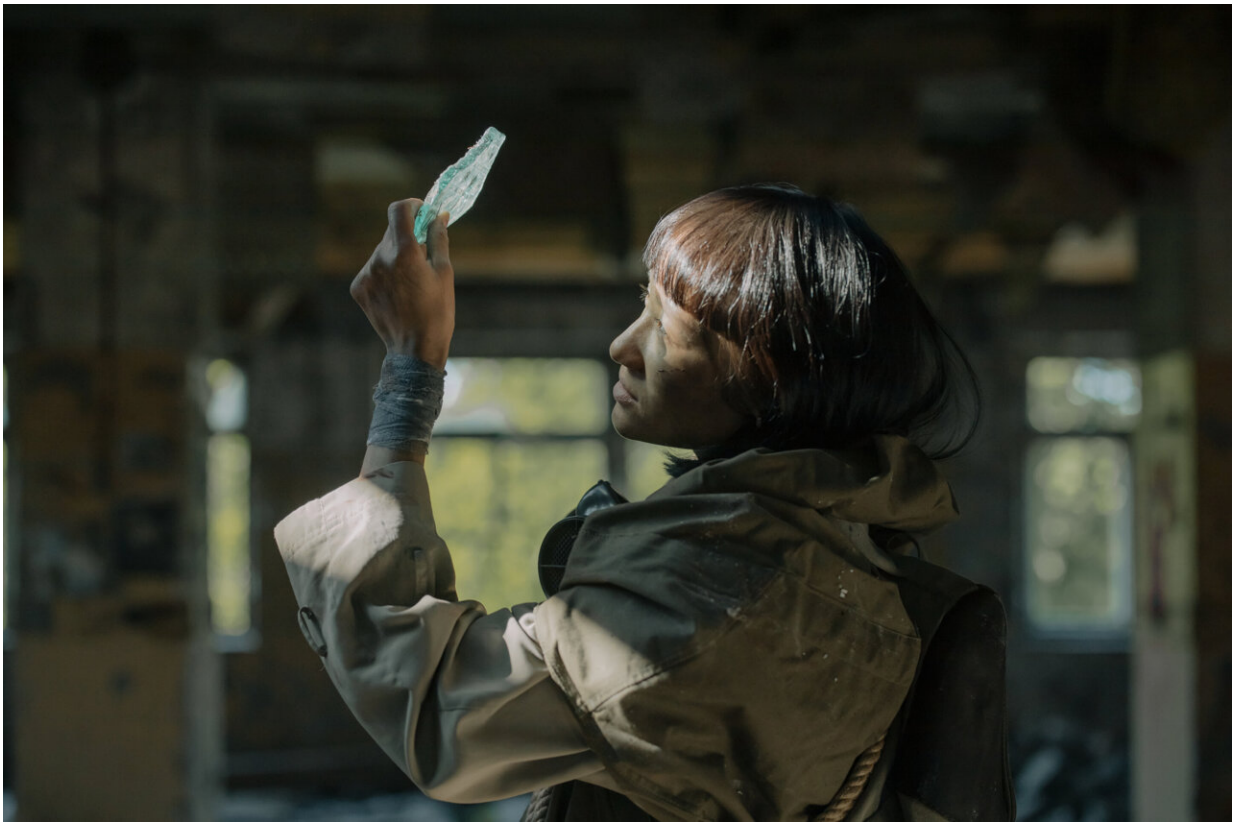
Finding the tipping point for sleep

January 5 2018



Credit: cottonbro studio from Pexels

Sleep is essential for many aspects of normal life, but how we actually fall asleep remains a mystery.

Researchers have now shown how specialist nerve cells in the brains of fruit flies trigger several key steps of falling asleep.

The team at Oxford University's Centre for Neural Circuits and Behaviour worked with a small cluster of neurons that had previously been shown to put flies to sleep when activated. When the flies are awake the sleep-control neurons are turned off. The longer the flies are awake, the more tired they become, which eventually reaches a tipping point and activates the neurons.

But the fact that the sleep-inducing neurons are only a tiny minority of all nerve cells posed a puzzle. Sleep entails some of the most profound and widespread changes our brains experience on a daily basis. How could so few cells control so much?

The team have found that the sleep-inducing cells 'gate' – or regulate the flow of electrical signals through – a node in the brain that is critical for all aspects of sleep: the fly's motor system – controlling movement – was disconnected, preventing the animal from sleep-walking; the insect's sensory thresholds were increased, making it less aware of its surroundings; and the 'sleep debt' or tiredness that had accumulated during waking was cleared.

Fruit flies are widely used by scientists as a model organism to understand how biological mechanisms work in larger, more complex organisms like humans. The 2017 Medicine Nobel Prize was awarded for discoveries concerning the body clock in flies.

Professor Gero Miesenboeck, Director of the Centre for Neural Circuits and Behaviour, said: "The sleep-inducing neurons act as a brake on the very brain cells whose activity causes tiredness. A beautifully simple system thus keeps sleep need and sleep in the balance.

"We still don't know why sleep debt builds up, what it consists of physically, how it triggers the switch to sleep and how the accumulated sleep debt is cleared. Finding the answers will help us solve the mystery

of sleep."

The full paper, "Recurrent Circuitry for Balancing Sleep Need and Sleep," is published in the journal *Neuron*.

More information: Jeffrey M. Donlea et al. Recurrent Circuitry for Balancing Sleep Need and Sleep, *Neuron* (2018). DOI: 10.1016/j.neuron.2017.12.016

Provided by University of Oxford