PERISLEEP — Result In Brief

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Imaging our sleep-wake cycles

EU-funded researchers are investigating how sleep affects cognitive function and brain plasticity.

The importance of sleep for proper cognitive function has long been recognized but the physiological processes involved are still poorly understood. Sleep is a complex state and linking cortical dendritic activity in the brain to sleep-wake cycles should help provide novel insight on the function of sleep. To bring this about, the PERISLEEP project was initiated.

Dendrites are branched projections of neurons where most synapses are formed and therefore represent the main “hub” for information processing and integration, and most probably the physical substrate of our memories. Researchers will combine optical recording (Ca2+ imaging) with electroencephalography to understand the correlation between different brain states (sleep vs. wakefulness) and changes in dendritic activity in the cortex.

During a sleep-wake cycle, our brain switches between four major brain states: active wake, quiet wake, non-rapid eye movement (NREM) sleep, and REM sleep. Cortical spindles (9-16 Hz) is a type of brain activity that is generally observed during NREM sleep cycles, especially during the transition from NREM to REM sleep. These brain waves have been repeatedly found to be linked to synaptic plasticity and memory processes in humans and animals.

Already, researchers have developed techniques to image Ca2+ from dendrites in rodents during sleep as well as free movement. They continuously recorded dendritic activity for over 15 hours during all major brain states. Interestingly, not only dendritic activity was highest during NREM to REM transition, but spindle activity was highly predictive of dendritic activity changes.

Researchers will assess the functional implications of these results through experiments on rodents. They will expose rodents to different waking experiences and assess changes in dendritic activity during sleep-wake cycles, and determine impact on synaptic plasticity.

Project outcomes should elucidate the impact of dendritic activity and sleep on important functions such as learning and memory as well as synaptic plasticity. This should attract more funding and facilitate further research activities with applications in treating sleep and learning disorders.

Related information

Report Summary

Final Report Summary - PERISLEEP (Imaging dendrites across wake and sleep: Synaptic plasticity in freely behaving animals)

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Subjects
Scientific Research

Keywords
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