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## Sleeping on problems really does help, experts find

The New Zealand Herald · 4 Jun 2024 · A19 · Dan Denis Dan Denis is a Marie Skłodowska-Curie Senior Research Fellow at University of York.

Mounting evidence suggests that sleep problems earlier in life increase the risk of dementia. Twenty-six years is roughly how much of our lives are spent asleep. Scientists have been trying to explain why we spend so much time sleeping since at least the ancient Greeks, but pinning down the exact functions of sleep has been difficult.

During the past decade, there has been a surge of interest from researchers in the nature and function of sleep. New experimental models coupled with advances in technology and analytical techniques are giving us a deeper look inside the sleeping brain. Here are some of the biggest recent breakthroughs.

### We know more about lucid dreaming

No longer on the fringes, the neuroscientific study of dreaming has now become mainstream. US researchers in a 2017 study woke their participants up at regular intervals and asked them what was going through their minds prior to the alarm call. Sometimes participants couldn't recall any dreaming. The study team then looked at what was happening in the participant's brain just before waking.

Participants' recall of dream content was associated with increased activity in the posterior hot zone, an area of the brain closely linked to conscious awareness. Researchers could predict the presence or absence of dream experiences by monitoring this zone in real time.

Another exciting development in the study of dreams is research into lucid dreams, in which you are aware that you are dreaming. A 2021 study established two-way communication between a dreamer and a researcher. In this experiment, participants signalled to the researcher that they were dreaming by moving their eyes in a pre-agreed pattern.

The researcher read out maths problems (what is eight minus six?). The dreamer could respond to this question with eye movements. The dreamers were accurate, indicating they had access to high level cognitive functions.

The researchers used polysomnography, which monitors bodily functions such as breathing and brain activity during sleep, to confirm that participants were asleep.

These discoveries have dream researchers excited about the future of "interactive dreaming", such as practising a skill or solving a problem in our dreams.

### Memories replayed while we sleep

This year marks the centenary of the first demonstration that sleep improves our memory. However, a 2023 review of recent research has shown that memories formed during the day get reactivated while we are sleeping. Researchers discovered this using machine learning techniques to "decode" the contents of the sleeping brain.

A 2021 study found that training algorithms to distinguish between different memories while awake makes it possible to see the same neural patterns re-emerge in the sleeping brain.

A different study, also in 2021, found that the more times these patterns reemerge during sleep, the bigger the benefit to memory.

In other approaches, scientists have been able to reactivate certain memories by replaying sounds associated with the memory in question while the participant was asleep. A 2020 meta-analysis of 91 experiments found that when participants' memory was tested after sleep they

remembered more of the stimuli whose sounds were played back during sleep, compared with control stimuli whose sounds were not replayed.

Research has also shown that sleep strengthens memory for the most important aspects of an experience, restructures our memories to form more cohesive narratives and helps us come up with solutions to problems we are stuck on. Science is showing that sleeping on it really does help.

### Sleep keeps our minds healthy

We all know that a lack of sleep makes us feel bad. Laboratory sleep deprivation studies, where researchers keep willing participants awake throughout the night, have been combined with functional MRI brain scans to paint a detailed picture of the sleep-deprived brain.

These studies have shown a lack of sleep severely disrupts the connectivity between different brain networks.

These changes include a breakdown of connectivity between brain regions responsible for cognitive control, and an amplification of those involved in threat and emotional processing.

The consequence of this is that the sleep-deprived brain is worse at learning new information, poorer at regulating emotions, and unable to suppress intrusive thoughts. Sleep loss may even make you less likely to help other people. These findings may explain why poor sleep quality is so ubiquitous in poor mental health.

### Neurodegenerative protection

Although we naturally sleep less as we age, mounting evidence suggests sleep problems earlier in life increase the risk of dementia. The build-up of b-amyloid, a metabolic waste product, is one of the mechanisms underlying Alzheimer's disease. Recently, it has become apparent that deep, undisturbed sleep is good for flushing these toxins out of the brain.

Sleep deprivation increases the the rate of build-up of b-amyloid in parts of the brain involved in memory, such as the hippocampus. A longitudinal study published in 2020 found that sleep problems were associated with a higher rate of b-amyloid accumulation at a follow-up four years later.

In a different study, published in 2022, sleep parameters forecasted the rate of cognitive decline in participants over the following two years.

### We can engineer sleep

The good news is that research is developing treatments to get a better night's sleep and boost its benefits.

For example, the European Sleep Research Society and the American Academy of Sleep Medicine recommend cognitive behavioural therapy for insomnia (CBT-I). CBT-I works by identifying thoughts, feelings and behaviours that contribute to insomnia, which can then be modified to help promote sleep.

A 2021 meta-analysis of 65 clinical trials found that improving sleep via CBT-I reduced symptoms of depression, anxiety, rumination and stress.