

ScholarWorks@GSU

Effects of systemic administration of 8-OH-DPAT on agonistic social behaviors in male Syrian hamsters

Authors	Andrews, Corey
Download date	2026-04-13 12:05:23
Link to Item	https://hdl.handle.net/20.500.14694/8033

Honors Thesis Proposal – Spring 2017

Corey Andrews – 002-23-9715

Description:

In my thesis, I intend on determining the agonistic effects of injecting the serotonin 1A agonist 8-OH-DPAT peripherally into the Syrian golden hamster (*Mesocricetus auratus*). I will be conducting this experiment on the 8th/9th floors of Petit Science Center with my research mentor, Joseph Terranova, of Georgia State University's Neuroscience Institute. In order to conduct this research, I will be using adult, male hamsters.

Serotonin (5-HT) and arginine vasopressin (AVP) are two neurotransmitters that regulate the agonistic behaviors of golden hamsters. Agonistic behavior is defined as both defensive/submissive and offensive/aggressive behaviors that hamsters exhibit when they encounter one another. 5-HT increases aggression in female hamsters, but decreases aggression in males. Conversely, AVP increases aggression in male hamsters, but decreases aggression in females (Terranova, et al., 2016). The observed sex differences in how 5-HT and AVP regulate agonistic behaviors, coupled with the fact that hamsters are an excellent model for observing psychological trauma (Huhman, 2006), make this an area of research for studying social anxiety from a scientific perspective.

The 5-HT_{1A} receptor is responsible for responding to the serotonin that affects the agonistic behaviors of hamsters. Using 8-OH-DPAT, an experimental chemical that acts as a 5-HT_{1A} receptor agonist, researchers have been able to observe the changes in behavior that result from the blockade of serotonin molecules. One study in the basolateral amygdala has shown that blocking the 5-HT_{1A} receptor prevents the creation of a fear-based memory in mice exposed to a

resident aggressor (Bader, Carboni, Burleson, & Cooper, 2014). Additionally, 8-OH-DPAT injection in the anterior hypothalamus elicits an anxiolytic effect on hamsters, making them less likely to demonstrate avoidant-agonistic behavior after an initial defeat (Terranova, et al., unpublished data).

In contrast, fluoxetine, a selective serotonin reuptake-inhibitor, makes it more likely that a hamster will display avoidant-agonistic behavior when injected peripherally. This injection stimulates an anxiogenic effect (Ferris, Stolberg, & Delville, 1999). Based off the evidence from the DPAT and fluoxetine studies, there is reason to believe that injection of DPAT peripherally could create an overall anxiolytic effect, opposite to the effect that fluoxetine creates peripherally. By activating 5-HT_{1A} receptors globally, instead of directly into the AH, this experiment could potentially demonstrate the ability for 8-OH-DPAT to act as an anti-depressant for male hamsters, and potentially males of other species.

Methodology:

Adult male hamsters (120g – 140g) will be singly-housed in polycarbonate cages (24 × 43 × 20 cm) inside of the GSU Animal Facility for two weeks prior to the start of the study. Hamsters will be housed in a 14:10 light/dark cycle with free access to food and water. After this period is complete, the hamsters will be handled for one week and then, during the fourth week, will be divided into four experimental groups: socially defeated hamsters receiving DPAT, socially defeated hamsters receiving a vehicle control (saline), no defeat control hamsters receiving DPAT, and no defeat control hamsters receiving a vehicle control (saline). The defeat groups will each have 8 hamsters, while the non-defeat groups will each have 5 hamsters. Defeat

hamsters will be placed in the cage of a resident aggressor (RA) hamster of the same sex for 15 minutes, eliciting a social defeat experience. The non-defeated hamsters will be placed in an empty resident aggressor cage. The next day, all of the hamsters (both defeat and no defeat controls) will be injected with either 0.5 mg/ml DPAT or vehicle (saline) control 30 minutes before testing for social avoidance.

To elaborate more on what social avoidance exactly means, hamsters of the same sex placed in the same cage will, in normal conditions, begin to spar with each other upon minutes of the social encounter. These sparring matches usually do not result in any serious physical harm, though the psychological impact these matches have on the “loser” of the battle indicate some sort of psychological trauma that establishes a subordinate relationship to the dominant, or “winner”, hamster. Some signs of defensive agonistic behavior that will be scored for in these subordinate hamsters include fleeing, tail-lifting, tooth chattering, defensive postures, and RA avoidance (Huhman, 2006). The variance in these data points will be compared and used to formulate the results of the experiment. This experiment’s purpose is to observe behavior, so there will not be any sort of imaging performed once it is complete (i.e. immunocytochemistry, in situ, etc).

Method of Assessment:

Since hypotheses are predictions and not absolutes, my assessment will not be graded on whether or not the hypothesis is supported. Instead, I will be assessed by my supervisor in several different aspects during the experimental time frame. My attendance is the first criteria. I

will be expected to be in the lab and performing the necessary experimental procedures for that day while following IACUC protocols and general lab safety rules. The second aspect will be data collection and analysis. It is expected that I will record and analyze the data in a timely fashion as not to delay mine or my supervisors' project completion. Next, there will be primary article discussions relevant to the experiment that we are performing. The last part of my assessment will be the manuscript. My proposed project will be completed by me, but it is an extension of the work that my supervisor, Joseph Terranova, is working on. Thus, my data will be incorporated into his final article. My role will be to help write up a proper manuscript that will provide additional substance to this final article.

In summary, I will be assessed on attendance, following proper protocol, data collection, researching articles, and manuscript writing.

Thesis Relevance

This thesis will allow me the opportunity to experience a hands-on approach to researching the material necessary to formulate my own hypothesis, designing and performing my own experiment, interpreting results, and making my own conclusions from these results. These are all essential tasks to the scientific method, which is studied extensively in the classes that I take for my neuroscience major, so it will certainly be useful for myself. As for its relevance for the scientific community, the 8-OH-DPAT experiment will help further clarify the purpose of the 5-HT_{1A} receptor in the mammalian brain. If an anxiolytic effect is created from the blockade of these receptors by DPAT in males, then this will assist my advisor's experiment on the effects that serotonin have on stress and anxiety, especially in males. His research shows

significance beyond academia, since the affirmation of his hypothesis encourages another hypothesis that due to the differential response to serotonin between men and women in response to stress, it may be necessary for men to take different anti-anxiety/depressant medication than women (Terranova, et al., 2016).

Bibliography

- Bader, L. R., Carboni, J. D., Burleson, C. A., & Cooper, M. A. (2014). 5-HT_{1A} Receptor Activation Reduces Fear-related Behavior Following Social Defeat in Syrian Hamsters. *Pharmacol Biochem Behav*, 122, 182-190.
- Ferris, C. F., Stolberg, T., & Delville, Y. (1999). Serotonin Regulation of Aggressive Behavior in Male Golden Hamsters (*Mesocricetus auratus*) . *Behavioral Neuroscience*, 804-815.
- Huhman, K. L. (2006). Social conflict models: can they inform us about human psychopathology? . *Hormones and Behavior*, 640-646.
- McCann, K. E., & Huhman, K. L. (2012). The Effect of Escapable Versus Inescapable Social Defeat on Conditioned Defeat and Social Recognition in Syrian Hamsters. *Physiol Behavior*, 105(2), 493-497.
- Terranova, J. L., Song, Z., Larkin II, T. E., Hardcastle, N., Norvelle, A., Riaz, A., & Albers, H. E. (2016). Serotonin and arginine-vasopressin mediate sex differences in the regulation of dominance and aggression by the social brain. *PNAS*, 1-6.