

How reward and daytime sleep boost learning

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Credit: xiaphias/Wikipedia

A new study suggests that receiving rewards as you learn can help cement new facts and skills in your memory, particularly when combined with a daytime nap.

The findings from the University of Geneva, to be published in the journal *eLife*, reveal that memories associated with a reward are preferentially reinforced by sleep. Even a short nap after a period of learning is beneficial.

"Rewards may act as a kind of tag, sealing information in the brain during learning," says lead researcher Dr Kinga Igloi from the University of Geneva.

"During sleep, that information is favourably consolidated over information associated with a low reward and is transferred to areas of the brain associated with long-term memory."

"Our findings are relevant for understanding the devastating effects that lack of sleep can have on achievement," she says.

Thirty-one healthy volunteers were randomly assigned to either a sleep group or a 'wake' group and the sensitivity of both groups to reward was assessed as being equal. Participants' brains were scanned while they were trained to remember pairs of pictures. Eight series of pictures were shown and volunteers were told that remembering pairs in four of them would elicit a higher reward.

Following a 90-minute break of either sleep or rest, they were tested on their memory for the pairs and asked to rate how confident they were about giving a correct answer. Participants were also asked to take part in a surprise test of exactly the same nature three months later.

Both groups' performance was better for highly rewarded picture pairs, but the sleep group performed better overall. Strikingly, during the surprise test three months later participants who had slept after learning were selectively better for the highly rewarded pairs.

The people who slept were also more confident of achieving a correct answer during the memory tests, even after three months.

The MRI scans revealed that the sleep group experienced greater activity of the hippocampus, a small area of the brain critical for forming

memories. This correlated with a higher number of bursts of brain activity called slow spindles. After three months, the sleep group also showed increased connectivity between the hippocampus, the [medial prefrontal cortex](#) and the striatum, areas of the brain implicated in memory consolidation and [reward processing](#).

"We already knew that sleep helps strengthens memories, but we now also know that it helps us select and retain those that have a rewarding value," says Igloi.

"It makes adaptive sense that the consolidation of memory should work to prioritise information that is critical to our success and survival."

Provided by eLife

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