

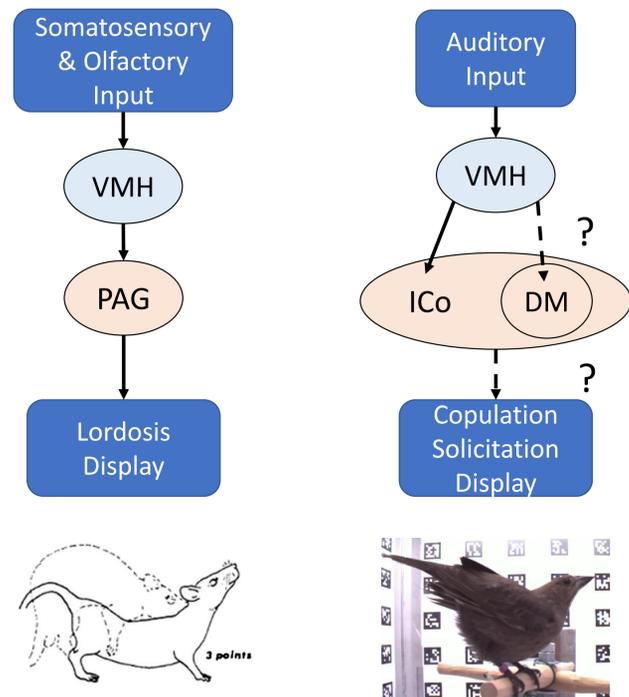
Neural Circuitry for Female Reproductive Behavior in Songbirds

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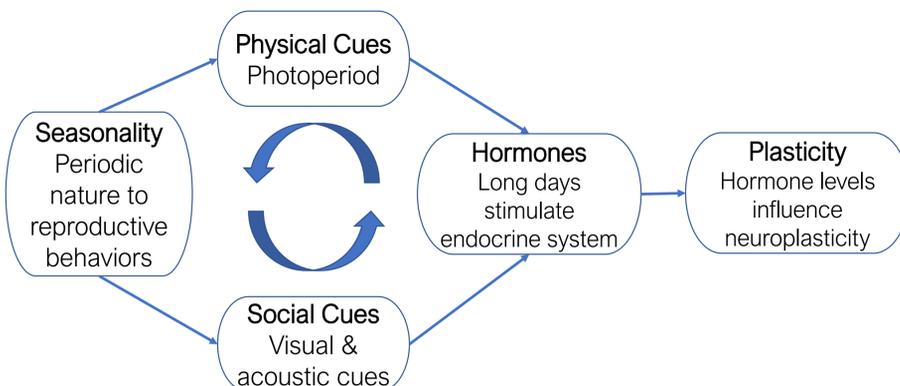
Introduction

A. There are analogous female reproductive displays and brain regions within female mammals and birds (PAG = ICo + DM).



- The hypothalamus is a region in the brain that controls a variety of basic life functions including reproduction.
- The **ventromedial hypothalamus (VMH)** has been shown to have an important role in female sexual behavior in rodents and birds.

B. Reproductive and courtship behaviors rely on certain factors that must be taken into consideration when designing procedure.



Review of Literature

C. Investigating the neuroendocrine regulation of reproductive behaviors in rodents and birds.

Rodents

- Female rats experience cyclic variations in gonadal hormones (Flanagan-Cato, 2011).
- Estrogen drives the structural plasticity of a subset of neurons in the VMH that are involved with female mating behavior (Inoue et al., 2019).

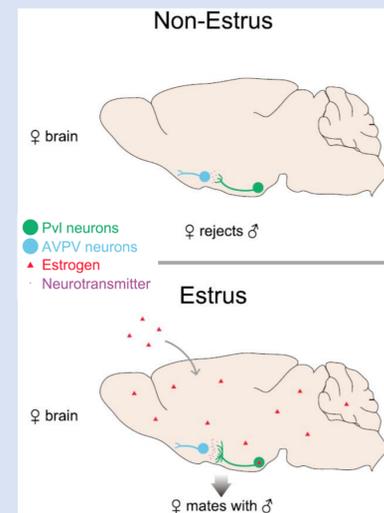


Fig. 3 Graphical abstract from Inoue et al., 2019.

Birds

- Female behavioral response to conspecific song changes with reproductive state in seasonally breeding songbirds.
 - Female reproductive behavior depends primarily on estrogen and the VMH is a key site of estrogen action (Ball, G. F., & Balthazart, J., 2010).
- In a female songbird, certain brain regions respond more to male song when estradiol is at breeding level (Maney et al., 2008).

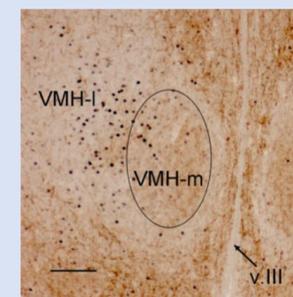
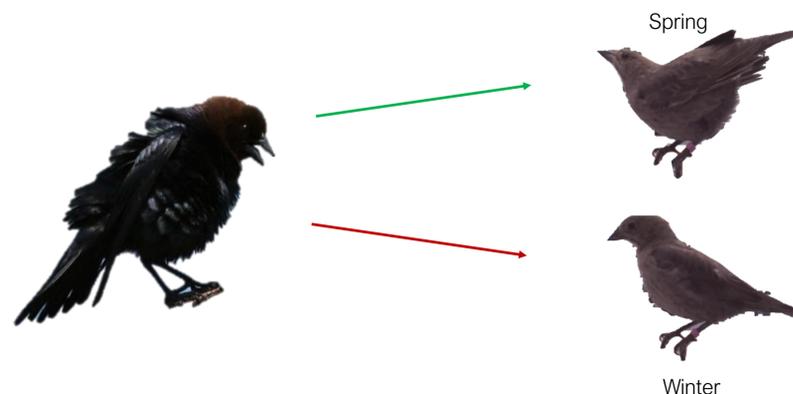


Fig. 4 The VMH exhibited male song-induced expression. (Maney et al., 2008).

D. Copulatory responses are seasonal (and hormone-dependent) behaviors.



Planned Experimental Approach

- We know that when females are out of breeding season, they will not produce copulation solicitation displays because they are not receptive.
- Therefore, we plan to do experiments in the **spring** and in the **winter**.

E. Hormone levels may enable plasticity in pathway for CSD.

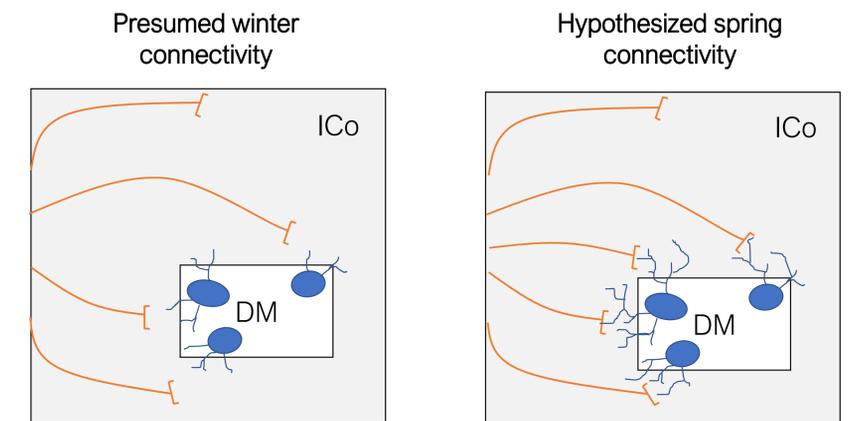
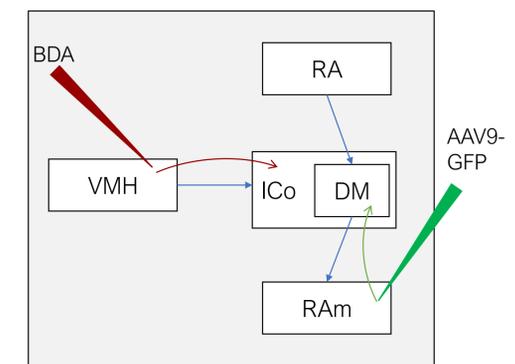


Fig. 6 Presumed winter connectivity and hypothesized spring connectivity. The VMH projects to the ICo region surrounding the DM nucleus. Large grey square is ICo, white rectangle is DM, DM cells and dendrites are in blue, and VMH axons are in orange.

F. Next Steps

- Employ a series of anterograde and retrograde tracers including BDA and AAV9-GFP to outline the connectivity of the VMH and DM.
 - Use electrophysiology to help locate and confirm tracer injections
- Use estradiol implants to prime females.



G. Future considerations

- Record from neurons in DM and stimulate VMH. Electrophysiological confirmation of connectivity.

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