In this final installment of a series exploring sleep and its effect on the body, we look at the role sleep plays in fighting off illness.

The Biology of Sleep

By Pamela Young

Parts 1 and 2 of this series provided an overview of the mechanisms of sleep and how it influences internal biologic functions like brain activity and hormone regulation. This installment touches on the ways sleep, and the lack of it, affect one of our defenses against external threats: the immune system.

At one time or another, we've all experienced feeling extra sleepy while fighting a cold or infection. Most of us have also learned to heed conventional wisdom about the lack of rest putting us at greater risk of becoming sick. Though much is unknown about the exact role sleep plays in protecting us against illness, science is uncovering evidence that validates those connections between sleep and wellness.

It appears that there's a definite two-way link between immune function and sleep—with the immune system influencing the sleep/wake cycle and sleep bolstering certain elements of the immune system.

On one side of this interaction, research has shown that the body's immune response affects sleep. Neurons that control sleep interact closely with the immune system. In particular, certain chemicals the immune system produces to fight infection, called cytokines, can signal the brain that an immune defense is under way. The brain then responds by altering physiologic processes and behaviors, including sleep, to support the immune system.

A complex network of cytokines and their receptors exists in the brain, affecting the sleep/wake cycle even when infection isn't an issue. But certain cytokines (interleukin-1 and tumor necrosis factor) are powerful sleep inducers that are released in abundance during an immune response. This is what fuels the drive to sleep more when we're sick, further helping our bodies to heal.

But how can sleep protect us from getting sick in the first place? Research is still answering this question, but there's plenty of evidence to show that a lack of sleep can break down our defenses.

The immune system is one of the first to respond to prolonged wakefulness. Animal studies have shown that rats that are completely sleep deprived will perish from a systemic invasion of bacteria that would otherwise be benign. A 2007 study found that flies with a genetically disrupted circadian rhythm (day/night cycle) were more sensitive to bacterial infections and died significantly faster when sick. On the other hand, a University of Tennessee study demonstrated that rabbits that get more sleep following infection have an increased chance of recovery.

In humans, studies have shown that the normal antibody response to vaccinations is reduced by as much as half when subjects are deprived of sleep either before or after vaccination. This is because poor sleep leads to a dip in the number of killer T-cells that destroy viruses and bacteria, as well as to lower levels of interleukin-2, a protein that stimulates production and growth of many infection-fighting cells, including T cells. This results in suppressed immune function.

In the most recent findings on the subject of sleep and immune function, a study just released in January 2009 by researchers at Carnegie Mellon University found that people who get fewer than seven hours of sleep a night are three times more likely to catch the common cold than those who get eight or more hours of shut-eye. This is among the first scientific evidence to indicate that even a relatively modest sleep debt can influence the body's reaction to infection.

The Carnegie Mellon study also showed that sleep efficiency, not just duration, plays a role in immune function. Results demonstrated that people who lose more than 8% of sleep a night—because they have trouble getting to sleep or wake up in the middle of the night—are more than five times as likely to get a cold when exposed to it. This could be of particular interest to people with CFS, many of whom experience persistent sleep maintenance insomnia and other proven sleep disruptions (see story on page 8).

Now researchers in Germany are exploring whether immune defense is actually the primary reason for sleep. Using white blood cells as an indicator of "immune system investment," their research is showing that species that engage in more sleep have higher numbers of white blood cells circulating. They've also found that as species evolve longer sleep durations they become less vulnerable to parasites, whether macroparasites (arthropods, protozoa) or microparasites (viruses, bacteria, fungi). These findings back their assertion that the evolutionary reason for sleep is to fuel the immune system. The investigators suggest that when living creatures sleep, the energetic costs of daily survival are allocated to recharging this system.

Our immune systems are our first line of defense against germs and bacteria, and proper sleep seems to play a role in keeping that system fit and ready. This a significant concern for people with CFS, who struggle with sleep issues as well as vulnerability to infections and illness. But it's just one more reason why addressing sleep dysfunction as part of a CFS treatment strategy is important.

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SLEEP MEDICATIONS AND CFS

There are a variety of sleep medications that can be used to help with the sleeping disorders prevalent in CFS. Most of these sleep aids aren't meant for long-term use but may be worth discussing with your health care provider to see what's right for you. Though it may be a matter of trial and error at first, treating sleep issues is one of the primary therapeutic strategies for CFS.

Melatonin is an over-the-counter supplement that you can purchase in any grocery or health food store. Melatonin is a hormone that tells the brain that it's time to go to sleep. Some people with CFS, particularly those with circadian rhythm problems, report that melatonin is helpful, but its effects have never been validated by independent study.

Ambien and **Sonata** are in a class of drugs that called nonbenzodiazepines. These prescription medications work by attaching to receptors on brain cells that trigger sleepiness. Risks involved in using these medications include addiction/dependency and suppressed REM (rapid eye movement) sleep.

Elavil, **doxepin** and **trazodone** are antidepressants that help balance brain chemicals to treat depression. When used for sleep, they usually work best at lower doses than what's needed for treating depression. Still, these medications may cause drowsiness the following day and can reduce REM sleep.

Overall, the type of sleep disturbance and the other primary symptoms of your CFS may determine the right sleep aid to explore with your health care professional. For sleep onset insomnia, short-acting agents such as Sonata might be effective. For sleep maintenance insomnia, Ambien or one of the benzodiazepines **Klonopin**, **Restoril** or **Halcion** may be worth trying.

If you suffer from CFS, you'll need to work with your physician to find the medication or combination of medications that work best for you. Keep in mind also that people with CFS tend to be drug-sensitive and may need to start any sleep medication at a fraction of the normal dose and then work up from there.

Pamela Young has brought more than 16 years of publishing experience to her role as editor of the CFIDS Chronicle*. She has led editorial and creative teams providing pertinent and reader-friendly content for audiences from all walks of life.*