Corticosterone and Approach and Avoidance Behaviors in *Xenopus laevis*

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Abstract

This study aims to test how corticosterone may act within the optic tectum (subconscious visual system) to affect approach and avoidance behaviors using an animal model that relies entirely on subconscious visual processing, the South African clawed frog *Xenopus laevis*. We hypothesize that corticosterone treatment will increase avoidance behavior and decrease mass of liver consumed.

This study hopes to advance knowledge on how stress impacts subconscious behavior.

Introduction

Glucocorticoids (GCs) such as cortisol and corticosterone are steroid hormones released by the adrenal cortex during stress. GCs act on animal behavior because they are lipid soluble and can access glucocorticoid receptors in the brain. Glucocorticoid receptors have been found in parts of the subconscious visual system that regulate approach and avoidance, but their specific role in this is unknown.

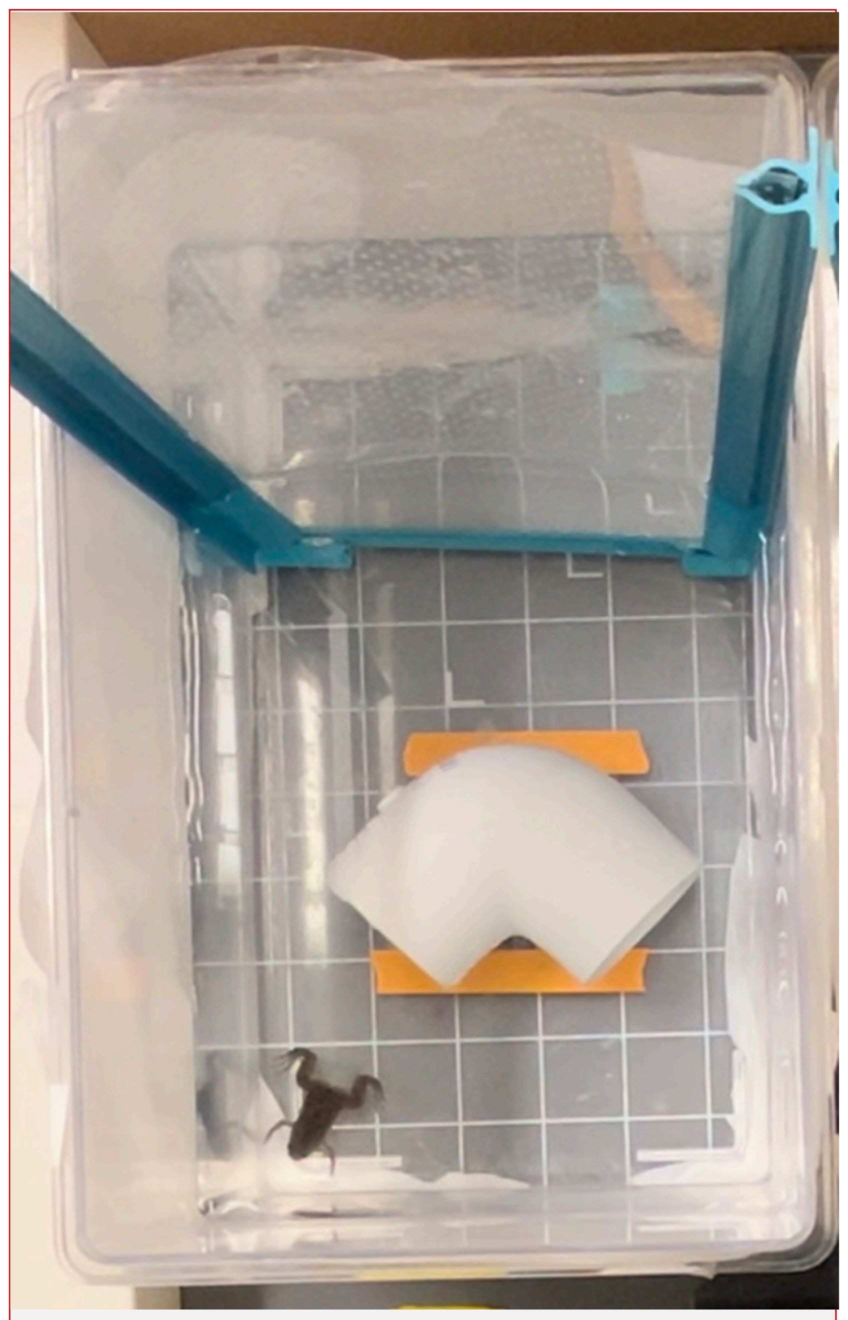

Figure 1. Section A of the tradeoff task testing.

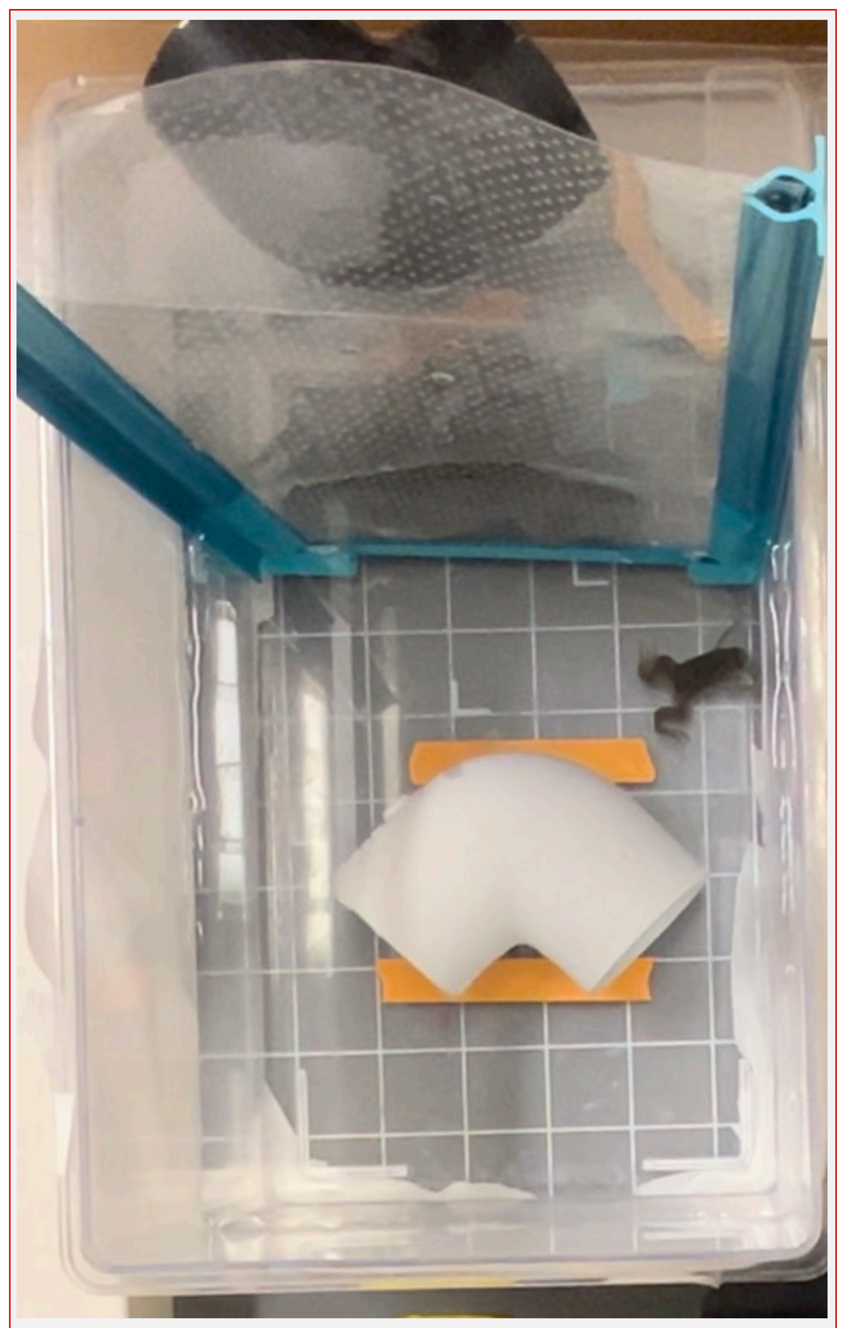

Figure 2. Section B of the tradeoff task testing.

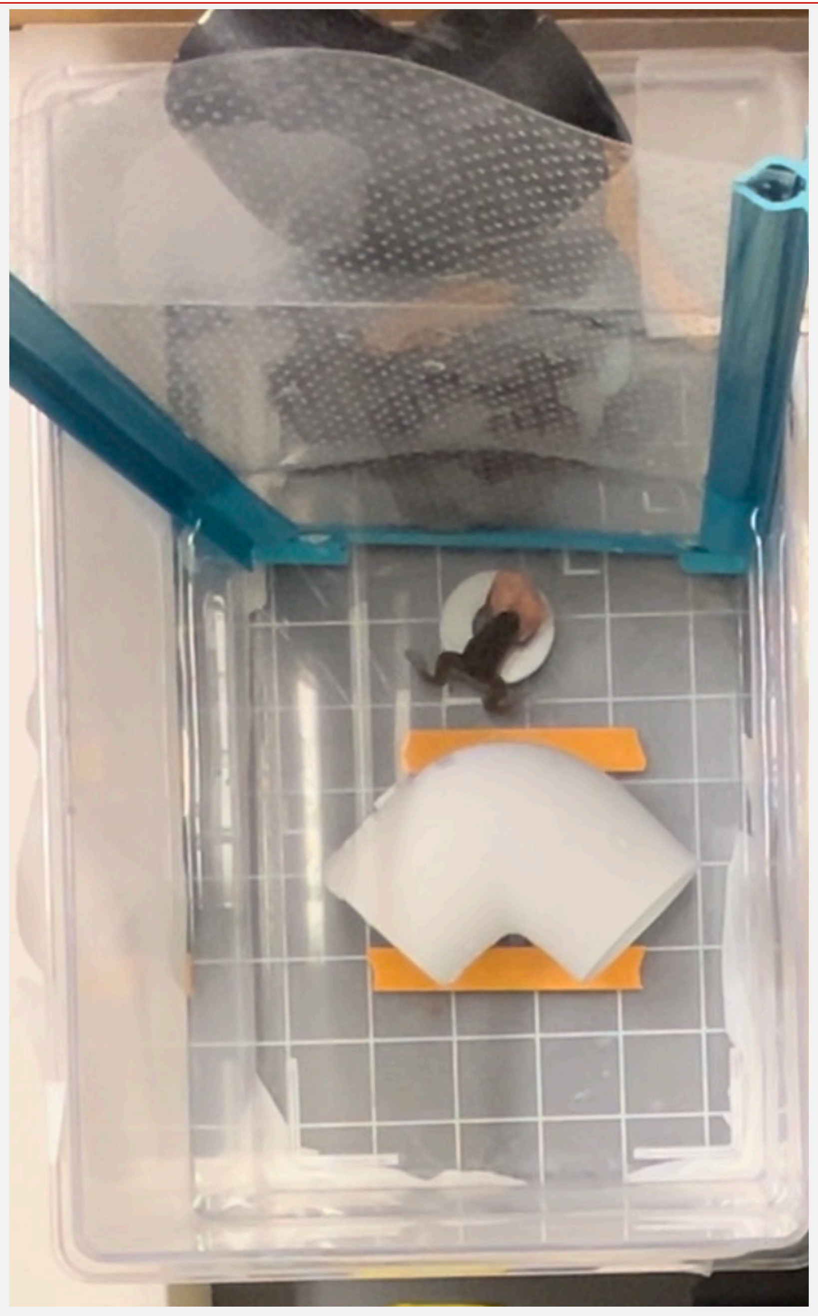

Figure 3. Section C of the tradeoff task testing.

Materials & Methods

Prior to the tradeoff task testing, 30 individual small *Xenopus laevis* are isolated in individual tanks and treated transdermally with one of three treatments: 500 nM corticosterone, 0.0025% ethanol vehicle only, or 500nM corticosterone and 100uM metyrapone (corticosterone receptor blocker).

The tradeoff task is conducted in a tank split into two sections: the experimental test frog side and the predator stimulus side. The experimental frog side is further divided into three sections and marked with tape placed underneath the bottom of the tank. The third closest to the divider is used during part C of the test as the chicken liver location. The middle third contains a PVC hide secured using superglue, and the back third is empty. Adult female Xenopus laevis will serve as a predator. The tests are recorded using a camera placed above the tanks. There are three timed sections of the test. In section A, the individual frog is placed in the experimental frog section of the tank with no food or stimulus and behavior is recorded for 10 min. In section B, the predator frog is placed in the predator stimulus section of the tank and the experimental frog behavior is recorded for 10 min. In section C, the predator frog remains in the predator stimulus area of the tank and a 1.22g piece of chicken liver is to the experimental frog area of the tank in the third closest to the divider. The washer prevents the experimental frog from moving the food away from the food location or attempting to hide with the food. Section C experimental frog behavior will be recorded for 30 min At T=50 minutes, the frogs will be removed from the tank and returned to their home individual cages.

Results

Results will be analyzed in two ways. First, the mass of the chicken liver is recorded after the 50 min tradeoff task test is completed and subtracted from the initial 1.22g of chicken liver. If the frog does not make contact with the chicken liver, this is also noted. Second, results will also be analyzed using BORIS behavior analysis tracking software. Measured behavior includes time spent inactive, locomotion, time spent exploring edges, time spent hiding, number of forearm sweeps, and number of gulps. In part C of the test, latency to move, latency to contact food, time spent in contact with food, and number of hind limb kicks. The experimental frog's location in the tank is recorded every 30 seconds.

Conclusion

If the frogs treated with corticosterone consume less chicken liver, do not make contact with the chicken liver, spend more time in the section of the tank farthest from the predator, engage in more hiding behaviors, or spend more time inactive, we would conclude that the corticosterone treatment does affect predator avoidance and prey capture behavior tradeoff. However, If the treatment group that received the 500nM corticosterone and 100uM metyrapone shows similar behaviors to the corticosterone only group, we would conclude that though the corticosterone affected predator avoidance and prey capture behavior, the corticosterone may be affecting something other than the glucocorticoid receptors in the optic tectum. If there are no significant differences across the three groups, we would conclude that this study does not find the corticosterone treatment to affect predator avoidance and prey capture tradeoff behavior.

References

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