0.22$, $t = 2.08$, $p < 0.06$

Body weight alone better accounts for variation in complexity when Br Vol, Cb Vol and body weight are considered in a stepwise regression.

DISCUSSION CONT.

- Cerebellar Volume and, possibly, brain volume, and acrobatic displays appear to have coevolved in respo, body weight nse to sexual selection.
- However, body weight accounts for more variation in complexity than either CB vol or Br volume suggesting metabolic or muscle demands are related to display complexity.

REFERENCES

1. Lindsay, WR. 2015. *Brain. Behav. Evol.,* 85: 29-36
2. Day, LB. 2011. *Brain. Behav. Evol.,* 77:206–218

NSF-IOS#1122180 to LBD