EXTERNAL

SEMINAR

INMED Conference Room

Monday, 15th May 2017 - 11 a.m

Dr Pascale QUILICHINI

Invited by: Valérie CREPEL

Institut de Neurosciences des Systèmes (INS)
Inserm UMR1106, AMU, Campus Santé Timone
13005 Marseille, France

Pascale.QUILICHINI@univ-amu.fr

The Nucleus Reuniens mediates a hippocampo-cortical coupling in the gamma band during slow oscillations

The hippocampus (HPC) and medial prefrontal cortex (mPFC) have well-established roles in memory encoding and retrieval. However, the mechanisms underlying interactions between the HPC and mPFC are not fully understood. Some evidences have recently emerged that an indirect pathway between the HPC and the mPFC via the midline thalamic nucleus reuniens (RE) may play a role in memory processing. This places the RE in a key position to relay information between the mPFC and HPC to coordinate their functions. However, it is not yet known how the RE mediates the transfer of information between these structures.

In order to understand the fundamentals of the functional connectivity of this network, we have recorded simultaneously the unit activities and local field potentials of the HPC, mPFC and RE during two stable brain states dominated by theta and slow oscillations in anesthetized rats. Our results showed that during the slow oscillations state, mPFC and HPC displayed coordinated bursts in the gamma oscillations-band whereas no specific interaction could be detected during the theta oscillations state. These gamma oscillations bursts were locked to a specific phase of the ongoing slow oscillations and entrained some of the local neuronal populations. This HPC-mPFC synchronization was also present during the natural slow-wave sleep in non-anesthetized rats. Such coordinated activity could be driven by the RE neurons. The analysis of their firing revealed that a large portion of them increased their firing probability prior (< 200ms) the expression of the gamma bursts detected in the mPFC and HPC. Such behaviour was specific to RE neurons, since we could not see any significant increase of firing around the gamma oscillations bursts in the neighbouring thalamic nuclei neurons. Moreover, pharmacological inactivation of the RE neurons firing using muscimol reinforced our initial assumption of a causal role of the RE neurons in the HPC-mPFC gamma bursts coordination.

We propose that the specific firing of some RE neurons could drive the coordinated gamma oscillations bursts between mPFC and HPC, which are known to play a major role in the binding of distant regions that underlies many central cognitive functions. Among them, the process of memory consolidation causally involves the hippocampo-cortical dialog through various oscillations, and such gamma coupling could then be instrumental.

Maëva Ferraris, Antoine Ghestem, Ana F. Vicente, Christophe Bernard and Pascale P. Quilichini

Parc Scientifique de Luminy
163 Avenue de Luminy
13273 MARSEILLE Cedex 09

Aix*Marseille université Initiative d'excellence

Inmed Institut de neurobiologie de la méditerranée

Instituts thématiques Inserm Institut national de la santé et de la recherche médicale