

# The Effect of Odor Cues Associated with Acute Morphine Withdrawal



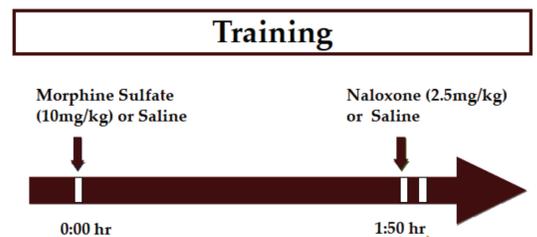
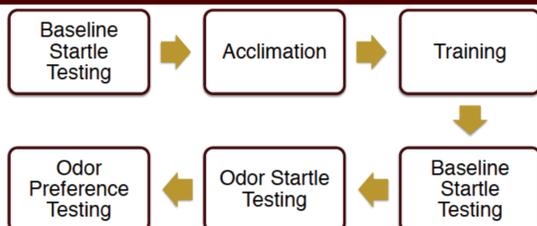
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## Introduction

- Environmental cues, such as odors, associated with withdrawal can motivate drug use<sup>1</sup>.
- Withdrawal following a single dose of opiate produces an elevation of the acoustic startle reflex, indicating a state of anxiety<sup>2</sup>.
- Odors associated with aversive stimuli potentiate startle<sup>3</sup>, and odors associated with pleasurable stimuli attenuate startle<sup>4</sup>.
- The purpose of this study was to examine if odors paired with withdrawal from acute morphine can elevate anxiety in the rat

## Methods



Day	Lemon	Lemon & Vanilla	Lemon & Mint
1, 3	MOR or SAL + NAL or SAL	MOR or SAL + SAL	MOR/NAL
2, 4		MOR or SAL + NAL	SAL/SAL
	* Same Protocol Each Training Day	** Present Odor 10 min. Before 2 <sup>nd</sup> Injection	** Present Odor 10 min. Before 2 <sup>nd</sup> Injection

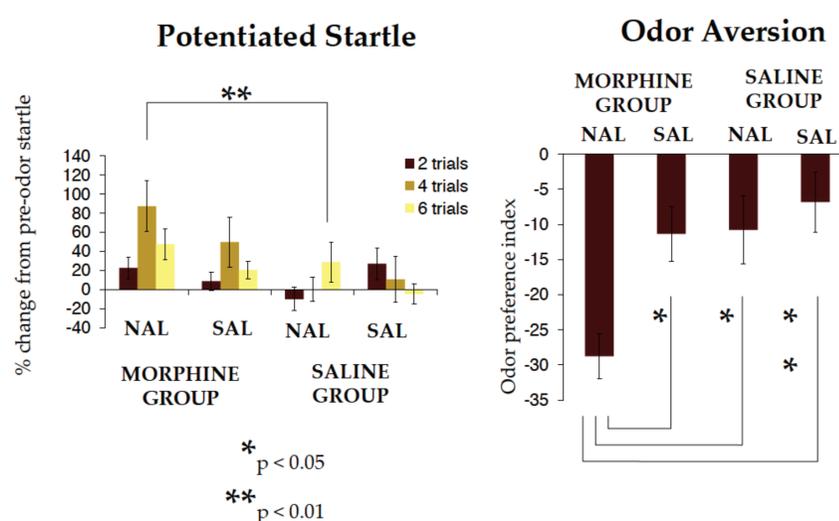
### Startle Testing

105 dB startle stimulus before and after odor presentation

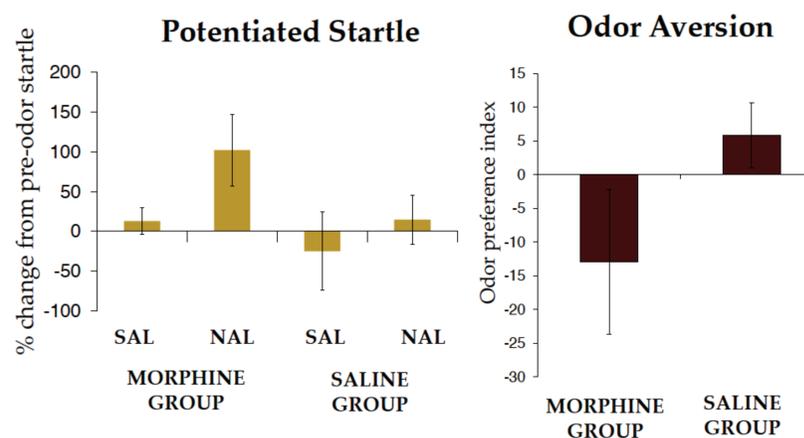
### Odor Preference Index



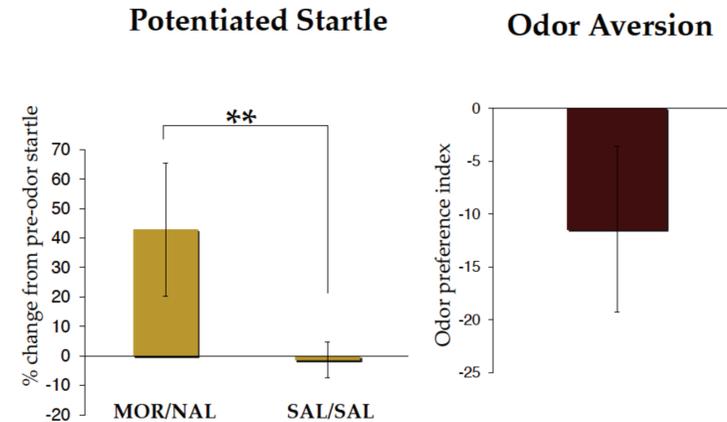
## Results



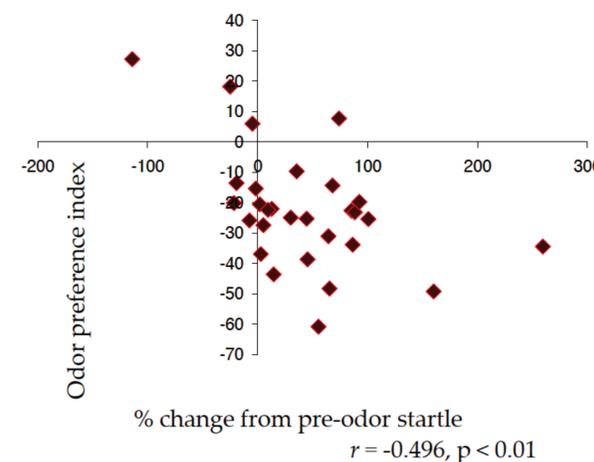
**Figure 1: Single Cue Experiment: Lemon**  
Rats show potentiation of startle to the withdrawal-paired odor (a). Rats receiving MOR/NAL show significantly more aversion to the withdrawal-paired odor compared to all other groups (b).



**Figure 3: Two Cue Experiment: Lemon and Vanilla**  
Withdrawal –paired odor potentiates the startle response in MOR/NAL rats (a). Rats receiving MOR showed an aversion to the withdrawal-paired odor compared to animals receiving SAL.



**Figure 2: Two Cue Experiment: Lemon and Mint**  
Withdrawal –paired odor potentiates the startle response in the MOR/NAL group compared to SAL/SAL (a). Both groups showed an aversion to the withdrawal-paired odor (b).



**Figure 4: Correlation of Startle and Place Preference**  
Startle potentiation shows a significant negative correlation with preference for the withdrawal-paired odors.

## Conclusions

- These findings suggest that odors associated with drug withdrawal elevate anxiety in rats.
- Startle potentiation is negatively correlated with odor preference index
- Olfactory mediated cues may play a role in relapse to drug taking behavior.

## Future Directions

- Investigate the mechanism by which olfactory cues lead to potentiation of startle
- Investigate the effect of natural odors on these behaviors

## References

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2. Harris AC and Gewirtz JC (2004) Elevated startle during withdrawal from acute morphine: a model of opiate withdrawal and anxiety. *Psychopharmacology* 171, 140-147
3. Richardson R, Vishney A, and Lee J (1999) Conditioned odor potentiation of startle in rats. *Behavioral Neuroscience* 113, 787-794
4. Schneider M and Spanagel R (2007) Appetitive odor-cue conditioning attenuates the acoustic startle response in rats. *Behavioural Brain Research* 189, 226-230

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