

Sleep and the Immune System Link

Because research shows lack of sleep further impairs the immune system, making individuals more prone to infection, PI patients should consider sleep an important part of their daily health regimen.

By Jim Trageser

BENJAMIN FRANKLIN is credited with saying: “Early to bed and early to rise makes a man healthy, wealthy and wise.” The record is unclear if Franklin actually ever wrote or said that quote widely attributed to him, but it is reflective of the long-held cultural belief that a good night’s sleep is critical to the next day’s success. Generations of children stretching back to time immemorial have been told they need to get to bed if they want to do well at school the next day.

As it turns out, science backs up the need for a good night’s sleep. Whether a person hits the sack early or late, getting that full period of rest is necessary to maintain good health. As diurnal animals, human beings are designed to sleep at night. And sleep — which is near-universal across vertebrates — serves important biological functions. It’s a built-in maintenance period for bodies, a time for an internal janitorial service to do regular cleaning and minor repairs to keep systems in good working order. And the immune system is particularly vulnerable to disruptions of sleep patterns. When people don’t get enough sleep, either from an overly busy

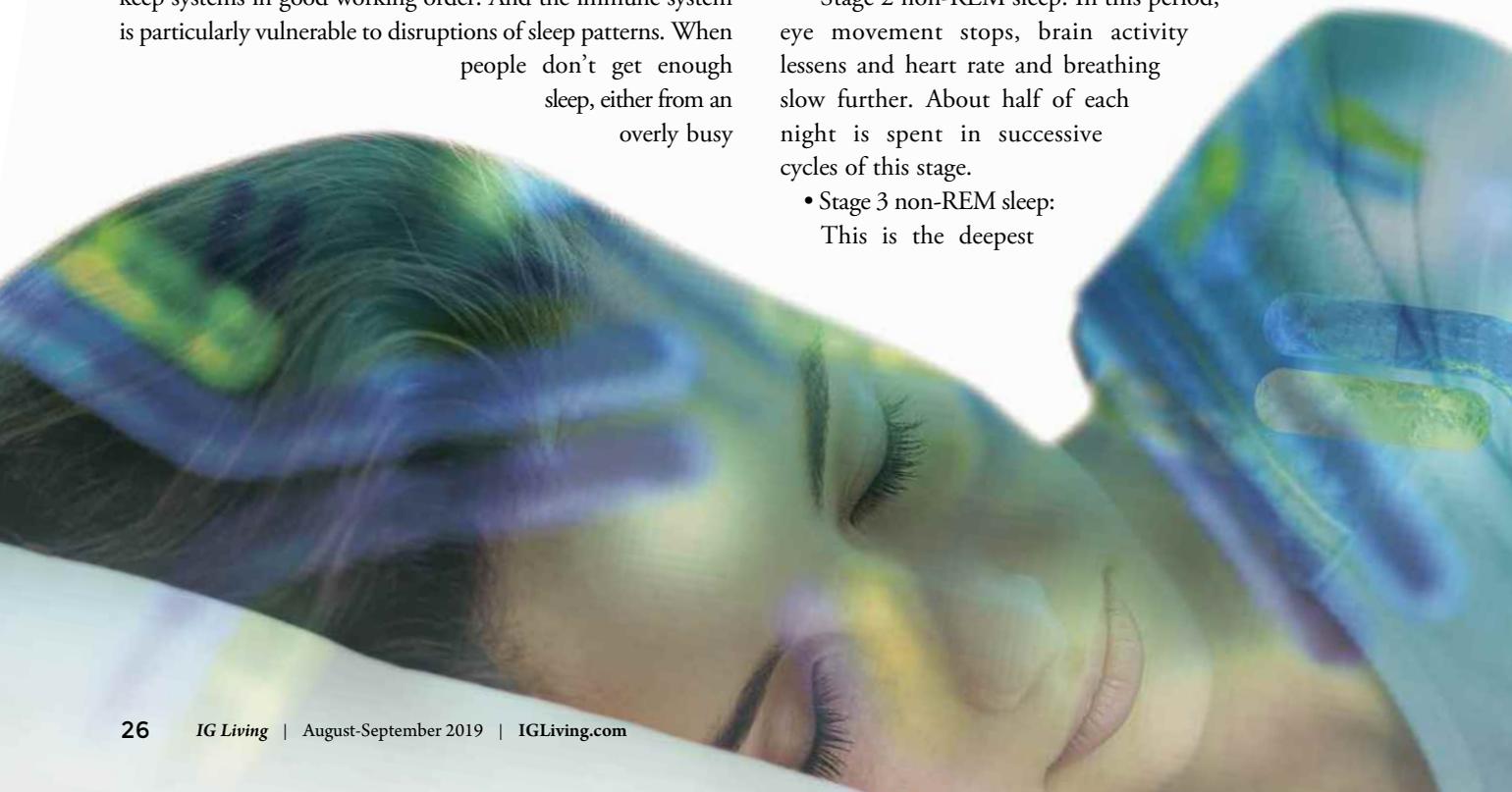
life or due to medical problems causing insomnia, they are more prone to infection.

What Happens When People Sleep

When people sleep, their bodies function differently than when they’re awake. Breathing and heart rate slow, temperature drops and voluntary muscles are temporarily turned off (preventing people from acting out their dreams). Different hormones and different amounts of hormones are released to help regulate everything from appetites to the ability to fight off infections.

Researchers now believe normal human sleep can be divided into a series of four alternating stages:¹

- Stage 1 non-REM sleep: This is the period when people first fall asleep. Brain waves begin to change pattern, and breathing begins to slow.
- Stage 2 non-REM sleep: In this period, eye movement stops, brain activity lessens and heart rate and breathing slow further. About half of each night is spent in successive cycles of this stage.
- Stage 3 non-REM sleep: This is the deepest



sleep, when it is hardest to wake up. Researchers also believe successful completion of this stage is what allows people to feel refreshed the next day.

- REM sleep: The acronym for “rapid eye movement,” the first REM stage usually occurs about 90 minutes after falling asleep. The eyes are moving, brain waves are active and heart rate and breathing are close to what they were when awake. Most dreams occur during this stage when the brain temporarily paralyzes the arm and leg muscles.

Stages 2 and 3 and REM sleep will alternate throughout an eight-hour sleep period, averaging three to five cycles per night.²

Sleep is controlled by a complex network involving different parts of the brain. The hypothalamus communicates with the eyes, and it helps regulate the circadian cycle so most people sleep during the night. The pineal gland starts pumping out melatonin (which helps people stay asleep) once the hypothalamus tells it that it’s dark and time for sleep.¹

What Happens When People Are Sleep-Deprived

Being sleep-deprived does not mean no sleep at all; it simply means the body did not completely cycle through a normal sleep pattern, meaning it got less than the six to nine hours most people need. (Children and teens need nine to 10 hours, most adults need seven to eight hours, and older adults may need as little as six hours.) Experts believe about 20 percent of American adults suffer some form of sleep deprivation.³

When the body fails to get enough sleep, its normal diurnal functions are interrupted. Too little sleep means the body won’t make enough cytokines — key proteins that help stimulate and regulate the immune system. Normal organ and cell repair

also is shortened. During stage 3, heart rate slows and blood pressure drops, giving the heart and blood vessels needed rest. Without that, the cardiovascular system doesn’t get the healing it needs, either.

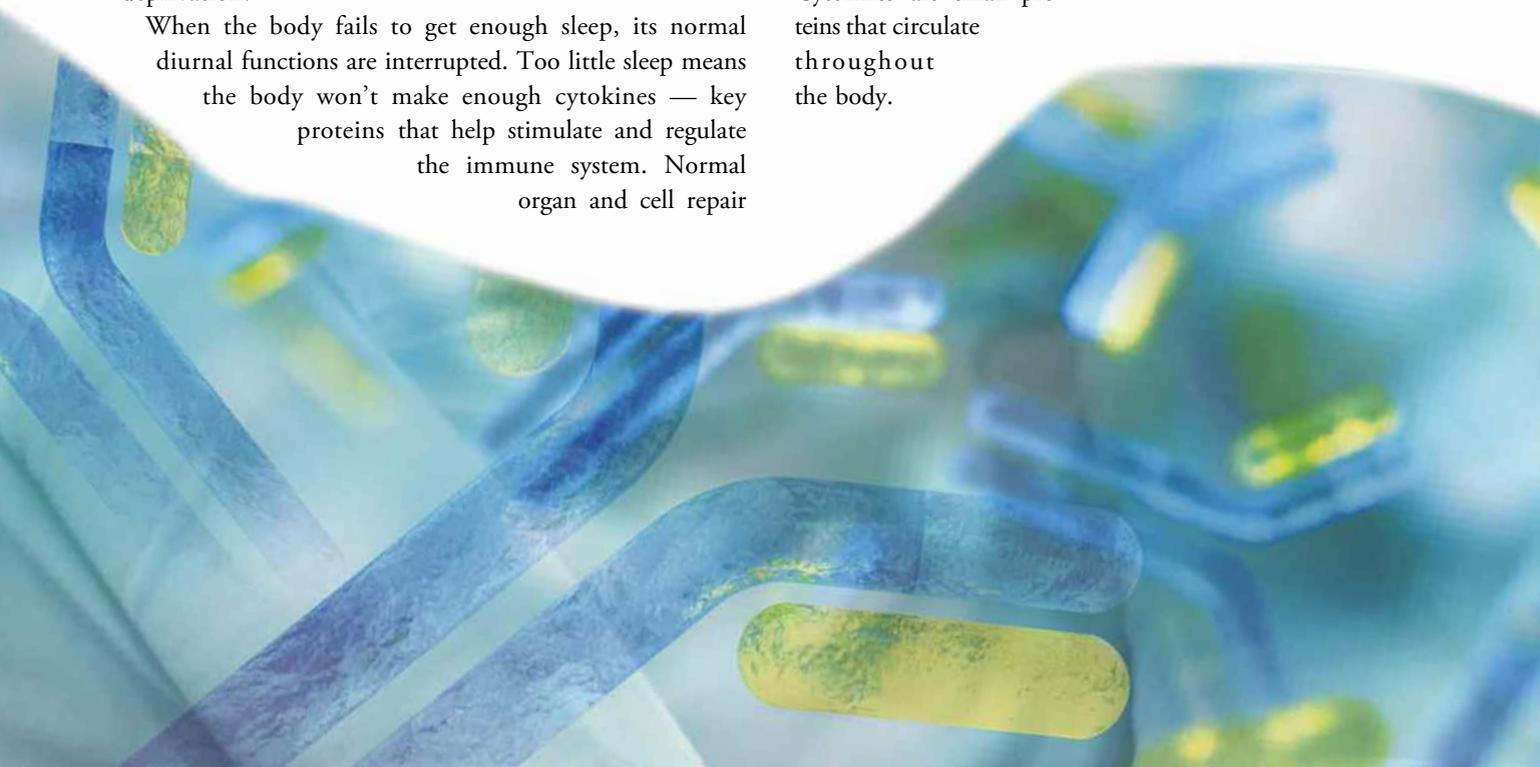
Short-term immediate symptoms of sleep deprivation generally include fatigue, difficulty concentrating, increased sleepiness, irritability, anxiety and/or restlessness. Even short-term sleep deprivation can have devastating consequences: While the National Highway Traffic Safety Administration attributed 800 deaths to accidents caused by drowsy drivers in 2013, the Centers for Disease Control and Prevention says that number is wildly underreported, and it’s more likely 6,000 fatalities a year are due to drowsy driving.⁴

When people regularly fail to get enough sleep, they have sleep deficiency.⁵ Long-term or chronic sleep deprivation can lead to more serious medical problems, including depression, high blood pressure, obesity, stroke and even diabetes.⁶

If people are unable to sleep (as opposed to making lifestyle choices that lead to not enough sleep), they are said to have insomnia. There are numerous causes of insomnia — from chronic pain to asthma, acid reflux to apnea, or an enlarged prostate in men.⁷

How the Immune System Is Affected

As mentioned, part of the normal sleep cycle is an increased production of chemicals known as cytokines. Cytokines are small proteins that circulate throughout the body.



They cannot enter the body's cells, but they can interact with other molecules on the surface of cells to serve as a signal from the body's immune system to individual cells.

When normal sleep patterns are short-circuited, the cells that produce cytokines — T and B lymphocytes, macrophages and mast cells, among others — don't have the opportunity to create as many as they would during normal sleep. Having too few cytokines interferes with the ability of the body to effectively react to the presence of foreign microorganisms, making the body more susceptible to viral, bacterial and fungal infections. One study found a correlation between immunity against the flu and sleep deprivation, with sleep-deprived mice losing previously developed immunity.⁸

A 2012 study showed undifferentiated T cells also are produced primarily during sleep, and regular sleep helped ensure they were properly deployed to the lymph nodes.⁹ A protein known as integrin that assists T cells in attaching themselves to invading microorganisms is also impacted by a lack of sleep, which is another way the immune system can be compromised by sleep deprivation.¹⁰

When people sleep, their bodies function differently than when they're awake.

Another study conducted in 2016 followed 11 pairs of identical twins who had different sleep patterns and found the twin who didn't get as much sleep had a measurably weaker immune system.¹¹ Interestingly, it is now believed narcolepsy, which causes patients to suffer from excessive daytime sleepiness, often falling asleep in public situations, is caused by a faulty immune system gene, resulting in the production of too little hypocretin.¹²

The Importance of Sleep for Primary Immunodeficiency Disease Patients

Because lack of sleep further compromises the immune system, patients with a primary immunodeficiency (PI) should include sleep as an important, indeed critical, component of their daily health regimen. Having enough sleep, but

also the same sleep pattern on a daily basis, can help maximize their body's ability to fight infection.¹³

Getting enough sleep may also put PI patients at lower risk of developing autoimmune disorders. In fact, some researchers believe long-term disruption of normal sleep cycles (for many weeks or months) may actually trigger autoimmune conditions such as fibromyalgia and chronic fatigue syndrome because of how sleep deprivation impairs immunity and affects the musculoskeletal system.¹⁴ One study of almost 85,000 adult patients diagnosed with non-apnea sleep disorders showed those patients were at higher risk for developing autoimmune disorders.¹⁵

On the other side of the spectrum, fatigue and nonrestful sleep are common and often debilitating components of autoimmune disease. In fact, sleeping problems are considered reliable warning signs for a variety of autoimmune conditions.¹⁴

Doctors recommend avoiding alcohol or caffeine in the evening, not snacking before bedtime, and not taking long naps during the day.¹⁶ And, given that depression is a major cause of insomnia, as well as a result of it, PI patients should be sure they are working with their physician to keep an eye out for either depression or sleep deficiency.

Addressing Sleep Deprivation

The only treatment for sleep deprivation is more sleep. Short-term coping mechanisms are just that; they can assist with staying awake and functioning in the aftermath of sleep deprivation, but they won't restore balance or full health. Only regular, full nights of sleep can do that.

For those who suffer from insomnia, treatment for the underlying cause will be necessary to restore regular sleep patterns. But, this needs to be discussed with a physician, because symptoms of sleep deprivation can also have many other causes, so a doctor may not immediately suspect sleep deprivation.⁵ In fact, most sleep deprivation goes undiagnosed and, thus, untreated.

Patients who are considering talking with their doctor should consider keeping a sleep log for a few weeks before the appointment. The log should include what time they went to bed, when they think they fell asleep, and how long they slept. It should also note how many times they woke up and how long it took them to fall back asleep. If vivid dreams or nightmares awoke them, those should be noted, too. In addition, it helps to track caffeine and alcohol consumption, naps and medications. The National Sleep Foundation has a sleep

diary that can be downloaded and printed at www.sleepfoundation.org/sites/default/files/inline-files/SleepDiaryv6.pdf.¹⁷

Looking Ahead

A good night's sleep is not a luxury; it is as important to overall health as a good diet and regular physical activity, and for those with a PI, it is even more important. While various cures for insomnia are being studied, there are already many effective treatments available.

Simply being aware of sleep deprivation is a big part of the solution. Much sleep deprivation isn't due to medically caused insomnia, it's simply a lack of awareness and a lack of commitment to getting needed sleep. ■

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