PRESS RELEASE

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Caffeine helps restore memory function after sleep loss, NUS Medicine study shows

Researchers at NUS Yong Loo Lin School of Medicine have shown that caffeine can restore social memory impaired by sleep deprivation by acting on a specific brain circuit. The findings provide new insights into how sleep loss affects memory-related brain pathways and may inform future strategies to address cognitive impairment.

Singapore, 23 March 2026 — Researchers at the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine), have demonstrated that caffeine can restore social memory impaired by sleep deprivation by targeting a defined brain pathway. Social memory enables us to recognise and differentiate familiar individuals, such as people we have met before. Published in Neuropsychopharmacology, the study offers insights into the effect of caffeine on cognitive function and memory.

The study, led by Associate Professor Sreedharan Sajikumar and first author Dr Lik-Wei Wong, both from the Department of Physiology and Healthy Longevity Translational Research Programme at NUS Medicine, investigated the effects of sleep deprivation in the hippocampal CA2 region of the brain. The hippocampus plays an essential role in memory and learning processes, and its CA2 region contributes significantly to social memory formation. The CA2 area also receives signals linked to the regulation of the sleep and wake cycle.

In their laboratory studies, researchers induced five hours of sleep deprivation, and subsequently provided caffeine mixed into drinking water for unrestricted consumption for seven days. Caffeine is a known stimulant. At the molecular level, it blocks adenosine receptor signalling pathways that accumulate during wakefulness and dampen brain activity. Electrophysiological recordings were subsequently performed on hippocampus samples to measure synaptic plasticity, which refers to the brain's ability to strengthen or weaken connections between nerve cells based on experience and learning.

The study findings revealed that sleep deprivation disrupted the maintenance of synaptic plasticity, weakening communication between neurons in the hippocampal CA2 region of the brain. A reduced capacity for synaptic strengthening in the brain was observed, alongside clear

deficits in social recognition memory. Overall, sleep loss disrupted both neural function and behaviour in a targeted and circuit-specific manner.

However, the researchers discovered that taking caffeine prior to sleep deprivation led to a recovery of synaptic communication in the CA2 region and plasticity returned to normal levels. Specifically, social memory deficits were reversed and the effects of caffeine were pathway specific, selectively restoring the disrupted brain circuit rather than globally increasing neural activity. This meant the control group that was not sleep-deprived did not exhibit signs of overstimulation despite caffeine exposure.

“Sleep deprivation does not just make you tired. It selectively disrupts important memory circuits,” noted Dr Wong. “We found that caffeine can reverse these disruptions at both the molecular and behavioural levels. Its ability to do so suggests that caffeine’s benefits may extend beyond simply helping us stay awake.”

Assoc Prof Sajikumar said, “Our findings position the CA2 region as a critical hub linking sleep and social memory. This research enhances our understanding towards the biological mechanisms underlying sleep-related cognitive decline. This could inform future approaches to preserving cognitive performance.”

The study underscores the fundamental role of sleep in supporting healthy cognition and memory. By demonstrating that caffeine can restore selective neural pathways impaired by sleep deprivation, the study strengthens insights into potential targeted molecular therapies for cognitive conditions. Building on these findings, the researchers aim to further examine the effect of caffeine on memory consolidation and retrieval, as well as employing targeted circuit manipulations to explore causality with neural pathways.

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Our multidisciplinary and real-world approach to education, research and entrepreneurship enables us to work closely with industry, governments, and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, research centres of excellence, corporate labs and more than 30 university-level research institutes focus on themes that include energy; environmental and urban sustainability; treatment and prevention of diseases; active ageing; advanced materials; risk management and resilience of financial systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research, and cybersecurity.

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Through a dynamic and future-oriented five-year curriculum that is inter-disciplinary and inter-professional in nature, our students undergo a holistic learning experience that exposes them to multiple facets of healthcare and prepares them to become visionary leaders and compassionate doctors and nurses of tomorrow. Since the School's founding in 1905, more than 12,000 graduates have passed through our doors.

In our pursuit of health for all, our strategic research programmes focus on innovative, cutting-edge biomedical research with collaborators around the world to deliver high impact solutions to benefit human lives.

The School is the oldest institution of higher learning in the National University of Singapore and a founding institutional member of the National University Health System. It is one of the leading medical schools in Asia and ranks among the best in the world (Times Higher Education World University Rankings 2025 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2025).

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