## Scientists Explore the Mysteries of Why We Sleep

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Has it ever occurred to you, when faced with a big decision, to stay awake on it?

The faculty in Berkeley's Psychology Department who research the many functions of sleep are betting not. Plumbing the mysteries of why we spend a third of our lives asleep is a modern research area, as new as the 1950s, when it was discovered that the brain is not dormant in sleep, but in fact actively cycling through various states of unconsciousness.

Together, Matthew Walker, who directs Berkeley's Sleep and Neuroimaging Laboratory, and Allison Harvey, who leads the Sleep and Psychological Disorders Laboratory, have discovered that sleep does far more than refresh the body and mind. Enough sleep, or a deficit of it, are directly linked to our immune systems, metabolic control, memory, emotional functioning and learning.

For all of the benefits of consistently solid nights of sleep, many teens and adults still don't get enough.
"We are getting close to understanding some of the functions of sleep, yet society still treats sleep like a luxury," says Walker, seated in his notably calming office in Tolman Hall. "We say, 'When I have two weeks' vacation I'm going to allow myself to sleep eight hours.' But we would never say that about water or food. If there's something that gets shortchanged, it's always sleep."

The functions of sleep are so key to our survival, Walker notes, that evolution is willing to have us unconscious and in a prone position for several hours a day.
"My research is not revolutionary, because your mother knew it all along," Walker says.

Indeed, many of Walker and Harvey's findings can be confirmed by everyday experience. We all know that not getting enough sleep puts us in a bad mood. It seems to lead us to have more extreme reactions to ordinary life events.
"We need sleep for problem-solving and other cognitive processing and for effectively managing the daily emotional challenges that life throws us," notes Allison Harvey. "As soon as sleep gets disturbed, all these basic functions become more difficult"

There are other benefits of sleep that seem like common sense: A person who has slept five hours a day or less is twice as likely to get sick as someone who has had adequate sleep. Consistent, adequate sleep also helps with metabolic control, which means that under-slept people are more vulnerable to obesity and diabetes.

It's easy then to imagine how difficult it would be to maintain mental and physical health if one has a sleep disorder like insomnia. Harvey's research has led to a series of therapies and interventions for people suffering from chronic lack of sleep - or its opposite, hypersomnia, in which a person struggles to completely surface out of sleep.
"Sleep disturbance is a normal response to a stressful life event," Harvey says. "For most people, normal sleep is restored soon after the stressor has passed. For others, the sleep disturbance becomes an ongoing problem "

When sleep is interrupted on an on-going basis, a person is more prone to become depressed or anxious, Harvey notes. Her research looks as ways to help people break a cycle of insomnia or hypersomnia without medication using a class of psychological treatments known as cognitive behavior therapy.
"Medication works more quickly, but when psychological therapy has had a chance to work there is longer-term success," she says. "The psychological interventions are very collaborative. We work week by week developing a picture of what's going on to contribute to the sleep difficulties, and then developing ways to cut into that."

As with infants and small children, the quality of sleep can come down to nighttime habits and bedtime routines. Take a typical teenager, for example, who may like to stay up late to chat with friends, check their favorite websites, download music or movies - all while doing their homework. Both Harvey and Walker note that, developmentally, teenagers need more sleep than adults, and yet their school schedules and social habits often conspire to leave them under-slept.
"At some point between childhood and the teenage years, parents stop worrying about sleep and start worrying about everything but sleep, including homework and sports," says Walker. There is very little research on the use of medications to help an adolescent or teenager sleep. Until there is data on the impact of using these medications in youth (including dosing, side-effects on the developing body and brain, and efficacy) it seems wise to be reluctant to advocate any specific medication at this time, Harvey notes. However, the use of cognitive behavior therapy towards developing healthier habits can help the child get the sleep they need.

In fact, some of the less obvious benefits of sleep could help a teenager with their studies. Walker's main research looks into the role of sleep in
learning and memory. His studies show that we have greater access to our memories - both facts we have learned and experiences from the past - if we've slept enough. Memories, Walker says, are fragile when they're first formed. In order for the memory to survive it has to pass through our brain's neural architecture and become integrated and stored. This process takes place when the brain is "offline," or asleep.

Memories are not isolated in the brain, Walker notes. They are interconnected like a web of information. This web must be updated regularly to integrate new information and memories - another step that takes place during sleep. At night, while asleep, the brain places memories into more efficient places so they can be accessed more quickly.
"Sleep is critical for learning," Walker notes. "It's like the brain is a sponge. Sleep wrings certain key regions out so you're able to soak up new information the next day."

The brain seems to need sleep to access memories. For example, if a person takes a piano lesson after having had a good night's sleep, and then goes home for to sleep for another eight hours, they will have 20 to 30 percent better recall of the music they learned at the lesson than they would have had the immediately after the lesson.

Walker's latest research shows a link between sleep and the brain's most sophisticated processing. While new memories are strengthened by sufficient sleep, new and old memories can also be linked together. A recent study, Walker says, shows that after ample sleep the brain is very good at making inferences and non-obvious connections between one memory and another.
"This starts to sound a lot like the basis for human creativity," he says, "the fusing of things that don't seem to have any connection. That's what
sleep, particularly dreaming does. Like good cooking, when it comes to memory, it's not enough to chop up the ingredients and put them together. The brain needs time to let things marinate."

## Provided by UC Berkeley

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