

The Sleep Cure: The Fountain of Youth May Be Closer Than You Ever Thought

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Mark Zielinski knew he was onto something when his mice stopped sleeping. Normally, the animals woke and slept on a 12-hour cycle. When the lights were on in the lab, the mice were active. When it went dark on a timer, down they went. But Zielinski, who teaches psychiatry at Harvard Medical School, had recently tweaked their schedule to keep the mice up past their bedtime.

Zielinski and his colleagues would rustle the bedding in the mice's cages to keep them from dozing off when they started to display the telltale signs of sleepiness--drooping lids, sluggish walk, EEG readings showing their brain activity was waning. But Zielinski noticed that when the mice were left alone to slumber at will after the disruption, they didn't, or perhaps couldn't, fall asleep.

That the sleep-deprived rodents slept less than they normally would didn't really surprise Zielinski. The mice had a genetic mutation that he suspected was linked to sleep problems. More striking were the electrical brain readings showing that even when they did sleep, they weren't getting the deep, restorative kind of rest that doctors say matters most--not just to rodents but also to humans.

In the right conditions, researchers believe, the brain produces a signal that essentially tells the body's major systems--the heart, the lungs, the digestive system, the nervous system, even the muscles--that it's time to call it quits for the day. Zielinski's research has found that, just as with the mice with the mutation, it's likely that in some people with chronic sleep problems, that critical signal isn't firing.

Understanding what's behind some forms of insomnia, an aim of Zielinski's research, is a major step in learning how to fix it. That's a big deal in sleep research, because evidence linking quality rest to good health and longevity has never been more convincing.

Scientists are learning that shortchanging sleep can compromise nearly every major body system, from the brain to the heart to the immune system, making our inability--or unwillingness--to sleep enough one of the unhealthiest things we can do.

Studies of people whose sleep sessions are irregular or short show they are at higher risk of developing diseases that can lead to early death, including heart disease, diabetes, high blood pressure and obesity. Poor sleep may have detrimental effects on the brain as well, increasing the risk of dementia, including Alzheimer's disease, as well as mood disorders like depression, posttraumatic stress disorder (PTSD) and anxiety. And like smoking, a terrible diet and not exercising enough, poor sleep is now linked to an overall increased risk of premature death.

"I used to suggest that sleep is the third pillar of good health, along with diet and exercise," says Matthew Walker, a professor of neuroscience and psychology at the University of California, Berkeley. "But I don't agree with that anymore. Sleep is the single most effective thing you can do to reset your brain and body for health."

Despite the mounting evidence of its benefits, Americans are sleeping about two hours less each night than they did a century ago. Blame the technology-fueled 24/7 workplace, social media or the relentless news cycle, but about one-third of U.S. adults sleep less than the recommended seven hours daily, and 40% report feeling drowsy during the day, according to data from the Centers for Disease Control and Prevention. The problem begins early: only 15% to 30% of U.S. teens get the 8½ hours a night recommended for adolescents.

While life expectancy has been inching upward over the past century thanks to advances in medicine and technology, those gains could start to sag under the weight of our collective sleeplessness. Many people still dismiss sleep as something they can occasionally (or even regularly) skimp on, but the biological facts are clear: it is neither safe nor wise to take sleep lightly.

"To me, sleep is like the canary in the coal mine," says David Schnyer, a professor of psychology and neuroscience at the University of Texas, Austin. "Changes in sleep can create systemwide changes in the organism, and all of the stages of sleep affect the entire body and brain."

That's why sleep deprivation is so strongly linked to disease and premature death. One recent study even showed that sleep deprivation in mice can cause death faster than starvation can. And yet doctors--those who talk to their patients about sleep in the first place, anyway--report that many people still aren't convinced that their nightly rest is a critical piece of the long-life puzzle. Health obsessives who would never touch a cigarette and pride themselves on avoiding junk food may also boast about how much they get done, and how little they sleep at night.

"Because we're asleep, we don't see the benefits of it," says Robert Stickgold, a well-known sleep researcher and an associate professor of psychiatry at Harvard Medical School. "That's the disaster and tragedy of our current world."

It's been that way for a long time. Benjamin Franklin famously quipped that "there will be sleeping enough in the grave," and today, sleep is still misperceived as one of the most duty-driven and unproductive parts of the day--the habit that gets in the way of life as opposed to the one most likely to extend it.

Perhaps that's because until very recently, scientists couldn't even agree on the evolutionary reason why animals need to sleep in the first place. But now they know that what happens during sleep, particularly in the brain, is critical to human well-being--not to mention a long life. That's why they also know that the cost of ignoring the latest science on sleep can be dear.

Spending a good third of the day oblivious to the world around you and, by extension, incapable of protecting yourself doesn't seem like a smart way for a species to stay alive. And yet every animal does it, leading scientists to accept that sleep must be nonnegotiable for some reason--and that we must need a certain amount of it to survive.

Following a rigorous, milestone study in 2002 of more than 1 million healthy men and women by the American Cancer Society, experts suggested that the magic amount of sleep for longevity was seven hours a night. People who slept that amount were most likely to still be alive at the end of the study's six years, compared with people who got either six hours or less, or eight hours or more, of sleep each night. To this day, that's typically the amount that doctors and public-health groups recommend for the average adult, though older people can probably get away with a little less sleep than that, and younger people need more.

Another even longer study, which followed more than 21,000 twins in Finland, found that people who were regularly sleeping less than seven hours daily were 21% to 26% more likely to die of any cause during the study's 22-year period than those who slept more than eight hours.

So clearly sleep has some real biological benefit. Could it just be that the brain and body need downtime to recuperate after the activity of the day? That was the most popular explanation for decades, until an inquisitive neuroscientist at the University of Rochester decided to look for the answer inside the brain itself. When she did, Dr. Maiken Nedergaard uncovered what many scientists now agree is sleep's primary evolutionary function: to clean out the brain, quite literally, of accumulating debris.

In 2014, Nedergaard first revealed that while the body appears to rest during sleep, a whole lot is happening inside the brain. Neurons pulse with electrical signals that wash over the brain in a rhythmic flow. The brain runs checks on itself to ensure that the balance of hormones, enzymes and proteins isn't too far off-kilter. All the while, brain cells contract, opening up the spaces between them so that fluid can wash out the toxic detritus that can cause all kinds of problems if it builds up.

"It's like a dishwasher that keeps flushing through to wash the dirt away," Nedergaard says.

Without that nightly wash cycle, dangerous toxins can damage healthy cells and interfere with their ability to communicate with one another. In the short term, that can impede memory formation and the ability to coherently compose our thoughts and regulate our emotions. Over time, the consequences can be more dire. Lack of sleep can lead to faster aging of brain cells, contributing to diseases like Alzheimer's, which is now the cause of death for 1 in 3 seniors.

Nedergaard's research, which was done in mice, prompted a crucial rethinking of not only the benefits of sleep but also its biological function. It turns out the brain and body are extremely active when we sleep--we're just not aware of most of what occurs while we do it.

"Sleep is not just a passive state but a fairly active state on the molecular level," says Dr. Allan Pack, director of the Center for Sleep and Circadian Neurobiology at the University of Pennsylvania. "During the day, the brain is using energy resources to fire neurons. At night, a switch turns on so the sleeping brain can take advantage of the metabolic downtime to do some cleaning up."

The idea that sleep is a time of important biological activity, rather than a period when the body checks out, is transforming how doctors think about another important factor in longevity: mental health.

Scientists have long known that sleep is important for memory. But it turns out that during sleep, especially the cycles of deep dream sleep, the brain doesn't just revisit the events of a day in a more organized way. It also works on processing the emotions attached to these recollections. When a memory is filed away during sleep, it's also stripped of some of the powerful feelings--like fear, grief, anger or joy--that might have clouded the experiences in the heat of the moment.

It wouldn't be healthy, or efficient, to remember every event or experience in its full factual and emotional context. But separating the emotional aspects of a memory--the anger over an argument with your spouse, the frustration at the guy who cut you off in traffic, the dejection you felt after getting a curt email reply from your boss--from its objective parts allows you to recall the experience without reliving it. "We sleep to remember and we sleep to forget," says Walker, the UC Berkeley sleep scientist, of this coping mechanism. "I call it overnight therapy."

This type of processing takes time. It likely happens only during deep, quality sleep, and only over consistent nights of such sleep. That may explain why people who cut their sleep short or experience interrupted sleep may not fully disentangle the emotional baggage from their memories.

In those cases the memory, in its emotionally taxing entirety, continues to resurface every time the brain tries to sleep, in a vain effort to be properly processed. The brain tries to store the memory in a neutral way, but without deep sleep, there just isn't enough time for that triage.

Walker believes these aborted efforts may drive conditions like PTSD, which is well understood to be common among combat veterans but which may be more common among the general population than therapists and researchers previously thought.

"The more nights you sleep, the more soothing the influence of sleep on that memory," he says. "Sleep continues to work on those emotional memories and flatten them out after about a week. Now there's great evidence that PTSD is a disorder in which that process fails."

Walker saw this effect firsthand when he showed a group of people a frightening video. He kept some of the people awake after the viewing and allowed the rest to sleep normally. Those who were not allowed to sleep properly were more likely to remember the negative aspects of the video than those who got enough sleep.

There's also strong support for the idea that insufficient sleep may be a trigger for, and not just a symptom of, a number of mental illnesses, including depression, bipolar disorder and even schizophrenia. Depriving people with bipolar disorder of sleep, for example, can launch a manic episode, while some people with depression report worsening symptoms when they aren't sleeping well.

Fully understanding the role sleep plays in mental illness is a rich area of future research. Already many doctors think consistent, high-quality sleep can have a direct bearing on the health of those with mental illness. "Anyone who suffers from moderate or significant mental-health concerns needs to be aware that sleep may be one of the most important things they can do," says Walker.

Stress, scientists also know, is one of the more potent accelerators of aging, and a body that's not sleeping enough looks similar to one that's stressed out--it's highly reactive to perceived threats, even when those threats don't pose any real risk. Biologically speaking, there's virtually no difference in the way a body reacts to a startling noise in the middle of the night, a rabid raccoon or a stressful work deadline: in all cases, fight-or-flight mode is triggered, blood pressure spikes, breathing gets shallow, and the heart starts to race. That's what happens to a body on no sleep too.

Those stress reactions can be useful, of course: they help you respond more readily to an actual physical threat. But that's not usually what's going on. And staying in an alert mode can trigger a number of unhealthy conditions, the most damaging of which is inflammation.

Inflammation is the body's natural defense system against injury or invading microbes like bacteria and viruses. It's why your toe turns red and throbs when you stub it or when it's infected: white blood cells rush to the area in order to protect it for the short time it's needed to help you get better. But inflammation can also become chronic, and that's when the real trouble starts.

Chronic inflammation, doctors now know, is a leading driver of many diseases, including some cancers, cognitive decline, heart disease, Type 2 diabetes--even chronic pain. And one of the main drivers of chronic inflammation is, of course, not sleeping enough.

Getting a decent night's sleep, then, is good advice for all of us. Americans spent an estimated \$41 billion on sleeping pills and other sleep aids in 2015; no matter how much we may boast about our stamina, we know intuitively that we need sleep, even if we don't always know why.

But scientists do. That's why experts are insisting, with increasing frequency and noise, that sleep be a priority--as important or more than what you eat and how much you exercise. We wouldn't dream of skipping meals on a regular basis, so why skimp on sleep?

There's still much about sleep that mystifies scientists--particularly about what goes wrong for so many of us, night after night. But as they chip away at the underlying causes of sleeplessness, they get ever closer to a cure. Harvard's Zielinski, for one, is hopeful that they will eventually find a way to help more people sleep better every night.

When he gave his sleepless mice a drug to fix the mutation that was interfering with their sleep in the first place, they began to slumber anew.