香港教育大學
The Education University of Hong Kong

Department of PSYCHOLOGY 心理學系

田家炳基金會 Tin Ka Ping Foundation

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Cortical Hierarchy Underlying Homeostatic Sleep Pressure Alleviation

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Zoom

Abstract

Sleep dissipates accumulated sleep pressure and restores brain function, yet how this recovery unfolds across the cortical hierarchy remains unclear. Here, we record simultaneous electroencephalogram (EEG) and blood oxygen level-dependent (BOLD) functional magnetic resonance imaging data from 130 healthy adults to map spatial patterns underlying sleep pressure alleviation. Compared to wakefulness, sleep elicits spatially heterogeneous changes in BOLD fluctuation along a sensory-association cortical gradient. The magnitude of these sleep-wake differences correlates with individual slow-wave activity and is most pronounced during the first hour of sleep. As slow waves dissipates, these hierarchical differences are progressively downscaled, implicating homeostatic regulation in sculpting cortical plasticity. In addition, the homeostatic regulation of BOLD fluctuation amplitude is spatially associated with the regional distribution of glycolysis. Finally, recovery sleep reinstates hierarchical BOLD dynamics after sleep loss in an independent sleep deprivation study. These findings consistently suggest a cortical hierarchy underlying the dynamic changes in sleep homeostasis.

SPEAKER

Dr Zou Qihong

Associate Professor at the Center for MRI Research, Peking University

Dr. Qihong Zou focuses her research on sleep homeostasis and clearance-related functions using various neuroimaging techniques. Her work reveals the cortical hierarchy underlying sleep pressure alleviation. Dr. Zou is the Principal Investigator for three NSFC grants and a key contributor to major national brain intelligence projects. With more than 60 SCI-indexed publications in top-tier journals, including Nature Communications, PNAS, and Sleep, Dr. Zou has been honored as an Elsevier Highly Cited Chinese Researcher for six consecutive years (2020–2025).

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