INTRODUCTION

In addition to its putative role in parturition and lactation, the neuropeptide oxytocin (OXT), exerts a myriad of appended actions within the central nervous system (Argiolas and Gessa, 1991). In the present report we focus upon the capacity for OXT to enhance memory/recognition responses. The beneficial effects of OXT upon memory/recognition have been demonstrated in a variety of paradigms (Engelmann et al., 1996). Since many of these paradigms consist of tests involving social recognition, which rely heavily upon olfaction (Sawyer et al., 1984; Dantzer et al., 1990), we were interested in the extent to which the olfactory bulb (OB) was involved with mediating these recognition responses. Accordingly, we addressed two fundamental questions which comprised the basis for this report: 1) Will OXT affect social recognition when applied within the OB? and 2) How does this neuropeptide function at this site? In an attempt to answer these questions, we combined a behavioral assay of social recognition with infusions/measurements of agents within the OB to evaluate whether the localized application of neuromodulators at this site would alter social recognition.

OXYTOCIN AND OLFACTORY BULB INFUSION

Our first venture in this endeavor consisted of infusing OXT directly into the OB of adult male rats to determine whether social recognition responses would be altered. Twenty-one gauge guide cannulae were implanted bilaterally above the dorsal center surface of the OB. At 5-7 days post-implant of guide cannulae, two 27 gauge infusion cannulae were inserted into the OB to permit bilateral infusion of test agents. Within one-minute following infusion, a stimulus animal (21-30 day old juvenile rat) was placed within
the cage of the male rat and the amount of behavioral investigation directed to the stimulus animal was recorded. At 120-minutes following this initial exposure, this same juvenile along with a novel juvenile were placed within the male’s cage and the amount of investigation directed to the two juveniles was recorded. Under ordinary (control) conditions, similar amounts of investigation would be directed to the two stimulus animals at this 120-minute test period and this lack of discriminatory responses would suggest an absence of recognition. A significantly greater amount of investigation directed to the novel versus same (original) juvenile, however, is interpreted to indicate that a social recognition response was present (Engelmann et al., 1995). In this way, the display of discriminatory investigatory responses at this 120-minute inter-exposure interval (IEI) indicates that recognition has been preserved or prolonged to periods beyond the normal capacity for the display of responses indicative of recognition.

When OXT was infused bilaterally within the OB, clear recognition responses were present when tested at the 120-minute interval as revealed by statistically greater amounts of investigation directed to the novel stimulus animal (Figure 1B). Such data show that the OB, like the septal (Dantzer et al., 1987; Popik et al., 1992) and medial preoptic (Popik et al., 1991) areas, represents an important target site where OXT can function to enhance social recognition responses. Since OXT is activated under social interactions (Hughes et al., 1987) and reported to be present within the OB (Halasz and Shepherd, 1983; Sofroniew, 1985) and/or transported to the OB following release from the paraventricular nucleus (Yu et al., 1996) our findings suggest a potential new role for this neuropeptide at this site.

![Figure 1](image.png)

Figure 1. Investigation times (Mean±SEM in Seconds) directed to the same versus novel stimulus animal as tested at a 120-minute IEI for animals infused with either Ringer’s solution (A. Controls, N=10) or Ringer’s solution with oxytocin (B. OXT @ 0.5 ng, N=11) into the OB. Animals receiving OXT showed significantly greater amounts of investigation directed toward the novel stimulus animals indicating a recognition response, that was not present for Control animals. Data from Dluzen et al. (1998a).

To verify these effects and establish that OXT is functioning through an OXT receptor mediated process we co-infused OXT with either an OXT or arginine vasopressin receptor antagonist into the OB. Discriminatory social recognition responses were abolished under conditions of OXT+OXT- receptor antagonist infusion (Figure 2A), but remained in animals co-infused with the OXT + arginine vasopressin receptor antagonist (Figure 2B). These results confirm that OB OXT infusion preserves recognition responses and this...