Why Sleep?

by Dara S. Manoach & Robert Stickgold

ABSTRACT

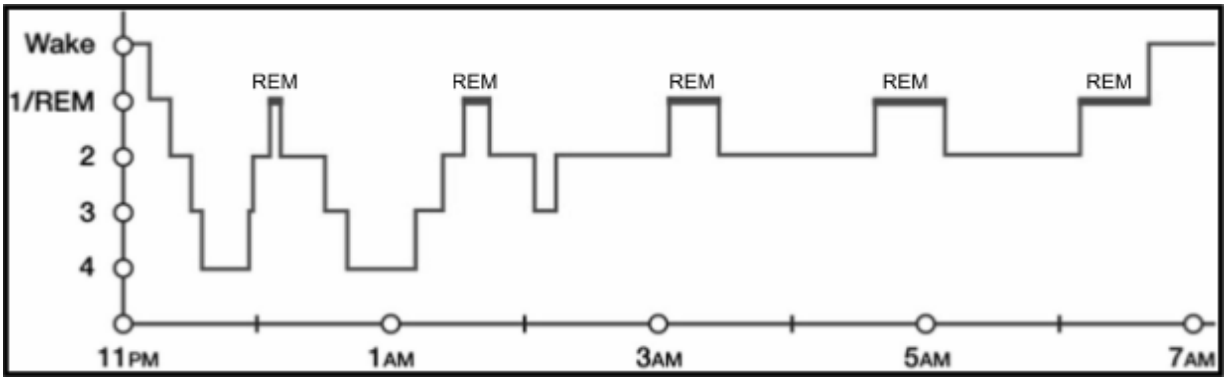
We human beings spend about a third of our lives sleeping. That means that if you live to 90, you'll sleep for about 30 years – probably more time than you'll spend doing anything else. Sleep is really important since we cannot live without it and spend so much time doing it. Yet unlike the other basic biological drives such as eating and reproducing, we still don't understand exactly why we need to sleep. It used to be thought that sleep was mainly to rest and **restore** the body and the mind, and to keep us safe from predators that hunted at night. But over the last 15 years, this view has radically changed. We now know that sleep plays an essential role in learning, memory and emotional well-being. In this review, we'll first discuss the structure of a good night's sleep, and then the role of sleep in learning and memory.

A Good Night's Sleep

Just as a good meal is made up of different kinds of food, a good night requires different kinds of sleep. There are two kinds of sleep:

- **REM** (Rapid Eye Movement)
- **Non-REM** (Non Rapid Eye Movement)

During the night, you pass through the different **stages**, from lighter to deeper sleep and back again over and over again, every 90 minutes. In the wee (early) hours of the morning, sleep becomes lighter and you spend more time in REM sleep, which means more dreaming. In addition, the different patterns of brain activity seen in these sleep stages serve different functions, and as a result each stage helps with specific kinds of learning and memory.



Sleep, Learning, and Memory

Scientists once thought that our learning occurs while we're awake. Now we know that the brain continues to work on new information for days and even years, and that much of this continued learning happens while we're asleep. Sleep is involved in strengthening new memories and fitting them in with what we already know, and updating our older memories based on what we just learned. But we do not remember everything we learn during the day. Somehow, the sleeping brain knows what information is important enough to keep. Here are some examples of what we should "sleep on."

Procedural Learning

Procedural learning is learning how to do something. When you're learning a new skill, like skiing or playing the piano, you may reach a point where you just can't get any better. But when you try again the next day, your performance is much, much better. This improvement happens while you're asleep, and not just after some amount of time. For example, if you spend 10 minutes typing a **sequence** of keys on a computer keyboard over and over, as fast as you can, after the first 5 minutes you just don't get any faster. But the next morning you'll not only be faster, but you'll be typing more smoothly. On the other hand, if you train in the morning and test that evening with no sleep in between? You won't be any better.

Insight

When you have a problem to solve, someone might tell you to "sleep on it." But does it really work? A group of researchers taught students to do a special kind of math problem. Unknown to the students, there was a much easier way to do it, but almost none of them figured it out. Some students were trained in the morning and tested 12 hours later (with no napping), but they weren't much better. Only about 22% figured out the shortcut. In contrast, when students were trained in the evening, and tested 12 hours later after a good night of sleep, 60% of them discovered the shortcut! So sleep can lead to **insight**!

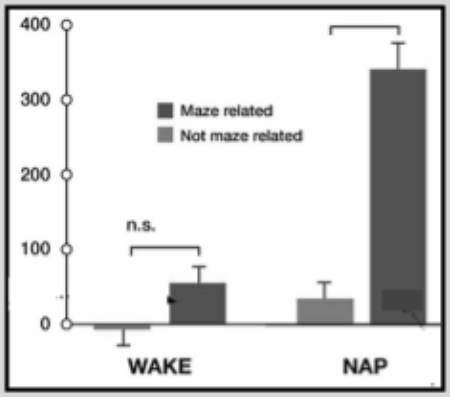
Emotion

Disrupting your sleep makes it harder to manage your feelings. After not getting enough sleep, people who are shown either pleasant or upsetting pictures have more activity in the *amygdala*, a part of the brain involved in emotions. In one study, the amygdala did not communicate as well with another part of the brain that normally helps to control emotional reactions.

Solving Mazes During Dreams

When students play an arcade style video game where they have to find their way through a complex maze, they can actually get better at it by simply taking a nap after practicing. Does dreaming have anything to do with this improvement in their memory of the layout of the maze? It's starting to look like the answer is, Yes. When researchers woke the students up during their naps and asked them what they had been dreaming about, it turned out that those who reported that they were dreaming about something related to the maze later showed ten times more improvement than those who didn't!

Quiet Wakefulness
"I was thinking about the game that I used to play in high school, "Counter-Strike," because of the same layout...and also I was just planning, and trying to remember the maze and trying to figure out the route...thinking about what we have to do in the second maze test...wondered if it was going to be the same..."



Dream Reports
"I was thinking about the maze and having people as checkpoints, and then that led me to think about when I went on this trip a few years ago, and we went to see these bat caves that were kind of maze-like. I was looking for something in a maze, hearing the music from the task."

What Happens If You Don't Sleep Enough?

When you don't sleep enough, well, you become tired. And aside from the bad health effects of not enough sleep (people who don't sleep enough tend to eat more and unhealthier foods, gain weight, and get sick!), you also don't learn as well the next day and have trouble paying attention. It's almost as if your brain is too full to absorb any more information. For some information learned the day before, it's like you've missed the opportunity to press the 'save' button – it's gone forever. For other learning, you just don't show the normal sleep-dependent improvement (like for that piano piece you practiced). You are also more emotionally reactive to both pleasant and unpleasant events, which can lead you to feel stressed out, yell at friends, and make bad decisions, based more on emotion than reason.

So What's the Bottom Line? (What Can We Learn From This?)

Get enough sleep, and don't sleep with your cell phone by your side. Sleep is too important to miss. A good night's sleep is like a symphony of brain rhythms with each movement serving a different **function**. Cut it short, or let it be interrupted by a text or a tweet, and you may miss the chance to have a breakthrough on that tricky problem you were sleeping on, or to perfect that basketball jump shot. Keep in mind that most teenagers need at least 9 hours of sleep per night! So sweet dreams!

Why Sleep?

Comprehension & Critical Thinking

You just read a scientific article about why our bodies need sleep. Answer the following comprehension questions. Read the text again if necessary. Take your time. Do not check the answers until you have done your best work.

★Answer Key is at the end of the packet★

1. The author compares a good night's sleep to a "good meal." According to the article, how are the two things similar?

a. Both a good meal and a good night's sleep are important to your health.
b. Both are necessary to gain muscle and learn new things.
c. A good meal is made up of different kinds of foods, just as a good night's sleep is made up of different stages of sleep.

2. According to the article, what are the two main types of sleep?

a. REM and Non-REM
b. Sleep for Learning and Sleep for Memory
c. Early and Late

3. Which of these would be an example of "procedural learning?"

a. solving a complex puzzle
b. learning how to drive a car
c. learning how to calm yourself

4. Read the following excerpt (short piece) of the text:

"In contrast, when students were trained in the evening, and tested 12 hours later after a good night of sleep, 60% of them discovered the shortcut! So sleep can lead to **insight**!"

Which word best helps you understand the meaning of the word "insight?"

a. students
b. tested
c. discovered
d. lead

5. Based on the information presented in the text, which memory would the "sleeping brain" be more likely to remember well?

a. A memory of seeing a terrible car accident
b. A memory of playing with your puppy

Written Analysis

You may write in English or another language.

6. Think back to the section entitled "Solving Mazes During Dreams." Explain the significance or importance of the graph and quotations from students. Why does the author include the visual and the words these students said? What can we learn from it?

7. Think back to the section entitled "What Happens If You Don't Sleep Enough?" Think about a time when you did not get enough sleep. Did you experience some of the things the article mentions? Describe your experience (of not having enough sleep) and connect it to what you learned in this reading.

8. After reading what the scientific community (a group of people who study science) has to say about sleep, do you plan to make any changes to your sleep habits? Why or why not?

Share what you have learned with your family.
Discuss what the whole family can do to get better sleep each night.

Photo by jose aljovin on Unsplash