

Press Release

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Why do we fall asleep when bored?

Losing yourself in your favorite things without sleeping, or falling asleep during boring lectures — As humans, we often defy sleepiness and stay awake when attention is necessary, but also experience an inescapable desire to sleep in boring situations. The brain mechanisms governing the regulation of sleep by cognitive and emotional factors are not well understood. A new paper published on September 29 in the journal *“Nature Communications”* finds that a part of the brain that is associated with motivation and pleasure – the nucleus accumbens – also can produce sleep. The new findings may explain why we have the tendency to fall asleep in the absence of motivating stimuli, i.e., when bored.

Researchers at the University of Tsukuba’s International Institute for Integrative Sleep Medicine (WPI-IIIS) and Fudan University’s Department of Pharmacology in the School of Basic Medical Sciences used chemogenetic and optical techniques to remotely control the activities of nucleus accumbens neurons and the behaviors they mediate. As a result, the Japanese-Chinese team discovered that nucleus accumbens neurons have an extremely strong ability to induce sleep that is indistinguishable from the major component of natural sleep, known as slow-wave sleep, as it is characterized by slow and high-voltage brain waves.

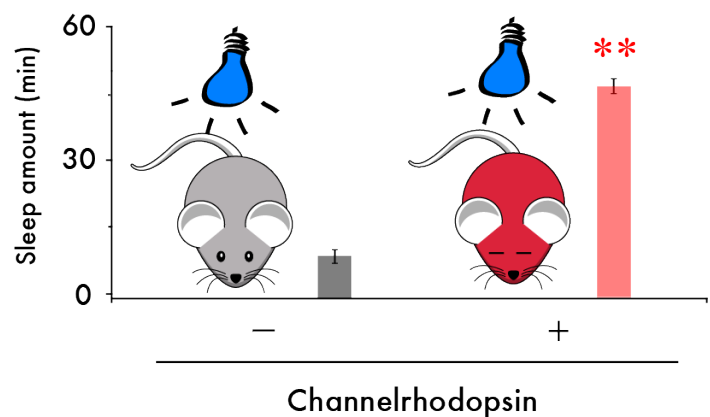


Figure | Excitation of nucleus accumbens neurons drastically increases sleep amount.

“The classic somnogen adenosine is a strong candidate for evoking the sleep effect in the nucleus accumbens,” says Yo Oishi, the lead author on this project.

Adenosine has long been known to represent a state of relative energy deficiency and to induce sleep via adenosine receptors. A specific subtype of adenosine receptors, the A_{2A} receptors, are densely expressed in the nucleus accumbens. Caffeine, the most widely consumed psychostimulant in the world, produces its arousal effect also in the nucleus accumbens by blocking A_{2A} receptors. Compounds that activate A_{2A} receptors in the nucleus accumbens may open safe therapeutic avenues for treating insomnia, which is one of the most common sleep problems with an estimated prevalence of 10-15% in the general population and 30-60% in the older population. ■

About IIS

IIS was launched by the Ministry of Education, Culture, Sports, Science and Technology of Japan with the aim of building globally visible research centers. At IIS gather globally prominent scientists from multiple research fields contributing to elucidate the fundamental principles of sleep/wake regulation, and develop new strategies to assess and treat sleep diseases as well as the closely associated metabolic and mental disorders. The research was funded by the Japan Society for the Promotion of Science and the Japan Science and Technology Agency.

About the Fudan University's research group

The Department of Pharmacology in the School of Basic Medical Sciences at Fudan University is focusing on molecular mechanisms of sleep initiation and maintenance, neural circuits of sleep/wake regulation and effects of sleep on advanced cognitive function. These researches are aimed to promote the understanding of the sleep process, strengthen the prevention and treatment of sleep related diseases and improve the national health and social productivity.

Bibliographic information

Oishi Y, Xu Q, Wang L, Zhang B-J, Takahashi K, Takata Y, Luo Y-J, Cherasse Y, Schiffmann SN, de Kerchove d'Exaerde A, Urade Y, Qu WM, Huang ZL, Lazarus M (2017) Slow-wave sleep is controlled by a subset of nucleus accumbens core neurons in mice. *Nat. Comm.* doi: 10.1038/s41467-017-00781-4

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