

Title: The effects of social enrichment and physical exercise on spatial learning in rats: An investigation of sex differences.

Two forms of enrichment have been shown to improve spatial learning: physical exercise and social enrichment (e.g., Dhanushkodi et al., 2007; Liu et al., 2009). Findings suggest that physical exercise can reduce impairments in spatial learning as measured by the Morris Water Maze (Ben et al., 2010). Previous research also suggests that social enrichment can augment spatial learning (Dhanushkodi et al., 2007; Leggio et al., 2005; Schrijver et al., 2003). Specifically, Leggio et al. (2005) found that socially enriched rats showed greater improvements in spatial learning than did non-enriched rats, as measured by the Radial Arm Maze.

My proposed study will extend past research by further assessing how physical exercise and social enrichment can each affect spatial learning in Sprague-Dawley rats as measured by the Radial Arm Maze task. Specifically, I will focus on sex differences in spatial learning that may exist as a result of exposure to social enrichment and physical exercise as compared to non-enriched rats. Research from our lab has shown that female rats exposed to social enrichment perform less consistently on the radial arm maze than rats exposed to physical exercise. This has not been assessed in males. Therefore, this study will assess spatial learning in both male and female rats.

Rats will be randomly assigned to one of three groups (physical exercise, social enrichment, and a non-enriched control). Rats in the exercise condition will be exposed to standard MedPC running wheels (48.26 cm x 26.67 cm x 20.32 cm) for 1 hour daily for 30 days, while rats in the social enrichment group will be housed together for 1 hour daily for 30 days. Rats in the control group will be housed in standard cages and treated identically to other groups

minus exposure to exercise or enrichment. Following 30 days of exposure, spatial learning will be then assessed using a standard eight-arm radial maze for 10 consecutive days. Four arms of the maze will be baited with food reinforcers. Rats will have 10 minutes to find all four reinforcers, after which time all trials will be terminated. Rats will be video recorded during maze testing trials. Wrong arm entries, arm-reentries, correct arm entries, and total time spent in the maze will be recorded during each trial. A mixed-model ANOVA will be utilized to assess differences in performance among male and female rats. I hypothesize that exercise will improve spatial learning, more so than social enrichment, but that social enrichment will improve spatial learning more so than no enrichment.

Findings may help better explain the role that social enrichment and exercise plays in mediating improvement in spatial learning, and learning in general. Relevant to human behavior, these findings may further clinical assessments, such as those utilized in treating drug abuse. For instance, recent studies have reported that aerobic exercise decreases drug-seeking behavior in humans (Buchowski et al., 2011; Kinnunen et al., 2010; Smith, & Witte, 2012) and lessens the symptoms of withdrawal (Kinnunen et al., 2010), providing evidence for the usefulness of physical exercise and various forms of enrichment in therapeutic treatments.