Sound stimulation during sleep can enhance memory

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"The beauty lies in the simplicity to apply auditory stimulation at low intensities—an approach that is both practical and ethical, if compared for example with electrical stimulation—and therefore portrays a straightforward tool for clinical settings to enhance sleep rhythms," says coauthor Dr. Jan Born, of the University of Tübingen, in Germany.

Dr. Born and his colleagues conducted their tests on 11 individuals on different nights, during which they were exposed to sound stimulations or to sham stimulations. When the volunteers were exposed to stimulating sounds that were in sync with the brain's slow oscillation rhythm, they were better able to remember word associations they had learned the evening before. Stimulation out of phase with the brain's slow oscillation rhythm was ineffective.

"Importantly, the sound stimulation is effective only when the sounds occur in synchrony with the ongoing slow oscillation rhythm during deep sleep. We presented the acoustic stimuli whenever a slow oscillation "up state" was upcoming, and in this way we were able to strengthen the slow oscillation, showing higher amplitude and occurring for longer periods," explains Dr. Born.

The researchers suspect that this approach might also be used more generally to improve sleep. "Moreover, it might be even used to enhance other brain rhythms with obvious functional significance—like rhythms that occur during wakefulness and are involved in the regulation of attention," says Dr. Born.

More information: Ngo et al.: "Auditory closed-loop stimulation of the sleep slow oscillation enhances memory." *Neuron*, 2013.

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