



**Ruprecht-Karls-Universität Heidelberg**  
**Medizinische Fakultät Mannheim**  
**Dissertations-Kurzfassung**

**On the role of oxytocin in the induction of reinforced neuronal representations for social recognition memory**

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Social recognition memory refers to the ability to recognize a previous interaction partner. It can be considered a fundamental building block for social cognition, enabling individuals to navigate complex social environments. In rodents, this form of memory is mainly guided by olfaction and is often evaluated by the reduced interest for exploration of familiar animals. This bias to spend less time with familiar conspecifics has led to the assumption that the underlying neuronal coding mechanisms is a habituation memory. The modification of the cortical representations of familiar animals and thus the neural correlates of social recognition memory have remained elusive, however. This study establishes an experimental configuration to present volatile body odors from different individuals to head-fixed mice. This experimental configuration allows a multidimensional examination of the cognitive processes in response to certain features of the presented social odors. It allows to test the behavioral responses by measuring sniffing patterns and pupil dilation as proxies for perceived salience and the neuronal responses using single-unit recordings from chronically implanted tetrode arrays and fiber photometry recordings of axonal projections under controlled conditions. The study then applies this approach to directly examine social recognition memory among male mice. It finds that the smell of familiar animals is perceived more saliently. Neural encoding of social recognition memory manifests as reinforced olfactory responses to the smell of familiar animals, in distributed olfactory regions including the anterior olfactory nucleus and posterior piriform cortex. This memory information propagates to other brain areas. The emergence of reinforced memory traces in the anterior olfactory nucleus is contingent upon plasticity facilitated by local oxytocin signaling, as demonstrated through optogenetic and genetic manipulations. In summary, oxytocin enables the induction of reinforced neuronal representations of familiar animals in distributed olfactory cortical regions, constituting a neural substrate of social recognition memory.