

# The Harm That Light Can Do to Your Sleep

Do you think about how you use and consume light? We live in a culture where electricity and artificial light are everywhere: inexpensive and always available in seemingly endless supply. We're so used to being surrounded by light -- it's truly at our fingertips -- that many of us don't even think about it, much less question the timing and degree of our exposure. Yet a robust and growing body of scientific research suggests that for the sake of our sleep -- and our overall health -- we all need to start paying a lot more attention to the presence of light in our daily lives.

How did we get here? After all, nearly all of human history has unfolded without electricity, and without the near-constant presence of artificial light. In the roughly 125 years since the advent of electricity, nearly every aspect of human life has been fundamentally altered. Unlike our ancestors, we're no longer expressly tied to the solar day and night or to the long and short light of the changing seasons. With the flick of a switch, we can experience "daylight" or "summer" at any time. Artificial light has enabled transformative change to the way we live, work, and play, the way we engage in relationships and community. Society and culture may have adapted readily and even voraciously to that transformative change. But our bodies have not. The widespread emergence of artificial light has ushered in new risks to health, risks our pre-electricity ancestors never had to face.

Over the past two decades, science has increasingly turned its attention to exploring the effects of light exposure to human health. What was once a somewhat shaky scientific proposition is now widely accepted, if not yet fully understood: chronic exposure to artificial light, particularly at the wrong time of day, is dangerous to health. And sleep, which can be deeply affected by light exposure, is one critical piece of the puzzle.

How does artificial light exposure disturb normal, healthy sleep? It does so in large part by disrupting the body's natural circadian rhythms. Circadian rhythms are one of the two physiological systems<sup>[1]</sup> that regulate sleep-wake cycles. (The other is the body's own, internal sleep drive.) Circadian rhythms<sup>[2]</sup> exist in almost all living organisms, and are influenced primarily by exposure to light and darkness. Circadian rhythms operate on an

approximately 24-hour cycle, essentially in line with the solar night and day. Our sleep -- as well as many other important biological processes, including digestion, hormone regulation, and immune function -- is deeply and fundamentally tied to these sensitive and finely tuned circadian cycles, which are in turn deeply influenced by both the presence and absence of light. Light exposure alters the ebb and flow in the body of the "sleep" hormone melatonin, which occurs<sup>[3]</sup> in circadian rhythm. Melatonin levels naturally rise at night -- in response to darkness -- and play an important role<sup>[4]</sup> in bringing about sleep onset. In turn, the natural early morning drop in melatonin levels helps prepare for wakefulness. Evening light exposure can delay the release of melatonin, causing a shift in circadian sleep-wake cycles.

Take a moment to imagine what life was like for people living before the widespread availability of artificial light. Even with supplemental light sources such as candles or oil lamps, the most powerful light exposure came from the sun. When the sun set, darkness appeared, largely without interference. That's no longer the case. When was the last time you experienced real darkness, with no street lights or city lights, no lamplight or overhead bulbs switched on after sunset, no television screens or computers lighting up the evening? Excessive exposure to artificial light in the evening hours -- which for most of us happens daily, often in abundance -- trumps the darkness that our bodies and circadian rhythms have evolved to expect and rely upon.

When circadian rhythms are disrupted by artificial light exposure at the wrong time of day, both the quality and quantity of sleep can suffer. Over time, the health complications<sup>[5]</sup> from poor and insufficient sleep can be widespread, numerous, and serious. Poor sleep is linked to higher rates<sup>[6]</sup> of anxiety, depression, and other mood disorders. Sleep problems are associated with increased incidence of cardiovascular<sup>[7]</sup> and metabolic disease<sup>[8]</sup>, as well as to problems with endocrine and immune function. Sleeping poorly may increase risk for cancer<sup>[9]</sup>. Poor sleep is also associated with sharp increases in accidental<sup>[10]</sup> injury and death, as well as in problems with memory<sup>[11]</sup> and cognitive function<sup>[12]</sup>. Nearly all measures of health, safety, and performance are negatively affected by a lack of regular and routine high-quality sleep.

What's more, there's a burgeoning body of scientific evidence indicating that circadian rhythm disruption is itself deeply harmful to health. Circadian dysfunction is linked to elevated risks<sup>[13]</sup> for cancer, cardiovascular disease, diabetes and other metabolic disorders, as well as to psychological stress and depression<sup>[14]</sup>.

Scientists have discovered that when it comes to sleep disruption and circadian rhythms dysfunction, not all light is the same. Different wavelengths of light appear to have different degrees of effect. In particular, blue spectrum light has been shown to be especially disruptive<sup>[15]</sup> to sleep, and to circadian function. Blue spectrum light is found in higher concentration in some energy-efficient LED and fluorescent light bulbs. High concentrations of blue-wavelength light are also emitted from the LCD screens of digital devices. Studies show exposure to blue-spectrum light at the wrong time of day has a greater effect than other light spectra on suppressing<sup>[16]</sup> the natural release of melatonin.

It is important to be clear: light exposure isn't uniformly or indiscriminately harmful. The dangers of light exposure occur largely in the timing and in the degree. That same blue light that can have such a negative impact at night can have beneficial effects<sup>[17]</sup> when you're exposed to it during the day. Daytime blue spectrum light exposure (as well as light exposure in general) can boost<sup>[18]</sup> alertness and reaction times, elevate mood, and help maintain healthy circadian rhythms. Receiving abundant light exposure during the day can strengthen and reinforce<sup>[19]</sup> sleep-wake cycles and improve sleep when nighttime--and bedtime--arrives. The key to healthy light exposure is to understand how light can affect the body, and to be thoughtful and strategic about when and how you use it. We need light, and we can benefit from it in innumerable ways. But we also need darkness.

It's time to start thinking about light as a powerful medicine -- capable of providing tremendous benefit when used correctly, but requiring care and education in that use. Like a potent drug, it's absolutely necessary that we stay educated and aware of all of light's possible effects on our brains and our bodies. Only then can we use light effectively and well, taking full advantage of its very real benefits while minimizing its dangers and risks to our health.

Sweet Dreams,

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The Sleep Doctor™

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Links

1. <http://sleepfoundation.org/sleep-topics/sleep-drive-and-your-body-clock>
2. [http://www.nigms.nih.gov/Education/Pages/Factsheet\\_CircadianRhythms.aspx](http://www.nigms.nih.gov/Education/Pages/Factsheet_CircadianRhythms.aspx)
3. <http://www.ncbi.nlm.nih.gov/pubmed/12622846>
4. <http://umm.edu/health/medical/altmed/supplement/melatonin>
5. <http://healthysleep.med.harvard.edu/healthy/matters/consequences/sleep-and-disease-risk>
6. <http://www.scientificamerican.com/article/can-a-lack-of-sleep-cause/>
7. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3132857/>
8. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3132857/>
9. <http://www.cancercenter.com/community/newsletter/article/researchers-are-studying-the-link-between-sleep-and-cancer/>
10. <http://www.ncbi.nlm.nih.gov/books/NBK19958/>
11. <http://www.health.harvard.edu/blog/little-sleep-much-affect-memory-201405027136>
12. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2656292/>
13. <http://www.qscience.com/doi/pdf/10.5339/jlghs.2013.3>
14. <http://www.livescience.com/31961-brain-clock-disrupted-depression.html>
15. <http://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side>
16. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2831986/>
17. <http://www.sciencedaily.com/releases/2014/02/140203191841.htm>
18. [http://www.huffingtonpost.com/dr-michael-j-breus/blue-light-sleep\\_b\\_4993859.html](http://www.huffingtonpost.com/dr-michael-j-breus/blue-light-sleep_b_4993859.html)
19. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2768129/>