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Norepinephrine Regulation of Spatial Memory Using the Barnes Maze in Male and Female Rats

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The role of norepinephrine (NE) in learning and memory has been extensively studied, yet its contribution remains to be clarified. This study aimed to investigate the role of NE on spatial learning and memory in female and male rats using a Barnes maze assay. We used N-(2-chloroethyl)-N-ethyl-2-bromobenzylamine (DSP-4), a specific noradrenergic neurotoxin that can cross the blood brain barrier, to deplete NE stores. We hypothesized that brain NE ablation would attenuate spatial learning and memory in rats. Loss of NE by DSP-4 was determined by measuring NE (and dopamine and serotonin) levels in several brain regions using HPLC. For the Barnes maze learning, 32 male (n=16) and female (n=16) Sprague-Dawley rats were trained to reach a hidden goal box using aversive visual and auditory cues with 3 trials per day for 5 days. Rats were administered 50 mg/kg/i.p of DSP-4 or saline 10 days prior to Barnes maze training. Results indicate learning via a reduced latency to reach the goal box with progressive training in both sexes over 5 days. There were no significant differences in latency to the goal box between saline and DSP-4 cohorts. Interestingly, levels of NE were significantly lower in the dorsal hippocampus, cingulate cortex, and the striatum indicating DSP-4 depleted NE levels. These data suggest that norepinephrine's role in spatial memory may be limited in simple tasks and non-stressed conditions. We are currently exploring whether increasing the task's behavioral demand via reversal learning will result in memory impairment in DSP-4 cohorts that have suppressed NE.