

Better sleep linked with family tree strength

August 6 2018



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The question of why we sleep has been a longstanding subject of debate, with some theories suggesting that slumber provides respite for the brain, which allows it to filter out insignificant neural connections, build new ones, strengthen memories and even repair itself. However, new Oxford University research has used mathematical approaches to tackle the adaptive significance of sleep, and the findings suggest that sleep has another equally significant purpose—boosting our 'fitness' and future

family line reproductive success.

The paper, published in *PLOS ONE* has used mathematical modelling to investigate the adaptive significance of sleep and assess if it impacts 'fitness' (defined as the number of future children, grandchildren, great grandchildren etc.) and mortality.

The work was led by Jared Field, a postgraduate student in the Oxford Mathematical Institute and Professor Mike Bonsall, Professor of Mathematical Biology in the Department of Zoology. The mathematical formulas allowed the team to compare the 'fitness' success of sleeping and not sleeping under a range of different conditions, such as varying birth and [mortality rates](#), and environments, including vulnerable and safe environments.

The findings show that in all conditions a sleeping strategy led to greater fitness compared to being constantly active. When birth rates were altered but mortality kept constant, they found that a sleeping strategy achieved a greater fitness than staying active indefinitely. In a safe sleeping [environment](#) it was best to be most active when mortality was lowest, where as in a vulnerable environment the reverse was true.

The only instance when constant activity was found to be as beneficial for reproductive fitness was when birth and [mortality](#) rates were constant. However, since organisms do not exist in a constant world this result was deemed insignificant.

Jared Field explains: "Sleep as a behaviour, is in and of itself, valuable. While much research has been done to find vital functions that explain why organisms sleep, our study provides broader ecological reasons applicable to a range of environments and conditions. Our analyses suggests that sleep first evolved simply because activity-inactivity cycles are adaptive in a non-constant world."

"Regardless of the scenario, sleep and periods of inactivity were found to have a more positive impact on fitness than not sleeping."

Mike Bonsall adds: "The application of mathematics to understanding biological systems has far reaching consequences and being able to understand phenomena such as how sleep evolved through a mathematical lens is a fantastic advance."

Now that the team have grasped a logical understanding of the evolution of sleep and the factors that underpin its value, in future work they will further investigate the ecological and demographic factors that make or break the difference between a good, productive sleep pattern and a bad one.

The full paper citation is "The evolution of sleep is inevitable in a periodic world" written by Jared M. Field, Michael B. Bonsall, published in *PLOS One*.

Provided by University of Oxford

Citation: Better sleep linked with family tree strength (2018, August 6) retrieved 3 May 2024 from <https://phys.org/news/2018-08-linked-family-tree-strength.html>

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