Role of basolateral amygdala efferents on incentive devaluation in rats

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Introduction

•Human and nonhuman animals form reward expectations (Tinklepaugh, 1928).

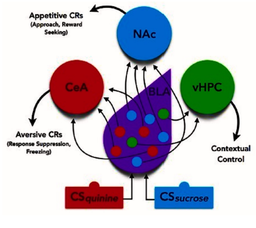
•Reward Loss: Receiving a less preferred reward than expected causes anxiety and psychological pain in rats, comparable to the consequences of an unexpected loss in humans (Papini et al., 2015).

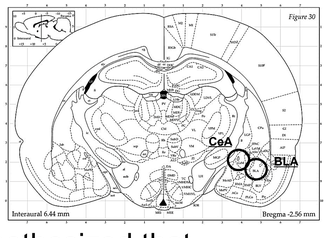
•Consummatory successive negative contrast (cSNC) is an established paradigm for studying unexpected loss, in which rats trained to receive a preferred 32% sucrose solution unexpectedly receive 4% instead.

•The amygdala is a brain area widely preserved across species, and known to be involved in coping with unexpected loss.

–Basolateral amygdala (BLA) and central amygdala (CeA) deactivation via surgery reduce or eliminate the cSNC effect (Kawasaki et al., 2015, 2017).

•It is hypothesized that the BLA responds to the discrepancy between current and expected rewards, and sends information to the CeA whenever the discrepancy is aversive (Maren, 2016; Ortega et al, 2017).





•The present experiment hypothesized that disconnecting the pathway from the BLA to the CeA would reduce or eliminate the cSNC effect.

Method

•Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) is a surgical technique that takes a chemogenetic approach to silencing specific brain regions.

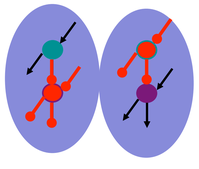
•An intracranial infusion introduces genes into target brain areas that code for a specific G-protein coupled receptor.

•Later, at key points in behavioral testing, an intraperitoneal injection of clozapine-N-oxide (CNO) activates this receptor to temporarily deactivate the target region.

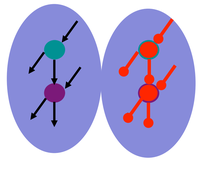
•Experimental (Contralateral) group has one functioning area in each hemisphere, disrupting direct communication between the BLA and CeA.

•Control (Ipsilateral) group has both regions disrupted in one hemisphere, leaving intact the second hemisphere and the communication between the BLA and CeA.

Contralateral



Ipsilateral

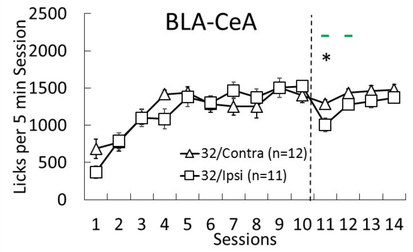


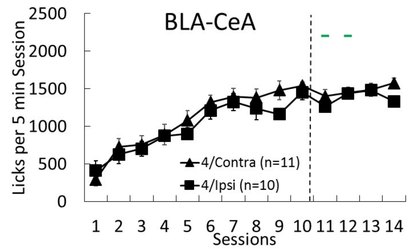
•Following recovery from surgery and a 2-week period to allow for genetic expression of the DREADD in target regions, all rats experience cSNC.

–Rats were given access to either 32% or 4% sucrose solutions during 5 min sessions for 10 consecutive sessions. On sessions 11-14, those who had previously experienced 32% sucrose received 4% instead.

	Surgery	Training (sessions 1-10)	Testing (sessions 11-14)
n=23	Contralateral	Downshifted: 32% sucrose	4% sucrose
		Unshifted: 4% sucrose	4% sucrose
n=21	Ipsilateral	Downshifted: 32% sucrose	4% sucrose
		Unshifted: 4% sucrose	4% sucrose

Results





•Consistent with the hypothesis, rats in the contralateral condition showed no evidence of a cSNC effect following a reward downshift from 32% to 4% sucrose (*: p = .02).

•Ipsilateral BLA and CeA silencing did not eliminate the cSNC effect. A single intact hemisphere is sufficient to produce cSNC.

•There were no significant differences between groups in the 4% control condition following downshift, showing that the BLA to CeA pathway is not involved unless there is a reward downshift.

•Histology is still in progress to confirm that DREADDs were infused in the target areas, with encouraging preliminary data.

Conclusions

•The pathway between BLA and CeA is important for cSNC, not just the individual regions.

•This research contributes to identifying the neural circuit activated by unexpected reward loss.

•Future research will explore other neural pathways.

References

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