All. 1 - Verbale 4

PROVA ORALE NR. 1

1) Descrivere la propria esperienza professionale
2) Descrivere un esperimento per caratterizzare un circuito di disinibizione multisinaptica
3) Descrivere un approccio all'analisi del dato elettrofisiologico

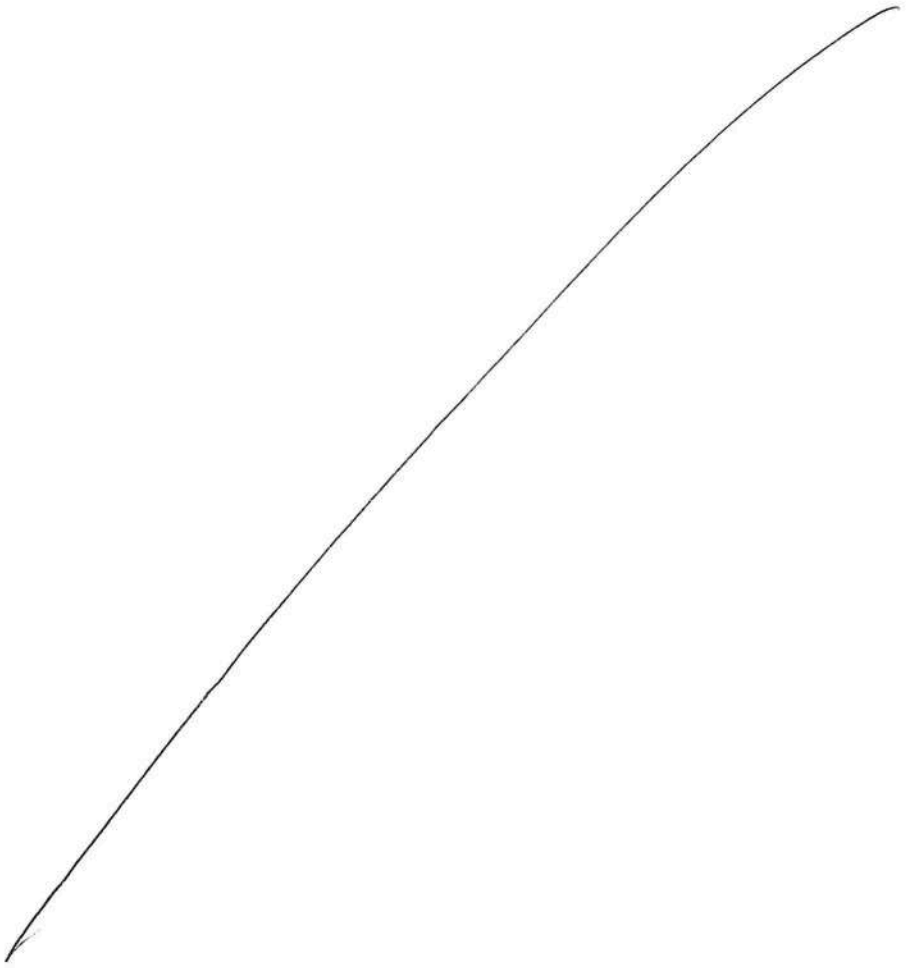
Accertamento lingua inglese:

EEG Oscillations Are an Excellent Link to Neurophysiology

Neural oscillations are the most prominent feature of EEG data, and countless studies over many decades have demonstrated that perceptual, cognitive, motor, and emotional processes are tightly linked with specific patterns of oscillations [17]. Oscillations are observed throughout the nervous system and at multiple spatial and temporal scales [18], and they seem to be ubiquitous across species [19]. Taken together, this suggests that oscillations have important functions that have been preserved over the course of evolution. Furthermore, neural oscillations have been investigated using *in vitro*, *in vivo*, and *in silico* techniques, producing a large and growing understanding of the principles and significances of oscillations. Therefore, the motivation for studying neural oscillations is that they can provide insights into the computational principles, as well as the temporal precisions and limitations, of the neural computations that implement perception, cognition, and action.

Accertamento informatica:

1 Quale strumento del pacchetto Office potrebbe usare per preparare un manoscritto?



PROVA ORALE NR. 2

1) Descrivere la propria esperienza professionale
2) Descrivere un protocollo di registrazione elettrofisiologica accoppiata alla stimolazione del circuito per via optogenetica
4) Descrivere un approccio all'analisi del dato elettrofisiologico

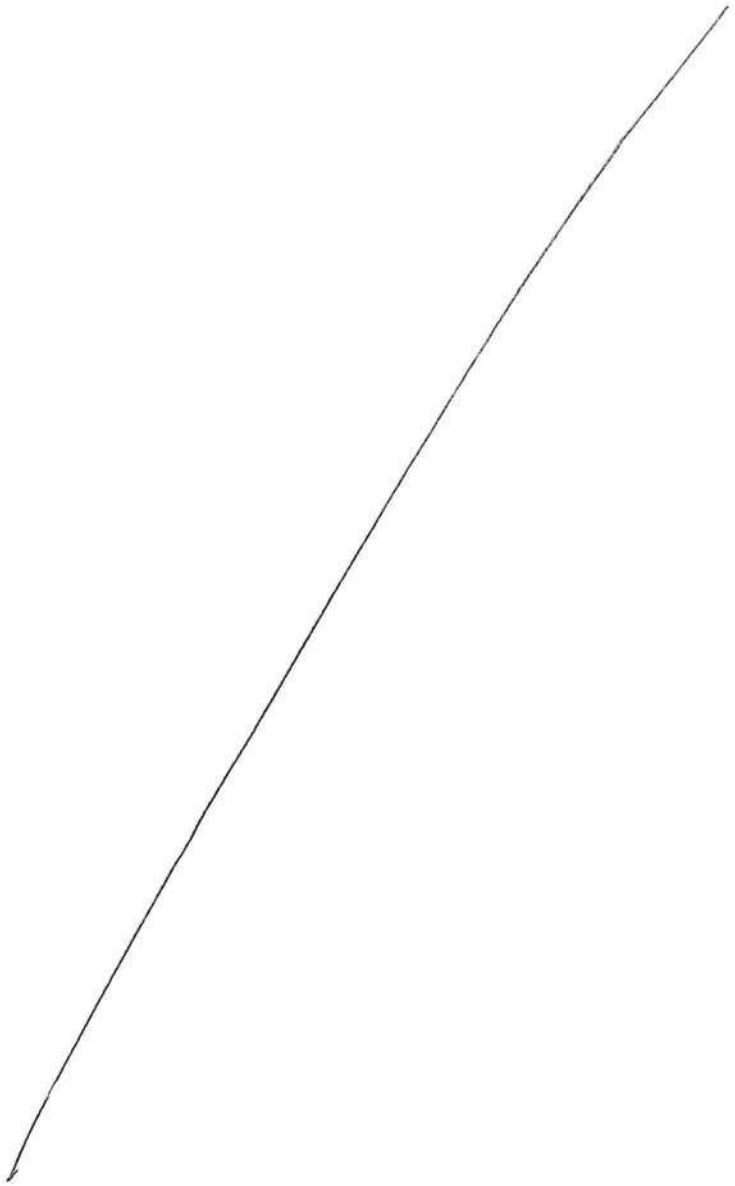
Accertamento lingua inglese

Theta oscillations support active exploration in human spatial navigation

Active navigation seems to yield better spatial knowledge than passive navigation, but it is unclear how active decision-making influences learning and memory. Here, we examined the contributions of theta oscillations to memory-related exploration while testing theories about how they contribute to active learning. Using electroencephalography (EEG), we tested individuals on a maze-learning task in which they made discrete decisions about where to explore at each choice point in the maze. Half the participants were free to make active decisions at each choice point, and the other half passively explored by selecting a marked choice (matched to active exploration) at each intersection. Critically, all decisions were made when stationary, decoupling the active decision-making process from movement and speed factors, which is another prominent potential role for theta oscillations. Participants were then tested on their knowledge of the maze by traveling from object A to object B within the maze. Results show an advantage for active decision-making during learning and indicate that the active group had greater theta power during choice points in exploration, particularly in midfrontal channels. These findings demonstrate that active exploration is associated with theta oscillations during human spatial navigation, and that these oscillations are not exclusively related to movement or speed. Results demonstrating increased theta oscillations in prefrontal regions suggest communication with the hippocampus and integration of new information into memory. We also found evidence for alpha oscillations during active navigation, suggesting a role for attention as well. This study finds support for a general mnemonic role for theta oscillations during navigational learning.

Accertamento informatica

2 Quale strumento del pacchetto Office potrebbe usare per preparare un poster scientifico?



PROVA ORALE NR. 3

3) Descrivere la propria esperienza professionale
4) Che cosa si intende e come procederebbe per misurare il "fingerprint" di una cellula in modalità "whole cell"?
5) Descrivere un approccio all'analisi del dato elettrofisiologico

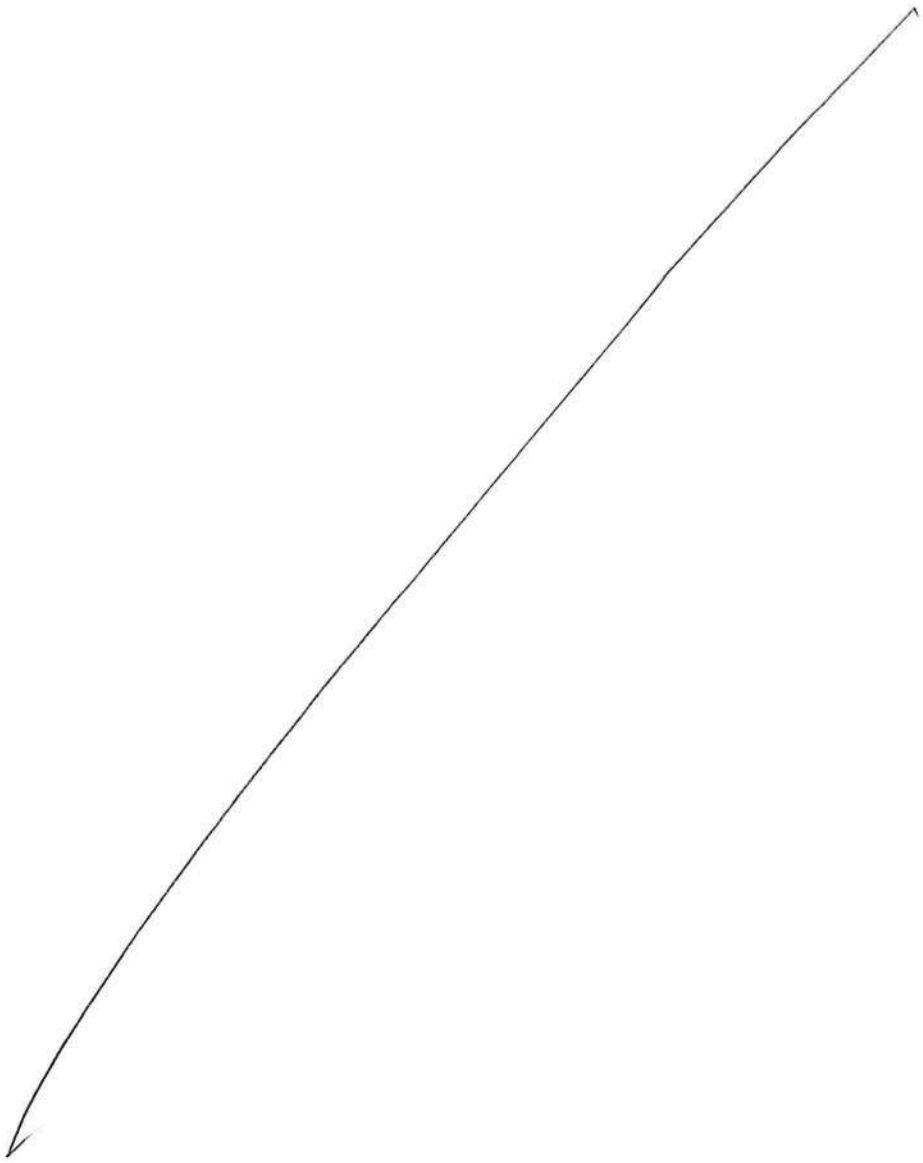
Accertamento lingua inglese

Neural responses to sensory novelty with and without conscious access

Detection of novel stimuli that violate statistical regularities in the sensory scene is of paramount importance for the survival of biological organisms. Event-related potentials, phasic increases in pupil size, and evoked changes in oscillatory power have been proposed as markers of sensory novelty detection. However, how conscious access to novelty modulates these different brain responses is not well understood. Here, we studied the neural responses to sensory novelty in the auditory modality with and without conscious access. We identified individual thresholds for conscious auditory discrimination and presented to our participants sequences of tones, where the last stimulus could be another standard, a subthreshold target or a suprathreshold target. Participants were instructed to report whether the last tone of each sequence was the same or different from those preceding it. Results indicate that attentional orientation to behaviorally relevant stimuli and overt decision-making mechanisms, indexed by the P3 event-related response and reaction times, best predict whether a novel stimulus will be consciously accessed. Theta power and pupil size do not predict conscious access to novelty, but instead reflect information maintenance and unexpected sensory uncertainty. These results highlight the interplay between bottom-up and top-down mechanisms and how the brain weights neural responses to novelty and uncertainty during perception and goal-directed behavior.

Accertamento informatica

3 Quale strumento del pacchetto Office potrebbe usare per eseguire semplici calcoli aritmetici, quali somme e moltiplicazioni?



PROVA ORALE NR. 4

1) Descrivere la propria esperienza professionale
2) Come procederebbe per valutare le risposte postsinaptiche di tipo eccitatorio escludendo quelle di tipo inibitorio?
3) Descrivere un approccio all'analisi del dato elettrofisiologico

Accertamento lingua inglese

Dynamic theta-modulated high frequency oscillations in rat medial prefrontal cortex during spatial working memory task

Interaction of oscillatory rhythms at different frequencies is considered to provide a neuronal mechanism for information processing and transmission. These interactions have been suggested to have a vital role in cognitive functions such as working memory and decision-making. Here, we investigated the medial prefrontal cortex (mPFC), which is known to have a critical role in successful execution of spatial working memory tasks. We recorded local field potential oscillations from mPFC while rats performed a delayed-non-match-to-place (DNMTP) task. In the DNMTP task, the rat needed to decide actively about the pathway based on the information remembered in the first phase of each trial. Our analysis revealed a dynamic phase-amplitude coupling (PAC) between theta and high frequency oscillations (HFOs). This dynamic coupling emerged near the turning point and diminished afterward. Further, theta activity during the delay period, which is thought of as the maintenance phase, in the absence of the coupling, can predict task completion time. We previously reported diminished rat performance in the DNMTP task in response to electromagnetic radiation. Here, we report an increase in the theta rhythm during delay activity besides diminishing the coupling after electromagnetic radiation. These findings suggest that the different roles of the mPFC in working memory could be supported by separate mechanisms: Theta activity during the delay period for information maintenance and theta-HFOs phase-amplitude coupling relating to the decision-making procedure.

Accertamento informatica

Quale funzione del pacchetto Office userebbe per la revisione e correzione di un manoscritto?