

Effects of Electrolytic Lesions of the Reuniens and Rhomboid Nuclei on Cognitive Behaviors Using the Intradimensional Extradimensional (IED) Task in Rats

Randy Ellis, Patricia Pinedo and Dr. Robert P. Vertes
Center for Complex Systems and Brain Sciences

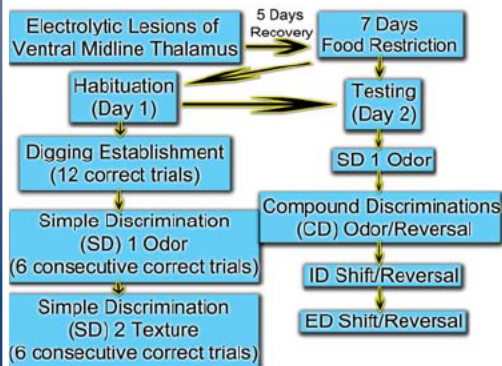
Does the ventral midline thalamus mediate cognitive behavior?

Introduction

- Reuniens and rhomboid (ReRh) nuclei of the ventral midline thalamus compose a functional relay between the medial prefrontal cortex (mPFC) and the hippocampus (Cassel et. al, 2013).
- We hypothesized that lesioning ReRh nuclei would impair performance on an odor texture discrimination cognitive task that requires medial prefrontal functioning.

Method

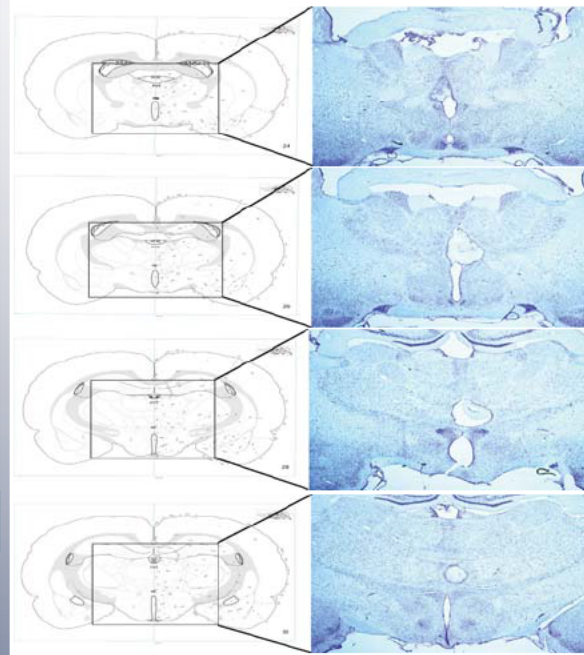
- Surgical Procedure:** Rats were anesthetized with isoflurane, an incision was made in the scalp, and an electrode conducted current to lesion the ReRh nuclei of the midline thalamus
- Apparatus:** Trials were conducted in a rectangular plastic cage with a central plastic divider and sliding Plexiglas panels used to separate one-third of the length of the cage into two sections. Each of these two sections contained a plastic bowl filled with medium, which could be scented.
- Task:** Seven stages of trials were conducted wherein a reward was paired with different odors and textures. Rats had to complete six successive correct trials to advance to the next stage.



Odors/Mediums by Stage

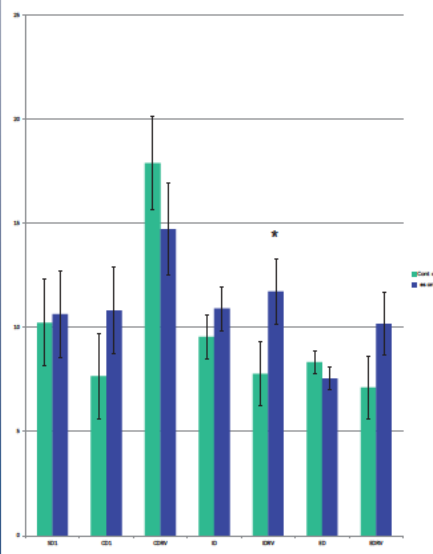
IED Stages	Odor/ Digging Medium Pairs
Stage 1 SD	O1 Ginger in recycled cellulose bedding O2 Mint in recycled cellulose bedding
Stage 2 CD	O1 Ginger; M1 Aspen O2 Mint; M2 Paper O1 Ginger; M2 Paper O2 Mint; M1 Aspen
Stage 3 CD Reversal	O1 Ginger; M1 Aspen O2 Mint; M2 Paper O1 Ginger; M2 Paper O2 Mint; M1 Aspen
Stage 4 ID Shift	O3 Cinnamon; M3 Bugles O4 Fennel; M4 Rubber O3 Cinnamon; M4 Rubber O4 Fennel; M3 Bugles
Stage 5 ID Reversal	O3 Cinnamon; M3 Bugles O4 Fennel; M4 Rubber O3 Cinnamon; M4 Rubber O4 Fennel; M3 Bugles
Stage 6 ED Shift	M5 Beads; O5 Citronella M6 Gravel; O6 Lemon M5 Beads; O6 Lemon M6 Gravel; O5 Citronella
Stage 7 ED Reversal	M5 Beads; O5 Citronella M6 Gravel; O6 Lemon M5 Beads; O6 Lemon M6 Gravel; O5 Citronella

Histology

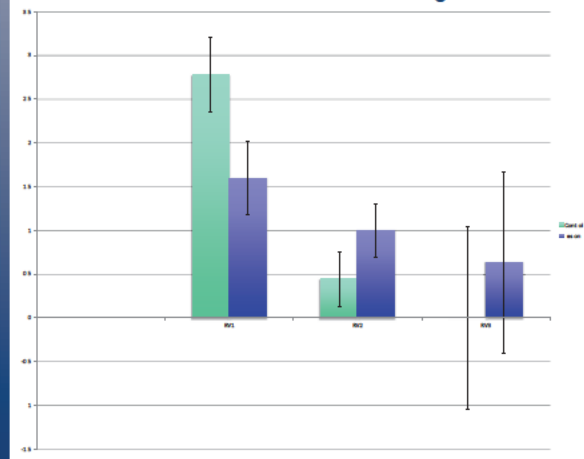


Lesion: n=11 Control: n=9

Total Trials



Total Errors in Reversal Stages



Results

- ReRh lesioned rats showed deficits in reversal learning, exemplified by the number of trials needed to complete the ID reversal shift stage ($F_{(1,18)}=4.2, p<0.05$).
- There was a trend of lesioned rats needing more trials to complete the ED shift reversal stage as well ($F_{(1,18)}=3.1, p=.09, NS$).
- Lesioned rats did not make significantly more errors in reversal stages than controls, but there was a trend of reversal learning deficits in the ED Reversal stage (RV1: $F_{(1,18)}=1.9, p=0.3, NS$; RV2: $F_{(1,18)}=.97, p=.34, NS$; RV3: $F_{(1,18)}=3.4, p=.08, NS$).

Discussion

- Lesions of rat ReRh resulted in an impairment in behavioral flexibility which was evident by deficits in reversal stages of the task.
- Lesions of ReRh resulted in more errors committed during the task. This result indicates perseveration in lesioned rats.
- Perseveration is a symptom of prefrontal damage in humans and is found in ADHD and autism/Asperger's syndrome.
- These learning deficits caused by lesions of ReRh show that these nuclei play a significant role in cognitive function, and beg further investigation for potentially novel treatments for a myriad of neurological disorders.

References

- Cassel, J. C., Pereira de Vasconcelos, A., Loureiro, M., Cholvin, T., Dalrymple-Alford, J. C., & Vertes, R. P. (2013). The reuniens and rhomboid nuclei: Neuroanatomy, electrophysiological characteristics and behavioral implications. *Progress in neurobiology*, 111, 34-52.
- Vertes, R. P.; Hoover, W. B.; Szigeti-Buck, K.; Leranah, C. (2007). "Nucleus reuniens of the midline thalamus: Link between the medial prefrontal cortex and the hippocampus". *Brain Research Bulletin* 71 (6): 601-609.

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