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INTRINSIC ACTIVITY

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MEETING ABSTRACT

A3.25

Replay of behavioral trajectories in the medial prefrontal cortex during rule switching

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Background: Temporally-organized reactivation of previous experiences during awake immobility is thought to underlie cognitive functions needed for the solving of tasks. Replay of trajectories has first been described for the hippocampus where spatially selective cells become active independent of space. The medial prefrontal cortex (mPFC) is required for flexibly adapting behavioral strategies upon a change in rule. One way in which the mPFC might support rule switching is with sequential replay. It is unclear however whether the mPFC displays sequential reactivation of behavioral experiences during the awake state and whether it has a functional role.

Methods: With 32-tetrode microdrives, we performed simultaneous recordings from the dorsal CA1 of the hippocampus (HPC) and prelimbic area of the mPFC of rats performing a rule-switching task on a plus maze, known to be mPFC-dependent. We recorded from an average of 63 mPFC and 78 HPC pyramidal cells per recording session.

Results: We found that the mPFC neuronal population coded for the relative position between the start and the goal arm with a precision similar to that of the HPC. During awake immobility periods, the mPFC replayed temporally-organized sequences of positions, resembling entire spatial trajectories. mPFC trajectory replay at the goal positively correlated with rule-switching performance and was increased on error trials. HPC trajectory replay at the goal was negatively correlated with rule-switching performance. Finally, trajectory replay in the HPC and mPFC occurred independently of each other.

Discussion: These results demonstrate that the mPFC can replay ordered patterns of activity during awake immobility. The relationship of mPFC trajectory replay with performance, suggests that replay may be a mechanism underlying the mPFC's role in flexible behavior. Finally, since we did not find a temporal correlation between trajectory replay events in the HPC and mPFC, sequential replay in these two areas might serve different functions in this task.

Keywords: mPFC – hippocampus – replay – rule switching

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