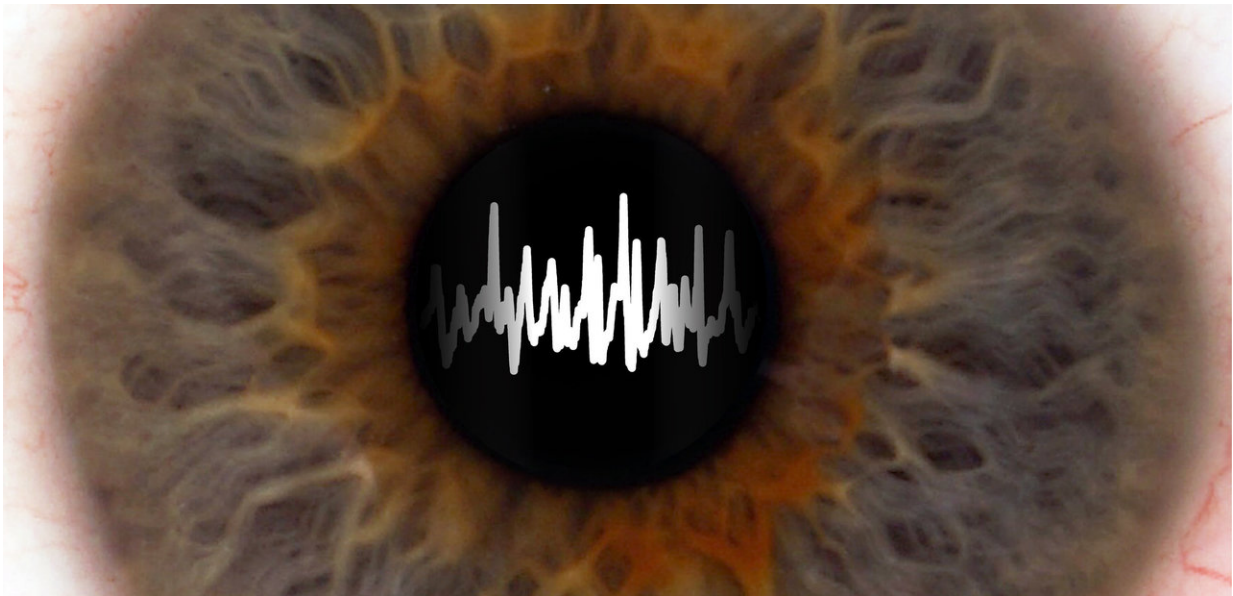


First look at pupil size in sleeping mice yields surprises

January 18 2018



Artistic illustration of how mouse pupil size is a window into brain activity even during sleep. Credit: Daniel Huber, University of Geneva.

When people are awake, their pupils regularly change in size. Those changes are meaningful, reflecting shifting attention or vigilance, for example. Now, researchers reporting in *Current Biology* on January 18 have found in studies of mice that pupil size also fluctuates during sleep. They also show that pupil size is a reliable indicator of sleep states.

"We found that [pupil size](#) rhythmically fluctuates during sleep," says

Daniel Huber of the University of Geneva in Switzerland. "Intriguingly, these [pupil](#) fluctuations follow the sleep-related brain activity so closely that they can indicate with high accuracy the exact stage of sleep—the smaller the pupil, the deeper the sleep."

Studies of pupil size had always been a challenge for an obvious reason: people and animals generally sleep with their eyes closed. Huber says that he and his colleagues were inspired to study pupil size in sleep after discovering that their [laboratory mice](#) sometimes sleep with their eyes open. They knew that pupil size varies strongly during wakefulness. What, they wondered, happened during sleep?

To investigate this question, they developed a novel optical pupil-tracking system for mice. The device includes an infrared light positioned close to the head of the animal. That invisible light travels through the skull and brain to illuminate the back of the eye. When the eyes are imaged with an infrared camera, the pupils appear as bright circles. Thanks to this new method, it was suddenly possible to track changes in pupil size accurately, particularly when the animals snoozed naturally with their eyelids open.

Their images show that mouse pupils rhythmically fluctuate during sleep and that those fluctuations are not at all random; they correlate with changes in sleep states.

Further experiments showed that changes in pupil size are not just a passive phenomenon, either. They are actively controlled by the parasympathetic autonomic nervous system. The evidence suggests that in mice, at least, pupils narrow in [deep sleep](#) to protect the animals from waking up with a sudden flash of light.

"The common saying that 'the eyes are the window to the soul' might even hold true behind closed eyelids during sleep," Özge Yüzgeç, the

student conducting the study, says. "The pupil continues to play an important role during sleep by blocking sensory input and thereby protecting the brain in periods of deep sleep, when memories should be consolidated."

Huber says they would like to find out whether the findings hold in humans and whether their new method can be adapted in the [sleep](#) clinic. "Inferring brain activity by non-invasive pupil tracking might be an interesting alternative or complement to electrode recordings," he says.

More information: *Current Biology*, Yüzgeç et al.: "Pupil Size Coupling to Cortical States Protects the Stability of Deep Sleep via Parasympathetic Modulation" [www.cell.com/current-biology/f...](http://www.cell.com/current-biology/fulltext/S0960-9822(17)31682-2)
[0960-9822\(17\)31682-2](http://www.cell.com/current-biology/fulltext/S0960-9822(17)31682-2) , DOI: [10.1016/j.cub.2017.12.049](https://doi.org/10.1016/j.cub.2017.12.049)

Provided by Cell Press

Citation: First look at pupil size in sleeping mice yields surprises (2018, January 18) retrieved 24 June 2024 from <https://phys.org/news/2018-01-pupil-size-mice-yields.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.