System that controls sleep may be same for most mammals

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In a novel mathematical model that reproduces sleep patterns for multiple species, an international team of researchers has demonstrated that the neural circuitry that controls the sleep/wake cycle in humans may also control the sleep patterns of 17 different mammalian species.

These findings, reported by researchers from Brigham and Women's Hospital (BWH), the University of Sydney, and the Center for Integrated Research and Understanding of Sleep (Camperdown, Australia), suggest that fundamental physiological mechanisms are at work across diverse species, even though sleep patterns vary drastically. This research published June 24th in the open-access journal PLoS Computational Biology.

"These findings show that although mammalian sleep is remarkably diverse in expression, from dolphins who sleep with one brain half at a time to rodents who have many short naps, it is very likely universal in origin, which suggests that this simple system is both highly flexible and evolutionarily conserved," said Andrew Phillips, lead author of the paper and researcher in the Division of Sleep Medicine at BWH.

Over the past decade, researchers have reported findings related to the structures in the brain that are critical to sleep regulation, but these findings have been limited to a small number of species. Until now, it was unclear to what extent these physiological mechanisms are universal across all mammals, especially given such large interspecies differences in sleep patterns.

Using their model, the authors also provide insight into why the sleep patterns of different species are so distinct. For example, the model explains how some mammals (such as dolphins and seals) sleep with one half of their brain at a time while the other half remains active; if the sleep centers on either side of the brain inhibit one another then only one is able to activate at a time, preventing the animal from sleeping with both brain halves at once. This testable prediction awaits physiological investigation.

The authors stress that this research was performed using a mathematical model of the physiology to simulate the sleep patterns of different mammals. Further research is thus required to test these predictions directly, and to determine whether the same physiological mechanisms are at work in nocturnal species.

More information: Phillips AJK, Robinson PA, Kedziora DJ, Abeysuriya RG (2010) Mammalian Sleep Dynamics: How Diverse Features Arise from a Common Physiological Framework. PLoS Comput Biol 6(6): e1000826. doi:10.1371/journal.pcbi.1000826