

New role of adenosine in the regulation of REM sleep discovered

September 1 2016



Sleeping lotus. Credit: University of Tsukuba

The regulation and function of sleep is one of the biggest black boxes of today's brain science. A new paper published online on August 2 in the journal *Brain Structure & Function* finds that rapid eye movement (REM) sleep is suppressed by adenosine acting on a specific subtype of adenosine receptors, the A_{2A} receptors, in the olfactory bulb. The study was conducted by researchers at Fudan University's School of Basic Medical Sciences in the Department of Pharmacology and the University

of Tsukuba's International Institute for Integrative Sleep Medicine (WPI-IIS). The research team used pharmacological and genetic methods to show that blocking A2A receptors or neurons that contain the A2A receptors in the olfactory bulb increases REM sleep in rodents.

Adenosine has long been known to represent a state of relative energy deficiency and to induce sleep by blocking wakefulness. The new findings demonstrate for the first time that adenosine also inhibits REM sleep, a unique phase of sleep in mammals that is characterized by random eye movement and low muscle tone throughout the body. The Chinese-Japanese research team discovered that adenosine acts specifically in the [olfactory bulb](#) which transmits odor information from the nose to the brain. Because olfactory dysfunction can be treated with an A2A receptor antagonist, for example caffeine, it is possible that REM sleep and the perception of odors are linked in the olfactory bulb. Interestingly, the ability to smell is reduced in patients with REM sleep behavior disorder (RBD). Dreams which mostly occur during REM sleep are usually a pure mental activity while the body is at rest. However, patients who suffer from RBD act out their dreams.

Yiqun Wang, the lead investigator on this project said that "our findings encourage us to believe that A2A receptors may be a novel target to treat RBD by suppressing REM sleep. Our observation clearly suggest an intriguing possibility for treating this disease with an A2A receptor agonist or allosteric modulator."

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.

WPI-IIIIS was launched by the Ministry of Education, Culture, Sports, Science and Technology of Japan with the aim of building globally visible research centers. At WPI-IIIIS 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.

More information: Yi-Qun Wang et al. Adenosine A2A receptors in the olfactory bulb suppress rapid eye movement sleep in rodents, *Brain Structure and Function* (2016). [DOI: 10.1007/s00429-016-1281-2](https://doi.org/10.1007/s00429-016-1281-2)

Provided by University of Tsukuba

Citation: New role of adenosine in the regulation of REM sleep discovered (2016, September 1) retrieved 2 May 2024 from <https://medicalxpress.com/news/2016-09-role-adenosine-rem.html>

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