

# Reactivation of semantically invariant neurons during HFOs in the human medial temporal lobe during sleep

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**Rationale** One proposed mechanism of memory consolidation is the reactivation of firing sequences in hippocampal neurons, especially during sleep. In the human medial temporal lobe (MTL), *semantic neurons* have been identified. These neurons respond to the content of a percept, and are thought to play a role in the encoding and consolidation of declarative long-term memory. We recorded the LFP and the activity of semantic neurons in epilepsy patients during an episodic memory task and subsequent sleep.

**Methods** We identified semantic neurons and the corresponding response-eliciting stimuli in the MTLs of 20 epilepsy patients implanted with depth-electrodes for presurgical evaluation. The patients then performed a memory task involving a short story which established episodic links between the response-eliciting stimuli in a predefined order. We recorded single- and multi-unit activity during learning, sleep, and recall. LFP events were subjected to a cluster analysis.

**Results** We identified distinct classes of LFP events, which differed in their sleep-stage dependence and regional extent. We successfully recorded from the same semantically invariant neurons in the MTL for up to 15 hours. These units showed a strong tendency to fire during LFP events resembling sharp-wave/ripples. Unit activity in the hippocampus was reduced during REM sleep.

**Discussion** Our results provide evidence in favor of current models of memory consolidation. To distinguish interictal epileptic discharges from physiological sharp-wave/ripples, a more fine-grained analysis of the relationship between unit activity and different classes of LFP events is necessary.