A Preclinical Platform for Simultaneous Behavior and Functional Connectivity Before and After Repeat Concussion.

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UCLA Brain Injury Research Center

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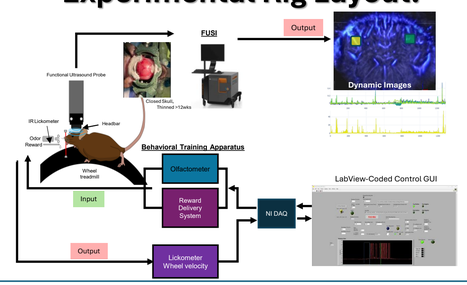
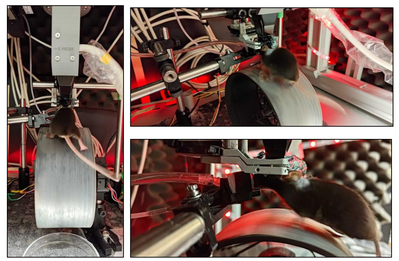
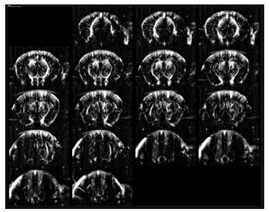
Experimental Rig Layout.

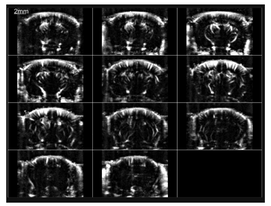


Functional Ultrasound Imaging (FUSI) Data Acquisition in Awake Mice.



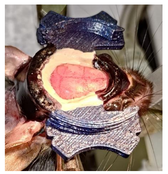


Raw FUSI Data: *Sedated*

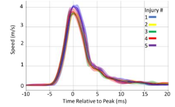


Raw FUSI Data: *Awake & Moving*

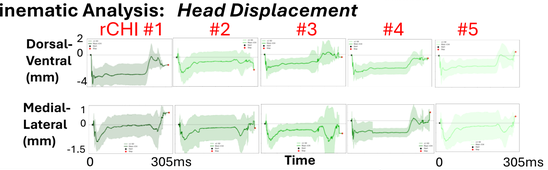
Head Cap Enabling Repeat, Awake Imaging & Pre/Post 5x Repeat Closed Head Injury (rCHI).



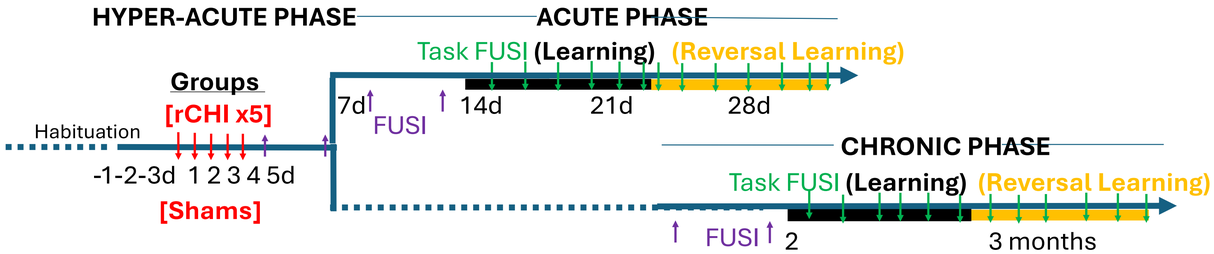
Kinematic Analysis: *Piston Speed*



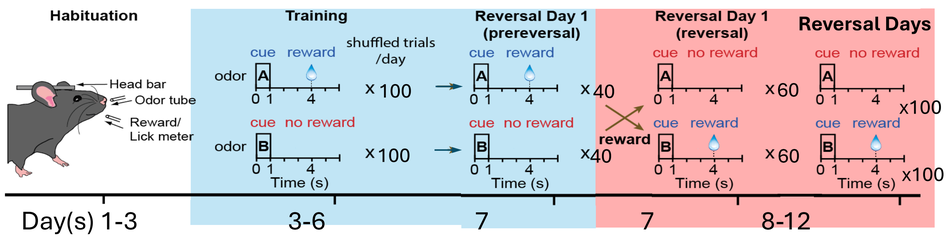
Kinematic Analysis: *Head Displacement*



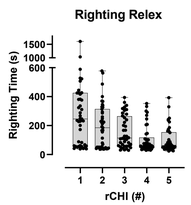
Experimental Protocol of Simultaneous Imaging and Behavior



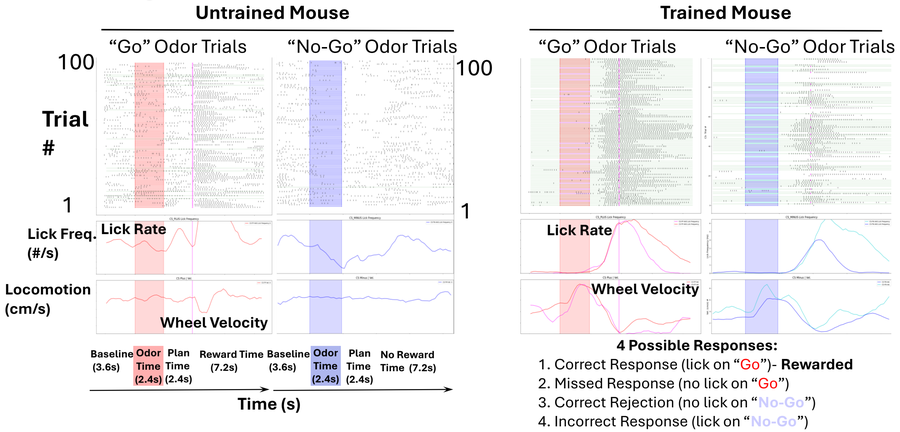
Learning & Reversal Learning: A 2-odor cue, Probabilistic Decision-Making Task



Each Trial:
80% correct
20% incorrect



Exemplar Behavioral Readout of Lick Rate and Locomotion

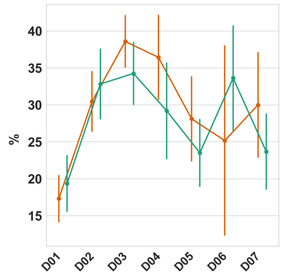


4 Possible Responses:

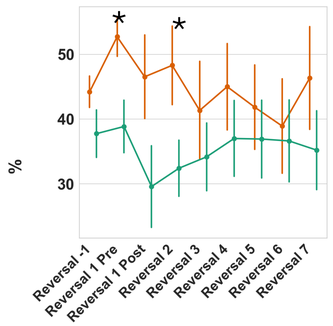
1. Correct Response (lick on "Go")- **Rewarded**
2. Missed Response (no lick on "Go")
3. Correct Rejection (no lick on "No-Go")
4. Incorrect Response (lick on "No-Go")

Concussion Results in Greater Goal-Directivity

Learning (Percent of all Trials With anticipatory Interaction)

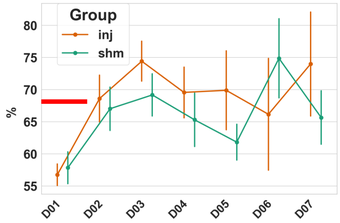


Reversal (Percent of Trials With anticipatory Interaction)



Decision-Making Behavioral at 2-4 Weeks Post-rCHI x5

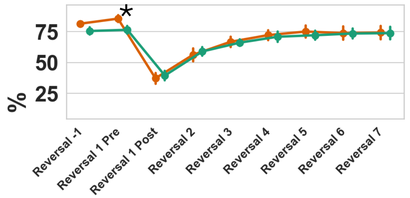
Learning (Percent Correct Anticipatory Response for all Trials) Mice Move to Reversal when Criterion Reached



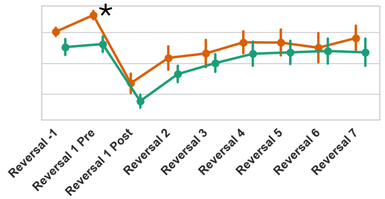
Group Sizes: Inj. (N = 12); Shm. (N=12)

* indicates significant group differences p-uncorr Mixed Model ANOVA

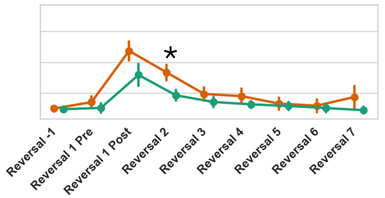
Reversal (Percent Correct all Trials)



Reversal (Percent Correct of CS+ Trials)



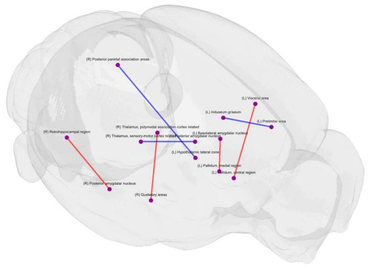
Reversal (Percent Incorrect of CS- Trials)



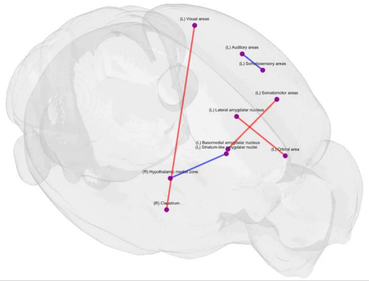
Decreases in memory circuitry and increases in reward networks indicate how injured mice adapt to perform the decision task.

Fully Learned

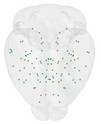
Response to "GO" Odor Trials



Response to "NO-GO" Odor Trials

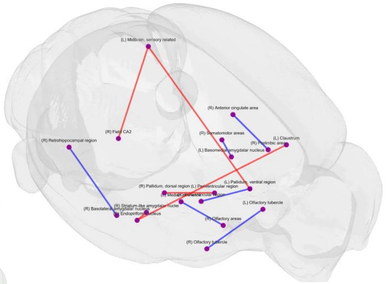


Brain Regions Tested

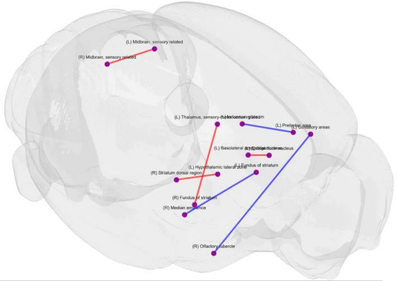


Reversal Learning

Response to "GO" Odor Trials



Response to "NO-GO" Odor Trials



KEY: Injured>Sham - hyperconnectivity Injured < Sham -hypoconnectivity

Controlled for lick rate, locomotion, ROI covariation; GLM; P<0.05, Bonferroni corrected