Network hypersynchrony

Network hypersynchrony refers to a condition where different brain regions exhibit abnormally synchronized activity at high frequencies. This phenomenon is often associated with neurological and psychiatric disorders, such as epilepsy, Parkinson's disease, schizophrenia, and autism spectrum disorders.

In the context of brain networks, synchronization is typically a fundamental process for coordinating the activity between different regions, allowing for efficient communication and processing. However, when hypersynchrony occurs, it can disrupt normal cognitive functions and behavior. This excessive synchronization can result from an imbalance in the excitation and inhibition within the brain's neural circuits.

For example, in epilepsy, hypersynchrony can manifest as the abnormal, synchronous firing of neurons, leading to seizures. In psychiatric disorders, hypersynchrony has been observed in certain brain networks involved in cognitive control, sensory processing, or emotional regulation.

Research into network hypersynchrony is an area of active investigation, as understanding this phenomenon can help improve diagnostic approaches and treatments for various brain disorders.y refers to a condition where different brain regions exhibit abnormally synchronized activity at high frequencies. This phenomenon is often associated with neurological and psychiatric disorders, such as epilepsy, Parkinson's disease, schizophrenia, and autism spectrum disorders.

In the context of brain networks, synchronization is typically a fundamental process for coordinating the activity between different regions, allowing for efficient communication and processing. However, when hypersynchrony occurs, it can disrupt normal cognitive functions and behavior. This excessive synchronization can result from an imbalance in the excitation and inhibition within the brain's neural circuits.

For example, in epilepsy, hypersynchrony can manifest as the abnormal, synchronous firing of neurons, leading to seizures. In psychiatric disorders, hypersynchrony has been observed in certain brain networks involved in cognitive control, sensory processing, or emotional regulation.

Research into network hypersynchrony is an area of active investigation, as understanding this phenomenon can help improve diagnostic approaches and treatments for various brain disorders.

Network hypersynchrony is emerging as an important system-level mechanism underlying seizures, as well as cognitive and behavioral impairments, in children with structural brain abnormalities. Chari et al. investigated patterns of single-neuron action potential behavior in 206 neurons recorded from tubers, transmantle tails of tubers, and normal-looking cortex in 3 children with tuberous sclerosis. The patterns of neuronal firing on a neuron-by-neuron (autocorrelation) basis did not reveal any differences as a function of anatomy. However, at the level of functional networks (cross-correlation), there is a much larger propensity towards hypersynchrony of tuber-tuber neurons than in neurons from any other anatomical site. This suggests that tubers are the primary drivers of adverse tuberous sclerosis complex prognosis in children [1].

1)

Chari A, Hernan AE, Mahoney JM, Thornton R, Tahir MZ, Tisdall MM, Scott RC. Single unit-derived

connectivity networks in tuberous sclerosis complex reveal propensity for network hypersynchrony driven by tuber-tuber interactions. Sci Rep. 2024 Dec 30;14(1):31654. doi: 10.1038/s41598-024-80634-5. PMID: 39738230.