idw - Informationsdienst Wissenschaft
Nachrichten, Termine, Experten

Press release

Max-Planck-Institut für biologische Intelligenz
Dr. Sabine Spehn

03/31/2025
http://idw-online.de/en/news849886

Research results, Scientific Publications
Biology
transregional, national

# Too tired to stay alert? A difficult trade-off between sleep and vigilance

**· Birds, unlike humans, can sleep deeply with both halves of their brains (symmetrically) or with one half sleeping lighter than the other (asymmetrically). · Study of European jackdaws led by an international team of researchers shows that when sleep-deprived, jackdaws were more likely to fall into deep sleep with both brain halves at the expense of keeping one half vigilant – especially early in the night, when the need to recover is greatest. · Observing how birds navigate the trade-off between vigilance and sleep may help scientists better understand how sleep loss affects brain function more broadly, including in us.**

As most people who have pulled an all-nighter will agree, lost sleep can leave us feeling foggy and far from our best. In some ways, birds respond similarly, often sleeping longer and more deeply after sleep loss. But unlike humans, birds can sleep with one eye open, keeping one half of the brain somewhat alert while the other sleeps deeply. This balance between vigilance and deep sleep helps them stay aware of danger while still getting some much-needed shut-eye. However, a new study of European jackdaws shows that this strategy has its limits: when sleep-deprived, these clever, social birds were more likely to fall into deep sleep in both brain halves – even at the cost of losing vigilance. The findings offer new insight into sleep and the consequences of going without it.

Keeping an eye out

Sleep is essential across the animal kingdom, but there is wide variation in how it happens. When humans sleep, our brains cycle through stages, alternating between rapid eye movement (REM) sleep and non-REM sleep roughly every 90 minutes. Birds go through these same stages, but typically in much shorter bursts – and their sleep patterns are far more flexible than ours. One weapon in their sleep armory is the ability to sleep with one eye open during non-REM sleep, a state known as asymmetric sleep. This is characterized by light sleep in the brain half connected to the open eye and deep sleep in the brain half connected to the closed eye. It allows birds, such as ducks, to keep one side of the brain more alert while the other enters a deeper state of sleep.

Non-REM sleep is thought to play a key role in memory consolidation and clearing waste from the brain. However, recharging one brain hemisphere with one eye open takes longer than resting both sides together in deep, symmetrical sleep. Scientists are still uncovering when, how, and why birds rely on this nap-time balancing act.

The new study of European jackdaws, led by researchers at the Max Planck Institute for Biological Intelligence and the Groningen Institute for Evolutionary Life Sciences, reveals a trade-off between getting sleep and staying alert. The findings, which tracked sleep patterns across several brain regions in nine jackdaws, are published today in Current Biology.

Previous studies have shown how birds and some other animals use adaptable, vigilant sleep strategies to stay alert in challenging situations – from great frigatebirds sleeping asymmetrically mid-flight, to mallard ducks keeping one eye open when vulnerable on the outer edge of their group, to northern fur seals sleeping asymmetrically when in the water. Even humans – who do not sleep with one eye open – tend to sleep more lightly with the left half of the brain on the first

night in a new environment. This new research reveals where such strategies fall short: sleep-deprived jackdaws spent more time in deep, symmetrical sleep, while asymmetric sleep became less common – especially early in the night, when the need to recover is greatest.

“Sleep is a dangerous part of life for many animals, as it leaves them exposed to all kinds of risks,” says Niels Rattenborg, group leader at the Max Planck Institute for Biological Intelligence. “Some birds can function surprisingly well on far less sleep than we can, but even that strategy appears to have its limits. We have found that when they’re tired, jackdaws are more likely to sleep deeply – even if that means becoming more vulnerable. Observing how birds navigate the trade-off between vigilance and sleep may help us better understand sleep in general.”

Tracking tiredness

To investigate how European jackdaws recover from sleep loss – and how they switch between symmetric and asymmetric sleep – researchers studied nine birds using electroencephalograms (EEGs), which measure the activity of millions of neurons across the brain.

The researchers found that some brain areas slept more deeply than others, which may suggest that regions used more during wakefulness need deeper sleep. For example, not all parts of the jackdaws’ brains responded to sleep loss in the same way. Regions involved in vision and decision-making showed stronger signals after sleep deprivation, while others, like the memory-related hippocampus, were less affected.

“Our findings reveal that even the highly flexible sleep strategies used by jackdaws have limits,” says Peter Meerlo, a group leader at the Groningen Institute for Evolutionary Life Sciences. “That tells us something fundamental about sleep: it’s not just a passive state, but a behavior shaped by both evolution and environmental demands. The study offers a fresh perspective on how animals balance the need for sleep with the risk of predation or other threats – and could help us better understand how sleep loss affects brain function more broadly, including in humans.”

contact for scientific information:

Dr. Niels Rattenborg
Research Group Leader
Max Planck Institute for Biological Intelligence
niels.rattenborg@bi.mpg.de

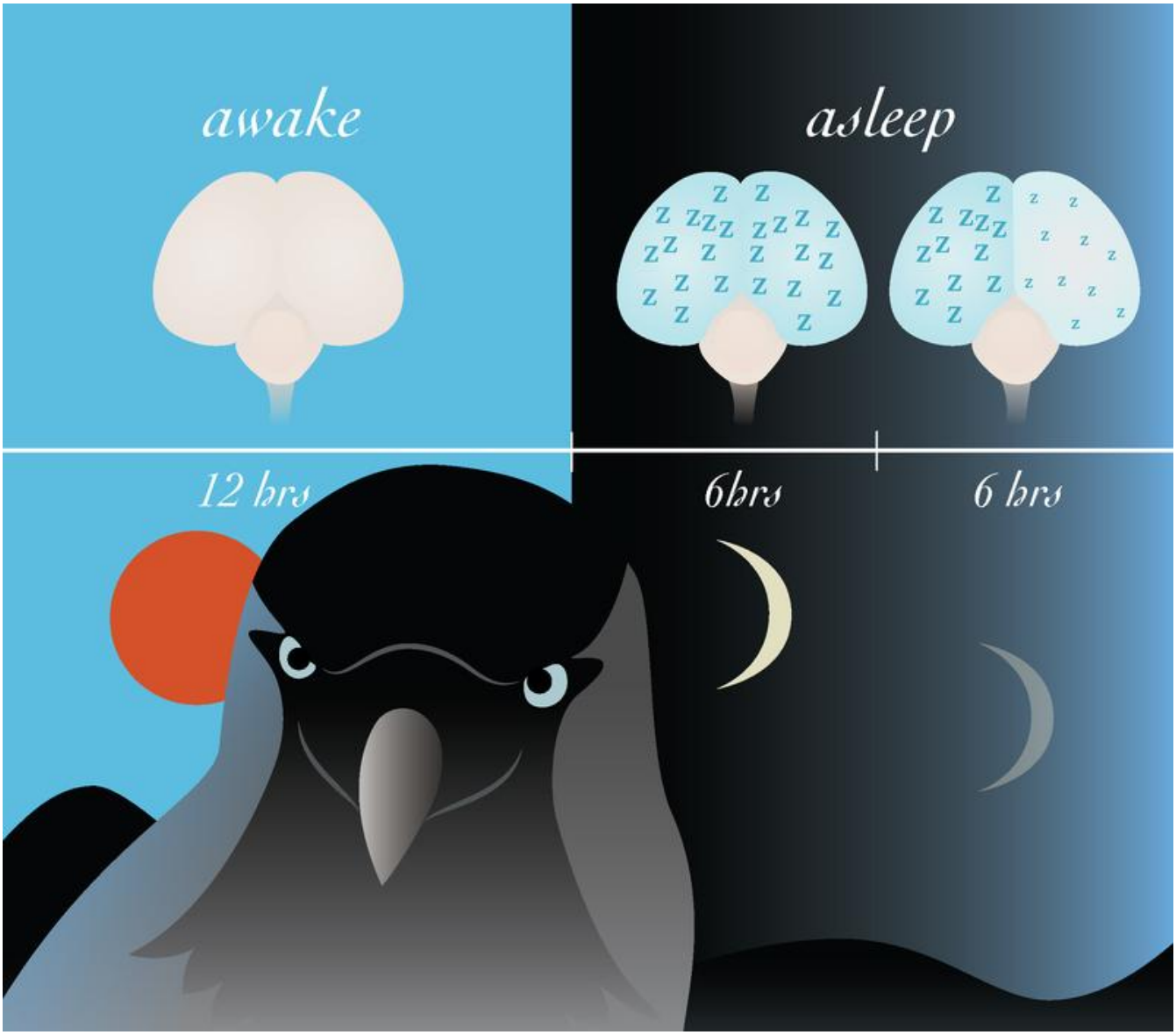
Original publication:

Sleep pressure causes birds to trade asymmetric sleep for symmetric sleep

Sjoerd J. van Hasselt*, Dolores Martinez-Gonzalez*, Gert-Jan Mekenkamp, Alexei L. Vyssotski, Simon Verhulst, Gabriël J. L. Beckers, Niels C. Rattenborg$, Peter Meerlo$
*, $ These authors contributed equally

Current Biology, online 31 March, 2025

URL for press release: https://www.bi.mpg.de/rattenborg - Research group website




Sleep-deprived jackdaws spent more time in deep, symmetrical sleep – especially early in the night, when the need to recover is greatest.
@ MPI for Biological Intelligence / Julia Kuhl