



## MEMORY IN RATS.

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Rats with hippocampal damage are severely impaired on T-maze alternation (Olton, 1986). One interpretation of this deficit is that hippocampal lesions produce a spatial memory impairment. A second interpretation is that rats with hippocampal lesions have impaired episodic memory (Eichenbaum, 2000), and therefore do not remember *what* happened on the previous trial. Consistent with this second interpretation, a recent report by Wood et al. (2000) has demonstrated that hippocampal place cells recorded on the stem of a T-maze, fire differently on left- and right-turn trials. To differentiate between these two hypotheses, we tested a group of rats with electrolytic lesions of the hippocampus (H group) and a group of sham-operated rats (N group), on both a spatial and a non-spatial (odor) alternation task.

### Surgery

8 Long-Evans rats were given electrolytic lesions of the hippocampus (H group), and 8 were given sham surgeries (N group). For the H surgeries, 12 lesions were made per hemisphere using a monopolar stimulating electrode (FHC, Inc.) and a digital stimulus generator (Model 6bp, FHC, Inc.). Lesion parameters were adapted from Agster, et al., 2002. One H rat was removed from testing because of infection.

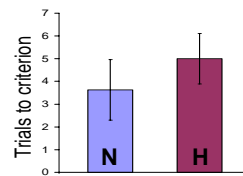
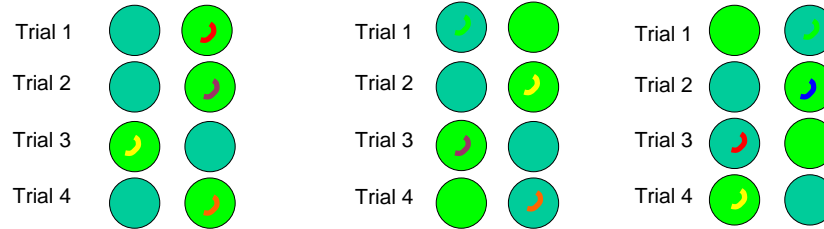
### Training

All training was conducted in the rat's homecage, using odorized (household spices) sand-filled cups, attached side-by-side to a Plexiglas™ plaque. Rats were trained to dig in the sand to retrieve a Froot Loop™ reward. On each trial, only one of the two cups would be baited, and the location of the bait depended on the odor or the spatial position of the cup. The ITI was approximately 1 min.

**Odor discrimination.** All rats were initially trained on a single odor discrimination in which one odor (e.g., cinnamon) was always rewarded. Rats were trained for up to 20 trials per day to a criterion of 9/10 consecutive trials correct.

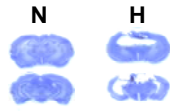
**Alternation.** After the odor discrimination, ½ of the rats were trained first on the spatial alternation problem and then the odor alternation problem, and the other half were trained first on the odor alternation. In both problems, rats were given an initial forced trial to inform them of the sequence (in forced trials, a lid with holes was screwed onto the unrewarded cup). Rats were then trained for 5 trials per day to a criterion of 9/10 consecutive trials correct. In odor alternation, rats needed to ignore the spatial position of the cup (left-right) and to alternate between the two odors (e.g., coffee and paprika). In the spatial alternation, rats needed to ignore the odor of the sand, and to alternate between the left and right cups.

### Odor Discrimination    Spatial Alternation    Nonspatial (Odor) Alternation

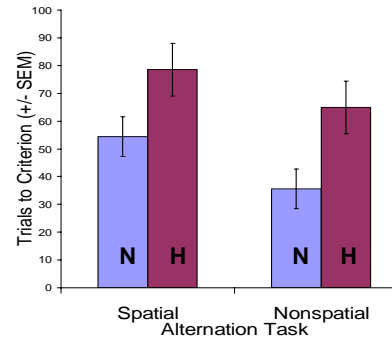


### Performance on Odor Discrimination

Rats with H lesions took the same number of trials as N rats to learn a simple odor discrimination  $t(13)=0.78$ ,  $p>.05$ .



Largest lesion illustrated on right. There was no systematic relationship between size of lesion and performance on either alternation task.



### Performance on Alternation Tasks

#### A two-way ANOVA revealed:

- the H group was impaired relative to the N group,  $F(1,13)=7.41$ ,  $p<.05$
- the spatial task was more difficult than the odor task,  $F(1,13)=11.33$ ,  $p<.05$
- there was no significant task x group interaction,  $F(1,13)<1$ , indicating that the H group was similarly impaired on both alternation tasks

#### This finding was confirmed by post-hoc analyses

- the H group required 30 more trials than the N group to learn the nonspatial task,  $t(13)=2.92$ ,  $p<.05$
- the H group also required 24 more trials than the N group to learn the spatial task,  $t(13)=2.06$ ,  $p=.06$ .

### Summary:

- Rats with H lesions were similarly impaired on the odor and spatial alternation tasks.
- Therefore, it seems likely that the H lesions produced a general alternation memory deficit rather than a specific spatial memory deficit.
- This deficit is not likely due to cortical damage to the parahippocampal region because there was no relationship between performance and lesion size, and a preliminary study (Ramus, unpublished data) showed similar magnitude deficits on both the odor and spatial alternation tasks following incomplete fornix lesions.

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