

Reinstatement of Oscillatory Power and Synchrony during Successful Memory Encoding and Recall

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Introduction

Successful memory encoding is hypothesized to occur through the establishment of neural association networks that are re-activated during recall. In this scenario, neural activity at the time of successful recall should recapitulate neural activity at the time of encoding. Here, we examine this directly by examining the similarity in oscillatory power and phase synchrony between encoding and recall.

Methods

Using electrocortigraphic (ECoG) recordings capture from subdural electrodes implanted in patients with medically refractory epilepsy, we measured oscillatory power and phase synchrony during a paired association memory task. We compared the distributed pattern of network activity, as measured through both spectral power and pair-wise synchrony, during the presentation of the stimulus pairs when memories are encoded and during the recall period.

Results

We found that the distributed pattern of oscillatory power across all network locations was reinstated during the recall period for words that were successfully remembered. The similarity in distributed neural activity between the recall period and stimulus presentation was significantly greater for correct words than for incorrect recalls. In addition, we found specific nodes of network activity that also exhibited similarity in their synchronous connections with the remaining nodes in the network, suggesting that network interactions were also re-instated during successful recall.

Conclusions

Our data demonstrate that memory encoding during a paired associate task is a distributed process, and suggest that the distributed pattern of neural activity across the entire network is important for the successful completion of a memory encoding task.

Learning Objectives

By the conclusion of this session, participants should be able to understand the distributed nature of memory encoding and to understand how memory networks are reactivated during successful recall

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