



An anatomical map of oxytocin receptors in the coyote brain: implications for social neuroscience



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Introduction

Coyotes: A unique organism in the Canidae family that exhibits socially and sexually monogamous behavior.¹

Oxytocin: Oxytocin is a peptide similar in structure to vasopressin that deals with maternal behavior, aggression, territoriality, and especially social cognition and complex social behavior.² Some of the effects of this neuropeptide include:

- Facial recognition
- Pair bonding behavior between human pair mates
- Increase in trust
- Eye gaze
- Uterine contraction during labor & Milk let-down
- Empathy
- Socially reinforced learning,
- Social attachment
- Emotional recognition.^{2,5,6}

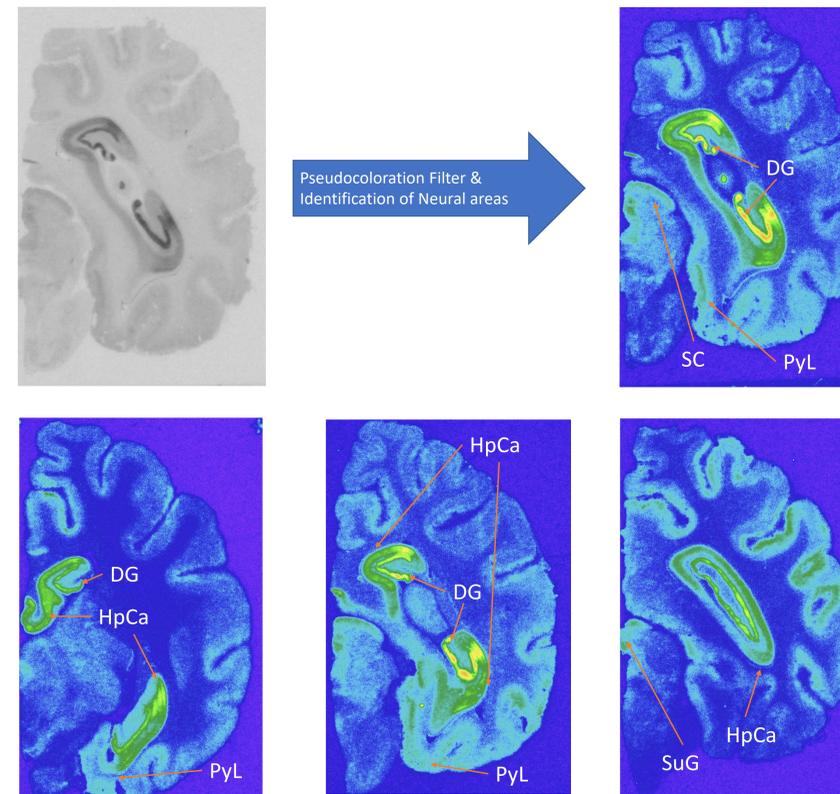
Our Goals: Our goal is to anatomically map sites in the deeper posterior region of the coyote brain that contain oxytocin receptors.

Methods:

- We sliced coyote brain tissues (n = 5; 3 females and 2 males) in the cryostat in around -15 degrees Celsius (figure 1).
- Tissues were then selected in the posterior region of the brain because they haven't been evaluated yet (figure 2).
- We then organized and stored sliced tissues in -80 degrees Celsius refrigerator (figure 3).
- Slides were then incubated in a series of washes, were lightly fixed, washed twice, and incubated in ornithine vasotocin analog (125I-OVTA) radioligand mixture at a concentration of 50 nM (figure 4).
- Once dry, the slides were placed in a film development chamber for 7 days (figure 5).
- We used MCID Core to measure the densities of oxytocin receptors in different regions of the brain (figure 6).

Results:

We performed a qualitative receptor density analysis and utilized a brain atlas for a beagle to compare brain anatomy and identify subcortical regions of the brain (see images below). We discovered high density of oxytocin receptors in the hippocampus (HpCa), Dentate Gyrus (DG), Pyriform lobe (PyL), the Superior Colliculus (SC), and Superficial Gray layer of Superior Colliculus in different slices of brain tissue.

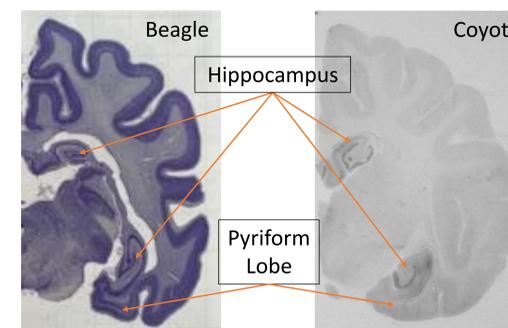


Conclusions:

- Oxytocin acts in areas containing high densities of oxytocin receptors. Due to the high density of oxytocin receptors in the hippocampal regions of the coyote brain, oxytocin likely positively affects sociospatial learning and memory.^{2,3}
- There is evidence from mice that oxytocin is required for social olfactory memory.^{3,4}
- The olfactory bulb is strongly related to the hippocampus because it is a major sensory pathway for coyotes in the limbic system. This highway from the olfactory bulb to the hippocampus may be induced by the effect of oxytocin in hippocampal areas of the brain. We suggest that oxytocin is a chief contributor to increased long-term potentiation of hippocampal synaptic cells and potent memory formation.^{2,4}
- Our findings align with the research findings performed on monogamous titi monkeys, which also have dense oxytocin receptor clusters in the hippocampus.⁶
- The optic layer of the superior colliculus aids in gaze shift i.e. movement of the head and eyes. How does this relate to oxytocin?
- Our findings better enable future, more enhanced mapping of the anatomy of the deeper structures of the coyote brain.
- Future studies will evaluate sex differences and the effects of life experiences like parenting and age.

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