

## Introduction

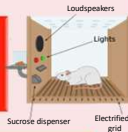
- Research in emotional regulation across sexes is limited, since typically only male subjects are used
- Goal - replicate past experiments' outcomes**, with a modified protocol to better **support single neuron recording analyses** and other new techniques
- Long Evans rats were assessed for fear and reward seeking behaviors during cues associated with administration of sucrose, foot shock or no outcome, and compared with a previous protocol
- Neuronal correlates of behavioral sex differences observed to a safety cue could provide **novel insights into the neural underpinnings of maladaptive fear across the sexes** → fear regulation disorders like PTSD

## Methods



16 Long Evans rats (8 Females & 8 Males)

Cued Sessions Video Recorded in Behavioral Boxes



Data Quantification (Self Written Program)

Data Analysis

2 Way RM ANOVA For Each Session (Cue, Sex)



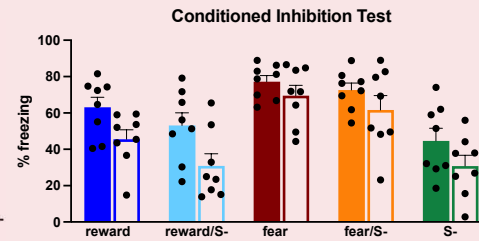
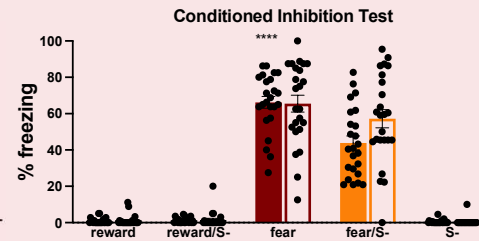
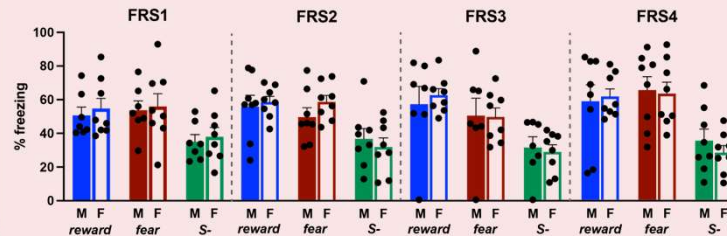
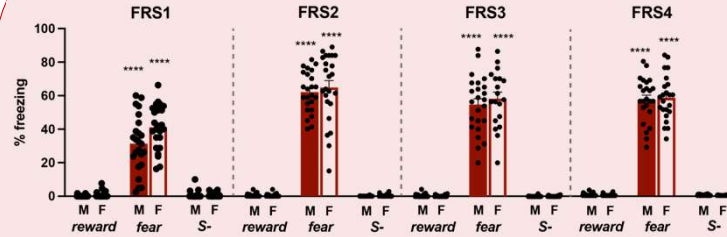
### FRS ORIGINAL Paradigm Sessions

- 6 Reward → (R+)
- 4 FRS (Fear; Reward; S-) → (R+)
- 15 Auditory A → (R+)
- 4 Auditory B → (F+)
- 25 Visual → (S-)
- CI (Conditioned Inhibition)
- 9 Auditory A → (R+)
- 4 Auditory B → (F+)
- 10 Visual → (S-)
- 10 Visual + A → (RS-)
- 11 Visual + B → (FS-)

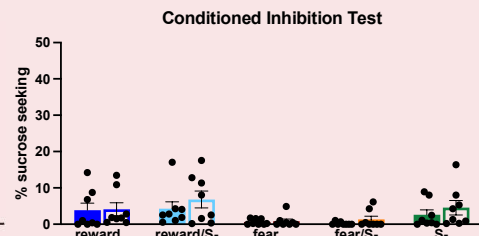
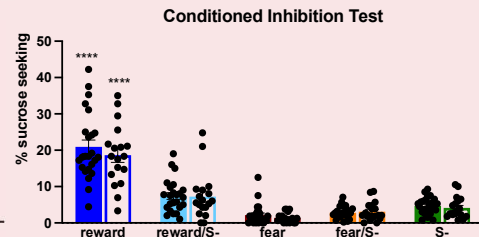
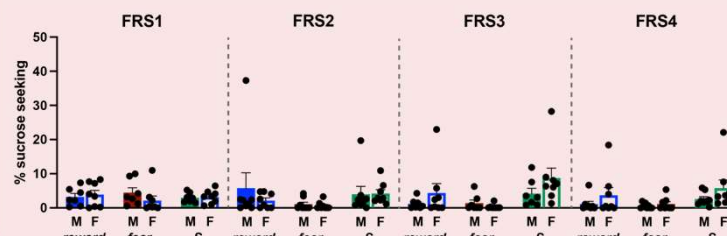
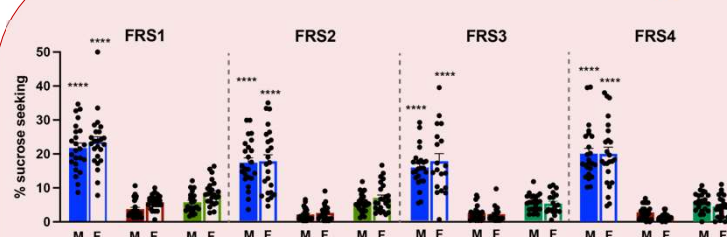
### FRS ADJUSTED Paradigm Sessions

- 4 Reward → (R+)
- 4 FRS (Fear; Reward; S-) → (R+)
- 15 Auditory A → (R+)
- 8 Auditory B → (F+)
- 20 Visual → (S-)
- CI (Conditioned Inhibition)
- 9 Auditory A → (R+)
- 8 Auditory B → (F+)
- 10 Visual → (S-)
- 11 Visual + A → (RS-)
- 10 Visual + B → (FS-)

## Freezing Results



## Sucrose Seeking Results



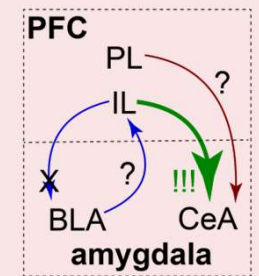
## Take Home Messages

- 4 shock trials (Original) → significant regulation of fear in the presence of S- cue for males, but not females.
- 8 shock trials (Adjusted) → generalization of fear for both sexes to all cues
- Despite the fear generalization, females learned to **freeze more to the fear cue Vs. reward cue**, while males froze equally to both.

## Additional Factors

- Diet Differences**
  - No Food Restriction
  - Treats Before Sessions
- Timing of Sessions**
  - Gap Between Last Reward and FRS1
- Animal Handling**
  - On Session Days

## Future Directions



Partial safety circuit of Amygdala and Prefrontal Cortex.  
 IL → CeA required for expression of safety behavior  
 IL → BLA not required for safety expression  
 BLA → IL and PL → CeA are projections of interest, which may be tested by the presented protocols

## References

Greiner EM, Müller I, Norris MR, Ng KH, Sangha S (2019). Sex differences in fear regulation and reward seeking behaviors in a fear-safety-reward discrimination task. Behavioural Brain Research, 368: 111903.