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European Research Council



Oxytocin attenuates the perception of cardiac signals and reduces fear learning at systole

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Background

Fear stimuli are salient

 Better retrieval and recognition of fearful relative to neutral stimuli (Keightley et al., 2011; Sergerie et al., 2005; Righi et al., 2012)

Associative memory

• Poorer emotional memory due to attentional narrowing

(Easterbrook, 1959; Rimmele et al., 2011;

Bisby & Burgess, 2014; Pfeifer et al., 2017)



Arousal theory of emotion

• James – Lange Theory (late 19th century)



• Implications for translational research (Anxiety)

Cardiac Timing

Timing of stimuli at cardiac systole and diastole





Garfinkel & Critchley (2016)

Cardiac facilitation of fear



Garfinkel et al., 2014 J. Neuroscience

Interoception

- Sensory processing of internal bodily signals (Garfinkel et al., 2015).
- Tested using methods such as the heartbeat counting task.



• Related to enhanced experience of emotions (Wiens et al., 2000) and emotional memory (Werner et al., 2010; Garfinkel et al., 2013; Pfeifer et al., 2017).

Oxytocin



- Increases parasympathetic activity.
- Improves social cognition and reduces anxiety.

Meyer-Lindenberg, 2011, Nature Reviews Neuroscience

Participants



- N = 27 male
- Age (M = 24.83; SE = 0.76)
- Within-subject design (2 sessions: OX/PL)

Associative Learning

In MRI





Hypothesis

 ✓ Learning of emotional faces will be poorer than neutral faces (attentional narrowing).

✓ Feedback at systole will lead to better learning of fearful faces.

✓ Oxytocin will reduce fear learning when feedback is presented at systole.

Results

Interoception

HB counting accuracy



- Main effect of drug, *F*[1,28] = 5.62, *p* = 0.034
- With HR included as covariate, *F*[1,28] = 4.67, *p* = 0.039
- No sign. effect of order of administration, F[1,13] = 0.228, p = 0.641
- No sign. Interaction between drug * order, *F*[1,13] = 0.785, *p* = 0.392

Results: Associative Learning



- Sign. main effect of emotion, *F*[1,29] = 24.78, *p* < 0.001: Neutral > Fear
- No sign. main effects of drug, cardiac cycle (all p's > 0.05).
- No interaction effects (all p's > 0.05).

Results: Main effect of Emotion



Results: Associative Learning

Four-way Interaction between Drug*Emotion*Cardiac Timing * HB-Counting Accuracy (F[1,27] = 8.37, p = 0.007)



Results: Drug*Emotion*CC



Results: Main effect of Drug



Results: Main effect of Cardiac Cycle



Results at Feedback: Main effect of Drug



Summary

- Oxytocin attenuated the perception of cardiac signals → shown by poorer interoceptive accuracy
- Oxytocin selectively reduces fear learning at lower states of cardiovascular arousal (i.e. with feedback at diastole).
- Potential treatment for anxiety disorders?



Thank you



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