



# Effects of MD thalamic lesions on mPFC activity during a delayed non-matching to position task

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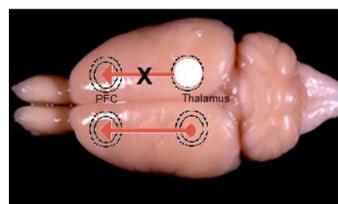
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## BACKGROUND

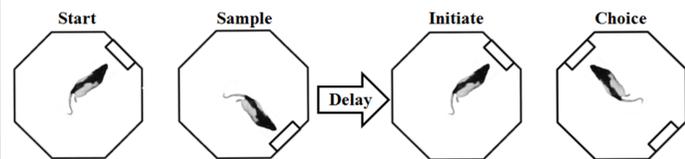
- Prefrontal cortex (PFC) is critical for executive functions that control behavior required to achieve a goal.
- Mediodorsal (MD) thalamus shares dense reciprocal connections with PFC and is positioned to influence PFC function.
- The delayed non-match to position (DNMTP) task requires executive functions, such as decision-making, planning, and working memory.
- The goal of the present study was to determine how MD lesions affect the acquisition of cortical activity supporting DNMTP performance.

## METHODS

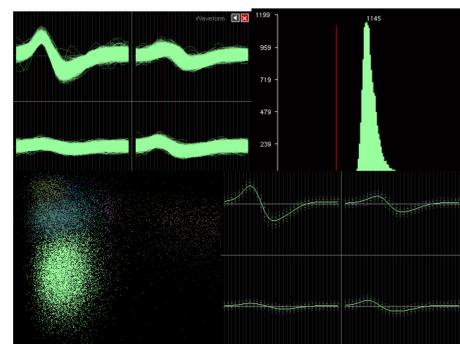


- Lesions were made to MD in one hemisphere prior to learning the DNMTP task.

- DNMTP requires a series of lever presses. The fourth lever press involves a choice between two response alternatives. The rat is rewarded for selecting the lever that was not previously reinforced (non-matching rule).

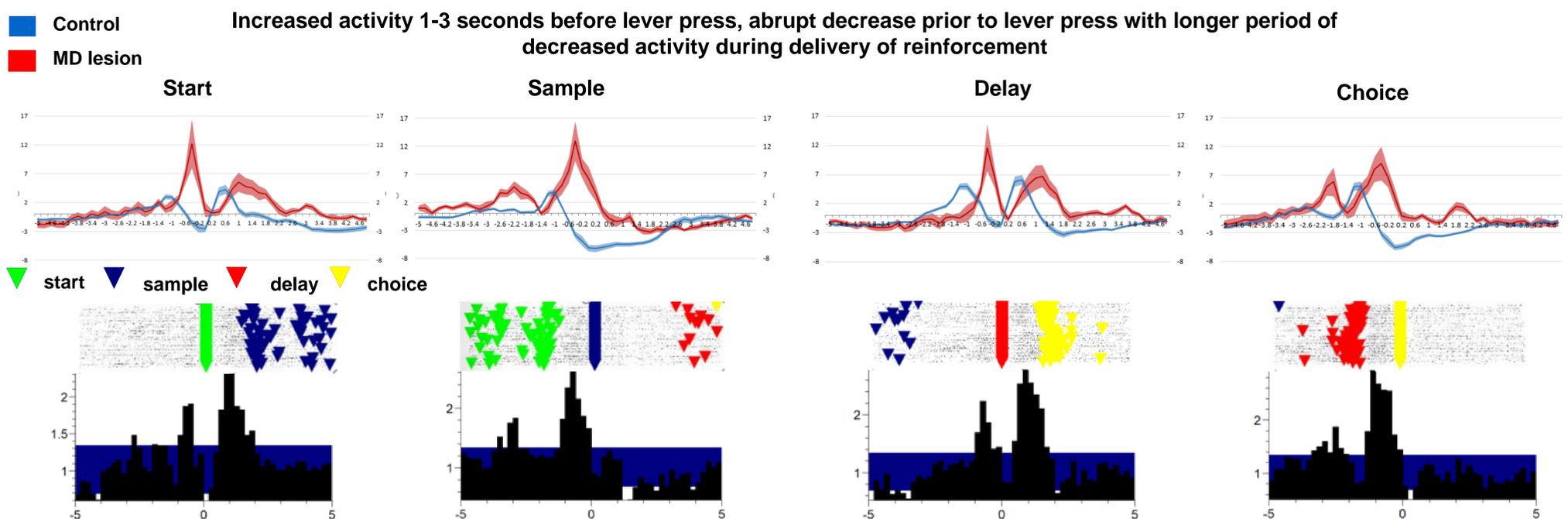


- After reaching criteria on DNMTP the rats underwent stereotaxic surgery to implant bilateral tetrode arrays in PFC.
- The tetrode arrays collected data from neurons in both hemispheres of PFC while rats ran the DNMTP task.
- Cluster cutting software, KlustaKwik™ was used for neuron identification and NeuroExplorer™ was used to determine event-related responses of neurons.
  - Perievent rasters and histograms were analyzed with a 99% confidence interval.
- Population histograms were made to measure normalized activity of event-related responses.
- Comparisons of neural activity in PFC were made between the control (no MD lesion) and experimental (MD lesion) hemispheres to determine the influence of MD on PFC activity.

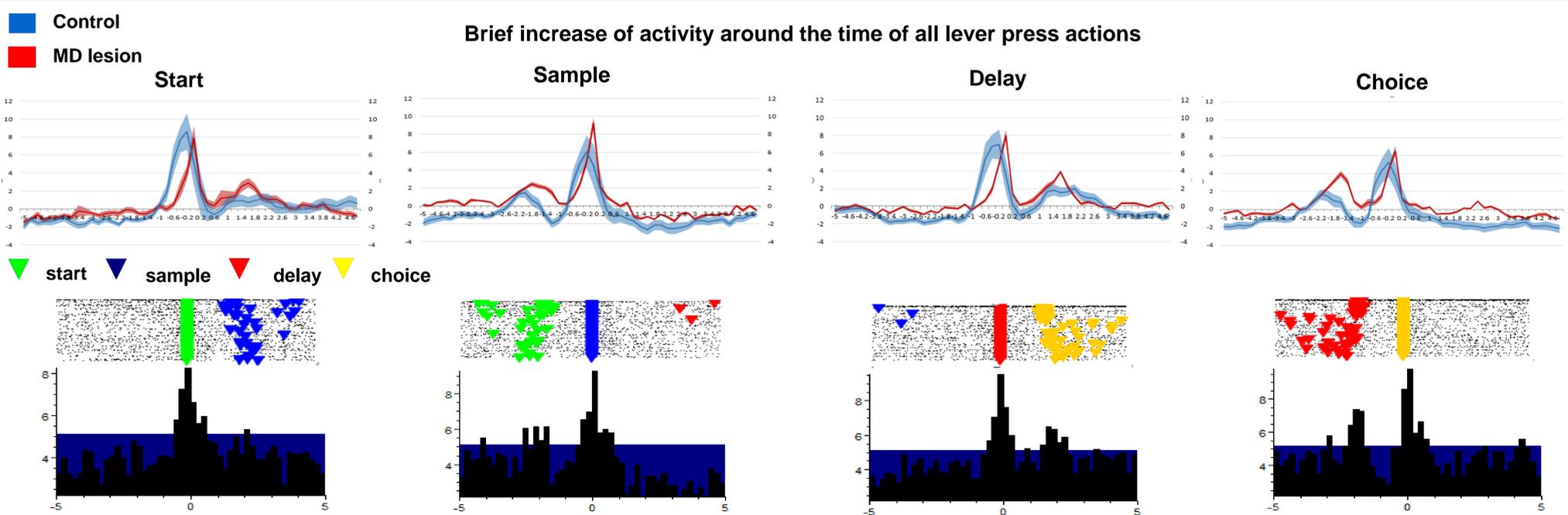


## RESULTS

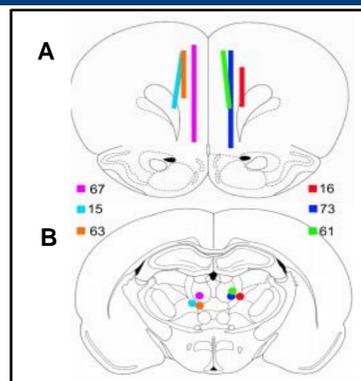
### MOVEMENT 1 RESPONSE



### LEVER PRESS RESPONSE



## ANATOMY



- (A) Hypothetical locations of bilateral tetrode arrays implanted into PFC. Neural activity is surveyed through anterior cingulate (ACC), prelimbic (PL) and infralimbic (IL) divisions.
- (B) Hypothetical locations of unilateral lesions made to MD before training on the DNMTP task.

Francoeur et al., (in preparation)

## CONCLUSIONS

- As compared to the control hemisphere of PFC, the MD lesioned hemisphere had restricted event-related response types. 14 lever press and 9 movement 1 cells were found in mPFC of the MD lesioned hemisphere. A small number (N < 5) of movement 2 and base lever cells were also found. 12 different event-related response types have been found in control PFC while rats perform the DNMTP task.
- The pattern of normalized activity in PFC has a delayed onset and shorter duration of excitation in the MD lesion hemisphere compared to control.
- These preliminary results suggest that thalamic nuclei modulate the development of task-relevant response types in PFC that give rise to executive functions.