

The Role of the Ventral Striatum in Olfactory Learning and the Exceptional Ability of Olfactory Associations to Evoke Emotional Memories

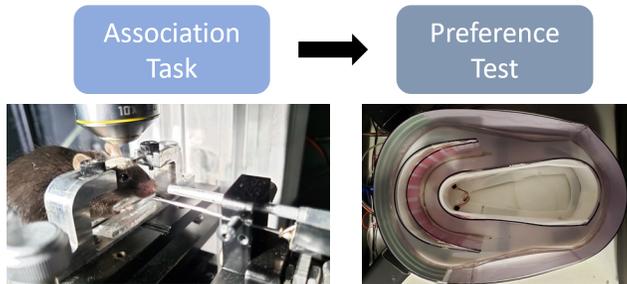
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Abstract

The exceptional ability of olfactory associations to cue emotional memories has been repeatedly described in both scientific and popular literature. This study developed a novel behavioral paradigm to reveal this phenomenon in mice and then used ibotenic acid lesions to investigate the roles of the olfactory tubercle (OT) and nucleus accumbens (NA) in olfactory association learning and these exceptionally powerful odor associations.

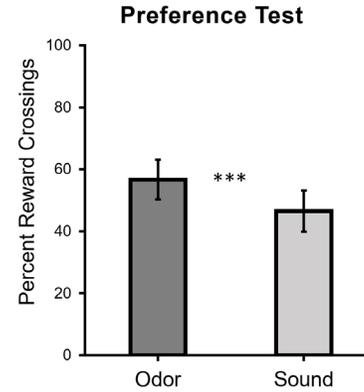
Study Design

Our behavioral paradigm consisted of an association task to form olfactory and auditory associations followed by a location-based preference test to reveal any uniquely strong preference that olfactory associations can evoke compared to auditory associations. We then repeated these tests in mice with partial OT and NA lesions to identify any contributions of these brain regions to olfactory learning and the unique power of odor-evoked memory.



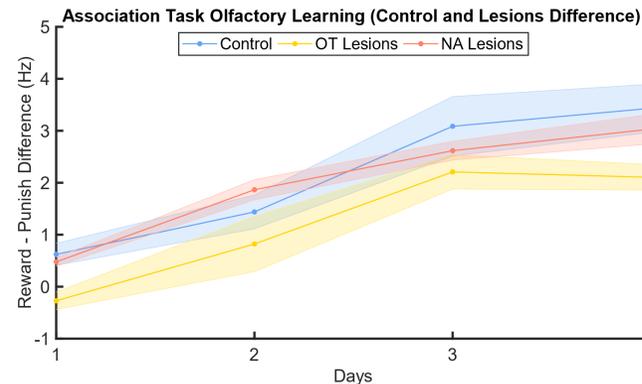
Odor Preference Effect

The association task effectively formed olfactory and auditory associations. The preference test revealed a significant preference for the previously rewarded odor over the previously rewarded sound.



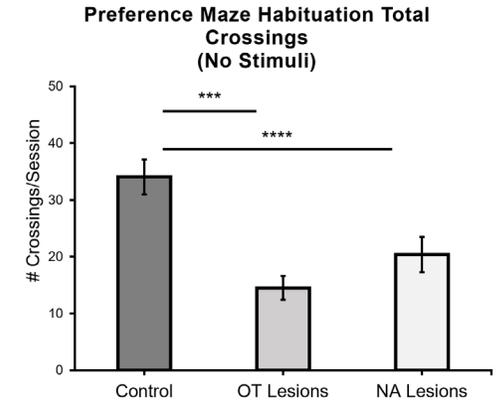
Olfactory Learning Rate After Lesions

Mice with partial OT lesions exhibited slower initial olfactory association learning rate than mice with partial NA lesions and control mice. However, mice with partial OT lesions ultimately performed the task at the same level as the other two groups.



Overall Activity Level After Lesions

Both lesion groups exhibited significantly less generalized activity during preference test habituation than the control group. This most likely reflects reduced motivation due to reward system damage.



Odor Preference Effect After Lesions

The odor preference effect observed in the control group was not observable in either of the lesion groups. However, the percentage of reward crossings per trial was not significantly different between any of the three groups.

