

Can't sleep? Here's some science-based advice

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Credit: Vera Kratochvil/public domain

A few weeks ago, thousands of researchers gathered in Denver,

Colorado for the SLEEP 2016 meeting. Skimming over the abstracts, one can find diverse research topics like "[Need better sleep? Consider the cognitive shuffle](#)," and "[Sleepiness and fatigue associated with brain atrophy in cognitively normal elderly](#)," showcasing the many questions that remain unanswered regarding sleep.

It's clear that [sleep](#) – a daily activity comprising one-third of our lives – deserves a lot of attention from the research community. And the failure to get a good sleep drives people to try numerous interventions: some based on science, others not.

Let's start with a common example: avoiding [blue light](#) for better sleep.

Subtracting blue light

Researchers have shown that [exposure to blue light](#) delays sleep onset, decreases [sleep quality](#), and increases [arousal](#). Our brains respond to [short-wavelength blue light as a signal of morning](#), and red light as a signal of sunset. Seven years ago, a group of developers launched f.lux, software that has since been downloaded over [15 million times](#). f.lux works by subtracting the blue light emitted from your computer's screen at night, making your daily environment more similar to the natural light-dark cycle. With less blue light exposure, your brain no longer receives artificial "morning" signals. In response to criticisms about blue light from the iPhone disrupting [sleep patterns](#), Apple introduced a night shift setting in the [iOS 9.3 update](#).

Blue light, but not red or green light, is bad for sleep due to its interaction with the retinal photoreceptor melanopsin. Before 1998, people thought there were only two [photoreceptors](#), rods and cones, in the retina to help us form images of our surroundings. In contrast, melanopsin gives us a "non-image forming" response to light to help regulate our [circadian rhythms](#). Melanopsin is most sensitive to blue

light, so blue light has the greatest influence on the melanopsin receptor, and too much blue light at night can disrupt the sleep schedule.

In a *PLOS Biology* study published in June, researchers from the University of Oxford showed that blue light caused behavioral arousal, delayed sleep onset, and elevated levels of glucocorticoids in wild-type mice. When they genetically engineered these animals to make them melanopsin-deficient, the same blue light actually enhanced sleep, a completely different response! Besides demonstrating melanopsin's significance for blue light's effects on sleep, the same study also found that melanopsin mediates the increase in glucocorticoid levels in response to blue light. [Glucocorticoids](#) link stress and arousal, and increasing glucocorticoid levels hinders sleep. When the researchers blocked the effects of elevated glucocorticoids using a glucocorticoid receptor antagonist, the effect of blue light on sleep was reversed.

In humans, melanopsin regulates the release of a sleep hormone, [melatonin](#), which circulates in the body after secretion from the [pineal gland](#) in the brain. Melatonin levels fall in the early morning as melanopsin senses bright daylight and suppresses the hormone. Melatonin levels then rise before bedtime because melanopsin is no longer active. But that is before the era of artificial light, and the exposure to bright blue light at night is worsened by usage of cell phones, tablets, and e-readers in bed. If blue light activates melanopsin at a time when it shouldn't be active, it will further prevent the natural melatonin rise and lead to sleep difficulty.

What do we know about melatonin supplements?

Given melatonin's role in sleep regulation, melatonin supplements are a common over-the-counter option for people with difficulty falling asleep. Moreover, melatonin-containing [relaxation drinks on the market have also increased in popularity](#).

Are these products truly helpful? Clinical trials have shown that the efficacy of melatonin is low for insomnia, only [decreasing sleep latency for about seven minutes](#). On the contrary, [melatonin's effect on improving jet lag symptoms](#) is more substantial.

Despite questionable benefits in humans, melatonin supplements have some known risks. First of all, there are [side effects](#) like next-day grogginess, nausea and irritability. In addition, combining melatonin with other neuroactive substances like alcohol could lead to dangerous conditions. An [editorial in Nature Neuroscience](#) warned consumers and regulatory agencies about the risks of relaxation drinks, including those containing melatonin, and urged them to remember that combining seemingly safe energy drinks with alcohol has caused several deaths. Finally, the FDA issued a warning letter about melatonin-laced brownies, voicing caution over melatonin's potential effects on the nervous system. [The letter is backed up by evidence from 23 research papers](#).

Consulting a doctor is also a good idea if you're interested in melatonin supplements. When interviewed by [Huffington Post in 2015](#), sleep physician [Dr. Andrew Westwood](#) from Columbia University addressed another issue related to [melatonin supplements](#): they "can de-sensitize your receptors so they're no longer responsive to lower doses of melatonin. Then, if you come off [the supplements], you might have difficulty sleeping—and require more and more melatonin to fall asleep." Westwood says that, in many cases, people actually need to modify their behavior, like avoiding bright light and blue light from electronic devices a few hours before bed.

What you can do today

After I had finished reading all the materials for my blog post on Saturday evening, I decided to conduct my own sleep experiment. Carefully following the scientists' suggestions, I placed my smart phone,

tablet, and laptop in the living room. Then, I turned on a dimmer light in the bedroom, opened a paper book, and read several short stories before sleepiness (or the natural [melatonin](#) tide) knocked me out. I slept through the whole morning and most of the afternoon. It seems I had a heavy sleep debt from my glowing backlit gadgets, and millions of others may have a similar problem.

The National Center on Sleep Disorder Research found that sleep-related problems affect around [70 million Americans](#) of all ages. While the reason for sleep problems among these millions could be social, psychological or even more complicated, there are always small things one can do, something as simple as freeing yourself from those gadgets for an hour before bedtime. In this hour, you could read a printed book (as I did), or listen to [relaxing music](#), whose power seems to lie in [delta waves](#).

More information: Violetta Pilorz et al. Melanopsin Regulates Both Sleep-Promoting and Arousal-Promoting Responses to Light, *PLOS Biology* (2016). [DOI: 10.1371/journal.pbio.1002482](https://doi.org/10.1371/journal.pbio.1002482)

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