

Light at Night Damages Your Health and Potentially Future Generations

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STORY AT-A-GLANCE

- › Light pollution triggers significant health changes in humans, animals and plants, and may be a hidden cost of a 24/7 lifestyle
- › Research identified health problems in the offspring of laboratory animals exposed to even dim light at night, showing it affects the animals' immune and endocrine systems
- › Both dim light at night and electromagnetic fields from electronic devices trigger mitochondrial damage, potentially affecting epigenetic expression in future generations

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There is a significant cost to your health from light pollution resulting from living in a 24/7 society. A growing number of streetlights and lit signs obscure the night sky, and your bedroom is likely dimly lit from streetlamps, digital equipment or alarm clocks.

It's not possible to "feel" the changes in your brain and body from outdoor streetlight that seeps in around your bedroom curtains or the dim glow from your alarm clock.

Yet, even a dim light at night affects your natural sleep cycle and produces biological changes which, in turn, may affect your risk for health conditions such as [obesity](#), diabetes, [cancer](#) and depression.

I have been a long-time advocate of sleeping in complete darkness. Even a small amount of blue light is enough to make a difference in your health. And now, research

demonstrates your exposure to light pollution may affect the health of your children.

Light Exposure at Night May Alter Immunity of Future Generations

In a 2017 study at Ohio State University, researchers concluded exposure to light at night may produce immune and endocrine disruptions.¹ To isolate the effect light has on sleep quality and not on interruption of sleep, they used naturally nocturnal hamsters that normally sleep during daylight hours.

The hamsters were separated into two groups. For nine weeks, one group was exposed to dim light all night while the other was exposed to standard light days and dark nights. Following this, the hamsters were allowed to mate and then all were returned to standard lighting conditions.

Initially, the researchers noted an increase in body mass of both male and female hamsters exposed to dim light at night.² The next generation was also raised under standard lighting conditions. The researchers ran a series of tests on the hamster pups once they reached adulthood.³

They found parental history of light exposure prior to conception left the following generation of hamsters with an impaired immune response and decreased endocrine activity. These health conditions were passed down through either parent's genetic material, meaning it didn't matter whether it was the mother or father that was exposed to dim light at night; the effect could be traced to either parent.

The impaired adaptive immune function noted in the hamster offspring illustrates a transgenerational effect of light at night. While the exposure did not change the DNA sequence of the hamsters, it did affect the epigenetic expression of that DNA. Epigenetics describes changes to genetic expression not occurring from an actual sequence change in DNA, but rather how the genes are expressed.

For instance, exposure to environmental factors such as nicotine or alcohol may trigger sections of DNA to be switched on or off. These changes in genetic expression can be passed to offspring while still maintaining the exact genetic sequencing. In this study, light exposure at night changed the epigenetics of the hamster offspring, negatively affecting their immune system.

Light Pollution Also Affects Your General Health

Senior author Randy Nelson, Ph.D., professor and chair of neuroscience at Ohio State's Wexner Medical Center commented on the significance of the results:⁴

"Now, we're seeing for the first time in these hamsters that it's possible this damage isn't just being done to the affected individuals, but to their offspring as well. These weren't problems that developed in utero. They came from the sperm and the egg.

It's much more common to see epigenetic effects from the mothers, but we saw changes passed on from the fathers as well.

I think people are beginning to accept that light pollution is serious pollution and it has health consequences that are pretty pronounced – an increase in cancers, depression, cardiovascular disease, diabetes and anxiety disorders.

We should be concerned about the increasing exposures to light at night from our tablets and phones and TVs."

Exposure to blue light at night, even when awake doing shift work or **dim light exposure** when sleeping, may be associated with an increased risk of certain cancers, cardiovascular disease, gastrointestinal ailments and mood disorders, regardless of the type of illumination.⁵

In both the 2017 study and others,⁶ animals exposed to light during night hours had greater weight gain. In some mice, up to 50% more weight was gained over eight weeks, despite identical activity levels and available food. Other studies show that rates of

cancers dependent on hormones, such as breast cancer or prostate cancer, increase with exposure to light at night.⁷

The suppression of melatonin, a sleep-regulating hormone, by blue light emitted from electronic media and other lighting, is linked with reduced sleep quality and interrupted sleep.⁸ Poor sleep quality increases your risk of depression and may impact your reproductive health as well.⁹

Mitochondrial Damage Is at the Center of Poor Health

Mitochondrial function plays an important role in many of the diseases and changes associated with aging, and melatonin plays a unique part in stabilizing the function of molecular mechanisms and biogenesis of your mitochondria.¹⁰ Melatonin acts as an antioxidant and regulator of mitochondrial functions.¹¹

It is selectively used by mitochondrial membranes, a function not exhibited by other antioxidants. The hormone effectively prevents oxidative stress-induced mitochondrial dysfunction. As exposure to light, and specifically blue light, severely impacts your melatonin production, it also has a substantial effect on your overall health.

Your mitochondria are tiny powerhouses inside the cells of your body. They are the primary source of energy for your cells, and thus your body. Since mitochondrial function is at the heart of everything that happens in your body, optimizing it is extremely important for good health and disease prevention.

For example, one of the universal characteristics of cancer is serious mitochondrial dysfunction with radically decreased numbers of functional mitochondria. A disruption of your circadian rhythm, and therefore your secretion of melatonin and subsequent effect on mitochondria, has been associated with aberrant cell proliferation and cancer.¹²

Mitochondrial dysfunction also plays a central role in insulin resistance, the hallmark symptom of diabetes.^{13,14} Glucose and lipid metabolism are principally dependent on

mitochondria to generate energy. Insulin resistance from mitochondrial dysfunction may contribute to subsequent increases in heart disease.

Cell death and survival are critical to neurodegeneration, and mitochondrial function is an important determinant of both.¹⁵ The relationship between melatonin and mitochondrial function has led to the emergence of melatonin as a potential therapeutic tool for treatment of neurodegenerative disorders, such as Parkinson's and Alzheimer's disease.¹⁶

How Much Light Is Too Much?

Your body requires exposure to bright daylight, especially in the early morning, to produce healthy amounts of melatonin each night. While melatonin helps regulate sleep and protects your mitochondria, that isn't all it does.

It is also a free radical scavenger that helps support your immune system and thymus gland, and helps you feel good in the morning. It also may protect your brain against aging. Your body secretes all the melatonin it needs based on natural circadian rhythms that are largely reliant on light.

Getting sunlight in the morning is one way to help reset your circadian clock daily. Ten to 15 minutes of morning sunlight sends a strong message that it's time to rise and shine. In this way, your body is less likely to be confused by weaker light signals later in the day.

My rule of thumb is, if there is enough light in your bedroom at night to see your hand in front of your face, then there is too much light. Your body requires light during the day to produce healthy amounts of melatonin, but at night, blue light inhibits melatonin production. So, it's difficult to get too much light during the day and easy to get too much at night.

The problem of light pollution has become so pervasive that the American Medical Association (AMA) has issued statements warning against blue light at night. In 2012, during their annual meeting, the AMA voted on a policy recognizing that exposure to

blue light at night can disrupt sleep and that LED streetlamps could create dangerous driving conditions.¹⁷

In 2016, the AMA again voted on guiding principles for the selection of public lighting options.¹⁸ The policy statement specifically addressed the "white light" LED streetlamps erected around the U.S. to save energy, and the vote was unanimous.¹⁹

The concern is prompted by the color spectrum used in the LED streetlights. The AMA recommends a color temperature no greater than 3000 Kelvin (K). The color temperature of the LED lighting currently being installed ranges between 4000K and 5000K, containing high levels of short-wavelength blue light in the spectrum.

Color of Your Light Matters

As detailed in my interview with Dr. Alexander Wunsch, a world-class expert on photobiology, lighting is an important health consideration. Natural sunlight simply cannot be beat, but unless you spend the majority of your time outside, you'll need to give some serious consideration to the kind of artificial lighting you use at home and at work.

Not all artificial light is created equally. The LED lights installed in major cities are harsh, triggering complaints from local residents. Blue lighting from LED lights reduces contrast at night and therefore reduces visibility. While this limits everyone's ability to see potential danger, it is especially difficult for older people to see well in this lighting.²⁰ According to the AMA statement:²¹

"Unshielded LED lighting causes significant discomfort from glare. Discomfort and disability glare can decrease visual acuity, decreasing safety and creating a road hazard. Various testing measures have been devised to determine and quantify the level of glare and vision impairment by poorly designed LED lighting."

Electric lighting is not inherently dangerous to humans or animals. However, it is important to balance safety at night against long-term health. Light pollution has an

effect on plants and animals, including preventing some trees from recognizing seasonal variations, and affecting the breeding cycles and foraging of wildlife.²² According to the AMA statement in 2016:²³

"Despite the energy efficiency benefits, some LED lights are harmful when used as street lighting. The ... AMA guidance encourages proper attention to optimal design and engineering features when converting to LED lighting that minimize detrimental health and environmental effects."

Additionally, the AMA estimates that LED streetlights have a five times greater impact on natural sleep rhythms than conventional streetlamps they are replacing.²⁴ Surveys have found these brighter residential blue wavelength streetlights are associated with excessive sleepiness during the day, impaired daytime functioning, obesity and dissatisfaction with sleep quality.

These effects may be improved when cities begin using LED lighting options operating at 3000K or less, often called warm white lights. These lights help balance the need for safety, reduced financial cost and smaller carbon footprint against your long-term health and the health of plants and animals exposed to external lighting.

Use REVERSE Sunglasses After the Sun Sets

In addition to eliminating all blue light exposure when you go to bed, it is also really important to filter blue light after sunset. The only light source our ancient ancestors had at night was from fire, which has virtually no blue or green light. Exposure to these light frequencies after the sun sets virtually assures that you will lower your melatonin and melanopsin levels. It also increases your risk of blindness from macular degeneration.

So, pick up a pair of [reverse sunglasses](#)²⁵ to protect your vision after dark. The glasses are only \$12 and they are far superior to traditional blue-blockers as they also filter out the yellow and green that can impair retinal health. They are my absolute favorite, and I

only use the amber blue-blockers during the day when I need to lecture in a dark hall illuminated by artificial light.

Also, Beware of Electromagnetic Frequency Emitted From Electronic Light Sources

While wearing a sleep mask may help reduce the amount of light seeping through your eyelids, it is also important to address the [electromagnetic field](#) (EMF) emitted from electronic devices that is at least as dangerous as the light. Although blue light at night reduces your melatonin secretion, and therefore antioxidant protection for your mitochondrial function, EMF from electronic devices also damages mitochondria by producing oxidative damage.

Thus, your computer, cellphone and other electronic devices may be doing double-duty health damage. One major concern of exposure to EMF has been the development of cancer.²⁶ Scientists have long believed that cancer is initiated by damage to a cell's genetic structure, but the initial damage can actually be traced to mitochondrial damage.

DNA damage triggered by EMF also leads to changes in cell function and cell death. EMF sources in your home, such as Wi-Fi routers, cellphones and microwave ovens, may increase your risk of cancer.^{27,28,29} In 2011, the World Health Organization (WHO) classified cellphone radiation as a 2B carcinogen, or possibly carcinogenic to humans.³⁰

It is REALLY important that you turn off your Wi-Fi every night before you go to bed to minimize your exposure. In other articles, I have discussed how you can use a [Faraday cage](#) to really improve protection from these sources.

EMF also has a detrimental effect on the health of your brain, altering function and potentially fueling dementia. Even though measured EMF from cellphones is considered low, studies have demonstrated it can alter your brain function and activity.³¹ EMFs from cellphones and Wi-Fi are also linked to changes in brain neurons that affect memory and the ability to learn.³²

Interestingly, EMF from cellphones may also reduce the number of antioxidants available in your saliva, one of the first lines of defense your body has against microbial infections.³³ Talking on a cellphone for up to one hour may reduce your salivary antioxidant levels by 25%. The proximity of your parotid salivary glands to where your cellphone is held during a conversation increases exposure to EMF.

EMF Found Where You May Not Expect It and How to Guard Your Health

Protecting yourself from EMF radiation begins by knowing what devices are emitting EMF and then developing alternatives to reduce exposure. This is not an exclusive list, but while you may have expected to see some of the devices on the list, others may come as a surprise.

Cellphones	Cordless phones	Bluetooth headsets
Refrigerators	Radios	Televisions
Wi-Fi modems and routers	TV remote controls	Microwave ovens
Alarm clocks	Lamps	Outlets
Powerlines and cellphone towers	Smart meters (transmitting your utility usage wirelessly to your utility company)	Computers including laptops, e-readers and tablets

The importance of the health of your mitochondria cannot be overstressed. Read about how you can protect your mitochondrial health in several of my previous articles:

- [What You Need to Know About Your Mitochondria](#)
- [Blue Light Is Causing Blindness](#)
- [Top 33 Tips to Optimize Your Sleep Routine](#)

- **Top Tips to Optimize Your Mitochondrial Health**

One of the strategies I've had great success with is a modified Faraday cage over my bed. You may easily incorporate shielding material at home using different types of EMF conductive fabric for different applications, such as bedding, curtains or canopies.

Remember, as you spend at least seven or eight hours each day in your bedroom, it is an important place to start reducing EMF exposure. If building your own bed canopy with proper conductive material is not something you want to attempt, you can purchase a bed canopy kit fitting twin- to king-sized beds.

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