

Why We Need To Sleep In Total Darkness

George Dvorsky, 1/8/14

The modern bedroom is full of lights, from glowing computer monitors and clock radios to any number of blinking and glimmering electronic devices. Trouble is, chronic exposure to light at night leads to a host of health problems.

To understand why chronic exposure to light at night is so bad, we need to consider human evolution. Prior to the end of the stone age, humans were exposed to two different kinds of natural light responsible for regulating circadian rhythmicity. During the day we had the sun, while at night we had the moon and the stars, and perhaps the light from campfires. The binary day/night pattern was unrelenting, and our biological programming followed suit.

Today, we have artificial lighting at night (LAN), and it's a different case altogether. Indoor lighting is considerably less powerful than sunlight, but many orders of magnitude greater than star and moonlight. Check out this chart to see what I mean:

Type of lighting	Illuminance (in lux)
Bright Sun	32,000 to 130,000
Partly cloudy sunny day	20480
Overcast day or shade	10240
Studio light	1000
Office with windows	640
Flouroscent lighting	320
Street lights	320
Low-light spaces	160
Homes	80
Civil twilight	3.4
Full moon at tropics	1
Full moon on a clear night	0.27
Quarter moon	0.01
Moonless night, clear sky	0.002
Starlight only	10 ⁻⁴

Keep in mind that this is a logarithmic scale, so the difference between sunlight and moonlight is considerable — a difference that influences a series of critical biochemical cascades tied to light periodicity, including the production of cortisol and melatonin levels.

Light is a Drug

Melatonin suppression is key to understanding much of why LAN is so crappy for us. This workhorse biochemical is produced by the brain's pineal gland at night — when it's dark — to regulate our sleep-wake cycle. It lowers blood pressure, glucose levels, and body temperature — key physiological responses responsible for restful sleep. As neurologist George Brainard puts it, "Light works as if it's a drug, except it's not a drug at all."

The part of your brain that controls your biological clock is the Suprachiasmatic Nucleus (SCN), a group of cells in the hypothalamus. These cells respond to light and dark signals. The optic nerves in our eyes sense light and transmit a signal to the SCN telling the brain that it's time to wake up. It also kickstarts other processes, like raising body temperature and producing hormones like cortisol. Our cortisol levels are relatively low at night, allowing us to sleep, and higher during the day, allowing for the stabilization of energy levels and the modulation of immune function.

But LAN *unnaturally* elevates cortisol levels at night, which disrupts sleep and introduces a host of problems relating to body-fat levels, insulin resistance, and systemic inflammation. It also contributes to sleep debt and a disruption the neuro-regulation of appetite.

But if our rooms are dark at night, there's no optic signal to the SCN, so our bodies pump out the much needed melatonin. Moreover, our melatonin levels are regulated according to the amount of exposure we had to light during the previous day.

The Light Before You Sleep

Indeed, studies have shown that exposure to room light before bedtime shortens melatonin duration by about 90 minutes compared to dim light exposure. In addition, exposure to room light during usual hours of sleep suppresses melatonin levels by more than 50%. That's significant.

So, even before you hit the hay, the light in your bedroom is causing you problems. With the introduction of tablets, smartphones, and energy-efficient light bulbs, it's an issue that's only getting worse.

And just to add insult to injury, many modern devices emit blue light from light-emitting diodes (LEDs) — light that's especially good at suppressing melatonin. This is because melanopsin — a photopigment found in specialized cells of the retina involved in the regulation of circadian rhythms — is most sensitive to blue light.

Recently, scientists warned college students about the impact of light from computer monitors on melatonin levels. They found that computer light at night — particularly blue light that was scanned by wearing different wavelength-blocking glasses — reduces college students' melatonin levels. A related study found that backlit tablet displays suppress melatonin, disrupting sleep. But the researchers write: “[It] is important to acknowledge that usage of self-luminous electronic devices before sleep may disrupt sleep even if melatonin is not suppressed. Clearly, the tasks themselves may be alerting or stressful stimuli that can lead to sleep disruption.” Which is a very good point.

The Cancer Link

Regrettably, all this hormone and biochemical disruption is creating downstream effects — cancer being one of them. Scientists aren't entirely sure why, but studies consistently show a correlation.

For example, a 10-year study found that a sample group of over 1,670 women exposed to higher intensity light in their sleeping environment had 22% higher odds of developing breast cancer than those who slept in total darkness. The researchers blamed it on hormone disruption caused by melatonin suppression.

In another study, researchers implanted nude rats with breast cancer xenografts and then gave them perfusions of blood from different women. Rats receiving blood from women who were exposed to dim light at night had their tumor growth reduced — but those with blood from women who were exposed to bright light at night weren't granted this beneficial effect.

Troublingly, this has grim implications for workers who do shift work. Case-controlled studies have shown that nurses who work rotating shifts at midnight are more at risk for breast cancer compared to nurses with permanent day work.

Low Light, Blue Light, Depression and Immune Response

Disturbingly, the light at night doesn't even have to be bright to cause problems. Chronic exposure to dim light at night leads to depression-like symptom in hamsters, such as exhibiting less interest in drinking the sugar water that they normally love. But by returning them to a normal, non-lit day/night schedule, the researchers were able to reverse the depression. Scientists suspect that this dim-light depression may be the result of a protein called tumor necrosis factor.

Chronic dim light at night also detrimentally affects the immune system.

You might want to think about this next time you leave even the dimmest lights on in your bedroom — including your clock radio and the light that bleeds in from street lights.

Another study, also on rodents, showed that blue light at night in particular is especially powerful at inducing depression-like symptoms. LAN can also impair mood and learning, again likely on account of melanopsin-expressing neurons.

Premature Aging and Heart Problems

Melatonin also has antioxidant properties, which plays an important role in anti-aging. Researchers have been able to treat artificially aged mice with melatonin, thus reducing oxidative stress. These mice models are helping scientists understand the fundamental mechanism behind aging because they're the same markers found in neurodegenerative diseases like Alzheimer's. Other studies show a link between melatonin suppression and cardiovascular disease.

Weight Gain

Light at night also contributes to weight gain by shifting the time of our food intake. Mice, when exposed to LAN, gained more weight — despite exercising and eating as much as their darkness-exposed brethren. Scientists have also correlated low levels of melatonin to diabetes, though it's not clear what role, if any, LAN plays in this matter.

Pitch Black

All this research points to one basic fact: We need to keep our bedrooms as dark as possible and avoid blue light before sleep. To that end, you should turn off all your light-emitting gadgets and close the blinds. And if possible, refrain from reading your tablet computer or smartphone in the hours preceding sleep.

I know, easier said than done.

Additional reporting by Joseph Bennington-Castro.