Is it Worth it?

Assessing How the Medial Prefrontal Cortex Processes Risky Actions

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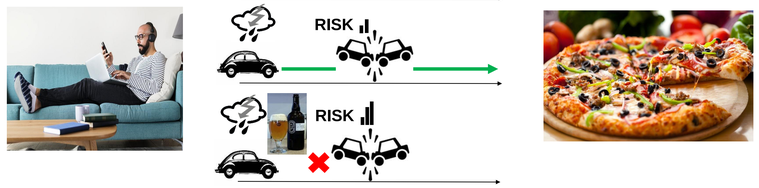
The Problem

Persons with addiction and anxiety disorders have trouble changing behavior in response to the risk of a negative outcome

An Example

Getting something you want also carries the risk of something bad happening (i.e. a negative outcome)



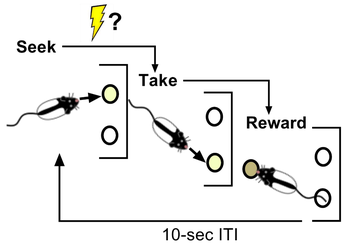
You need to decide at what risk something isn't worth it anymore. For someone with addiction, making the optimal decision may be difficult.

Rationale

Understanding how brain activity changes with risk taking behavior may identify neural signatures and treatment targets to improve mental health disorders like addiction and anxiety

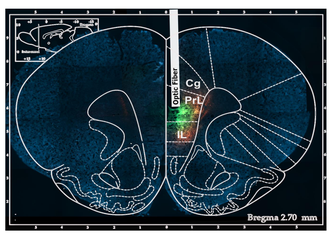
Methods

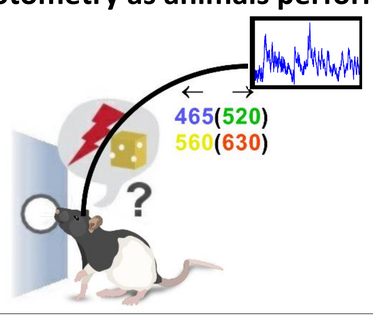
Train animals in a task where working for a food reward carries an increasing risk of a footshock



12-min Block	Trial Numbers	Shock Risk (%)
1	1-15	0
2	16-30	6
3	31-45	10
4	46-60	18
5	61-75	30
6	76-90	60

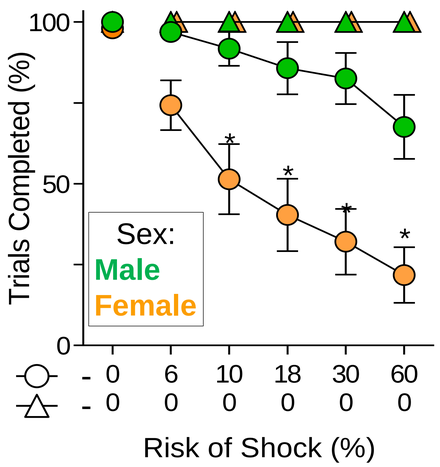
Record Neural Calcium Activity in the medial prefrontal cortex (mPFC) using Fiber Photometry as animals perform the task



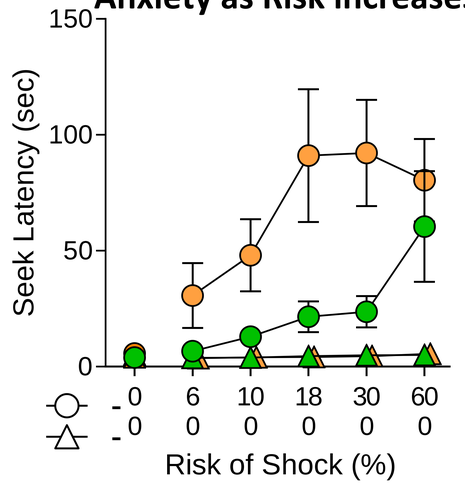


Results

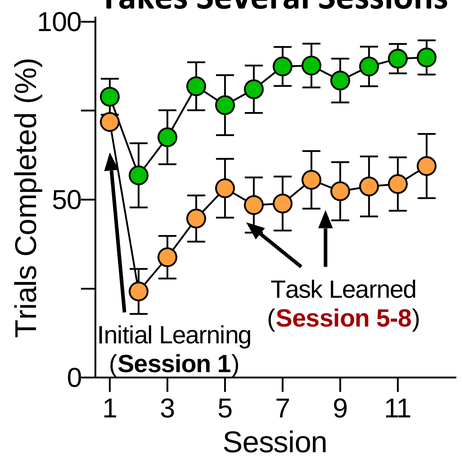
Rats Decrease Reward Seeking as Risk increases



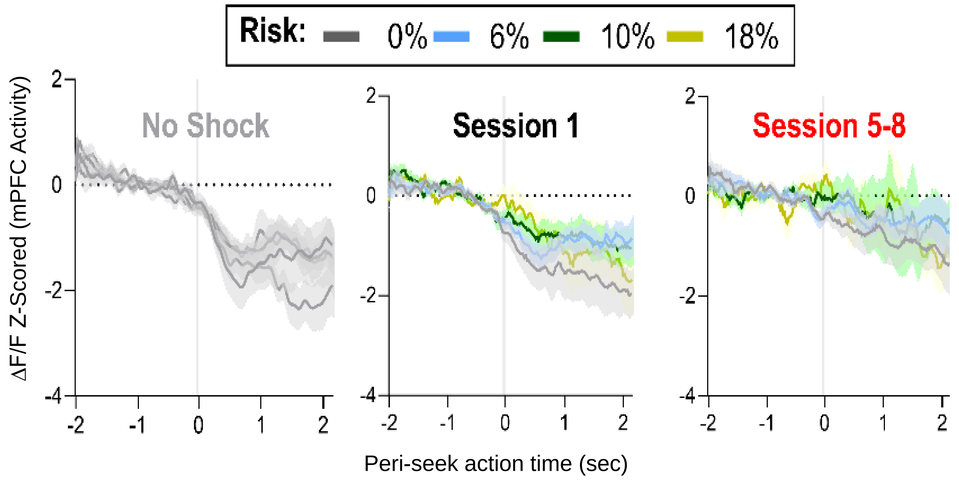
Rats Show Increased Anxiety as Risk increases



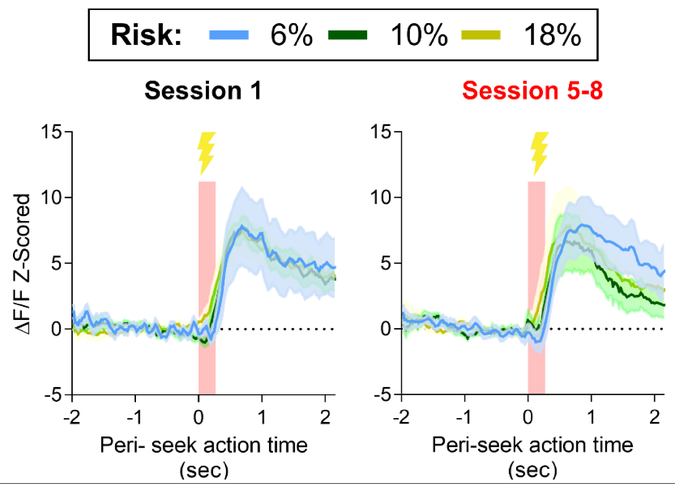
Learning of Punishment Risk Takes Several Sessions



Risky Action Encoding in the mPFC Changes As Subjects Learn Risk

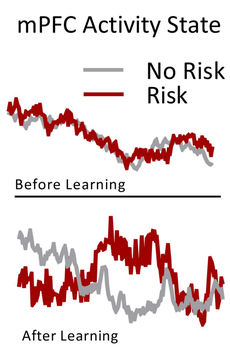


mPFC Encodes Negative Outcome (i.e. shock)

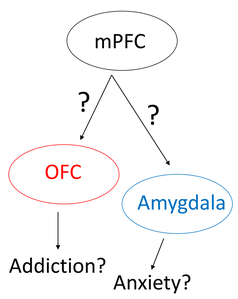


Conclusions and Directions

Rats show sex differences in punishment sensitivity that mirrors the risk-taking patterns seen in humans



The prefrontal cortex may serve a crucial role to track punishment exposure and adapt behavior to learning the risk of punishment



Future work in different brain regions will yield insight into how brain processes may become maladaptive in mental health disorders.

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