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The Role of Corticothalamic Projections (Prelimbic Cortex to Nucleus Reuniens) in Working Memory

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The Role of Corticothalamic Projections (Prelimbic Cortex to Nucleus Reuniens) in Working Memory

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Introduction

- Working memory (WM) is the ability to store information for short periods of time and is used to execute tasks.
- WM has been understood to work via the medial prefrontal cortex (mPFC) and dorsal hippocampus (dHPC), but they do not directly project to each other.
- The nucleus reuniens of the thalamus (Re) is a “middle man” between the mPFC and dHPC.
- There are projections between the prelimbic cortex (PrL) and Re that may be used during WM.
- To test the connection of the PrL to Re, a delayed non-match to position (DNMTP) task was performed.

Methods

- Subjects: 20 rats (n=8 control virus; n=12 DREADD virus)
- Stereotaxic surgery of inhibitory DREADD (Designer Receptors Exclusively Activated by Designer Drugs) receptor virus (hm4Di) or control into the PrL.
 - Perform DNMTP without delay phase.
- DNMTP behavior task
 - Sample Phase: Press lever associated with light to receive sugar pellet.
 - Delay phase: Delay between subsequent sample phases.
 - Choice phase: Press lever opposite of presented light to receive sugar pellet.
- Stereotaxic surgery to insert cannulae into Re.
 - Perform DNMTP with delays of 4, 8, 16, and 32 seconds.
- After learn DNMTP task, inject 0.3 ul CNO or saline into Re.
 - Perform DNMTP task again.

Results

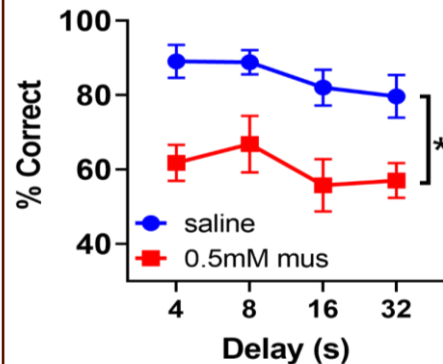


Figure 1. Rats received bilateral muscimol injections into the Re for the choice trials. Muscimol significantly impairs performance for choice trials at each specific delay (p=0.012).

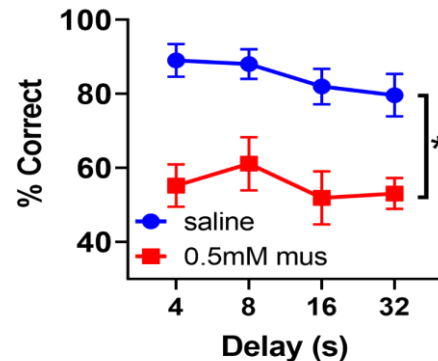


Figure 2. Rats received bilateral muscimol injections into the Re for all trials. Muscimol significantly impairs performance for all trials at each specific delay (p=0.0046).

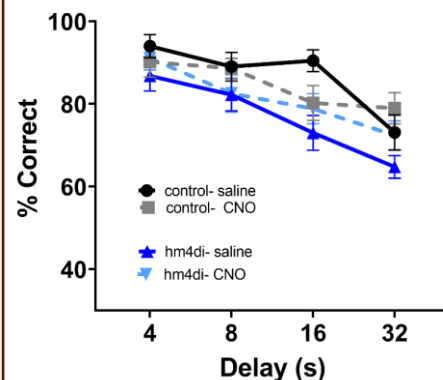


Figure 3. Rats received bilateral CNO or saline injections into the Re for the choice trials. CNO did not significantly impair performance. There is an effect of delay.

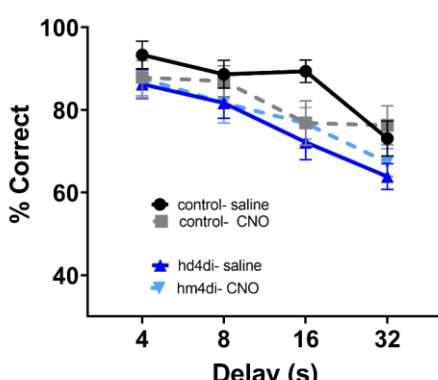


Figure 4. Rats received bilateral CNO or saline injections into the Re for all trials. CNO did not significantly impair performance. There is an effect of delay.

Conclusions

- Previous data shows Re inactivation via muscimol significantly impairs WM. It was unknown if this effects the PrL-Re or Re-PrL pathway.
- There is no significant effect on working memory via inhibition of the PrL-Re pathway via injection of CNO.
- There is an effect of delay with injection of CNO on the PrL-Re pathway as the percent correct decreased with increasing delay.
- The results suggest that the PrL-Re pathway may not be used in WM.
- A second project looked at the reverse, being the Re to PrL pathway (see Paul Kumpf's poster).
 - This experiment showed significantly that the Re-PrL pathway was inhibited via CNO injection (p=.006).
 - Re-PrL pathway may be important for WM.

Acknowledgements

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