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Seeing the Light of Day

Artificial Illumination Can Affect More Than Your Mental Health. As Daylight Saving Time Comes to an End, What Happens to Our Internal Clocks?

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Oh, the light! The autumn light! Is there anything more glorious than an October day, awash in the sun's low-slung amber rays?

And yet . . . perhaps you feel the dread, too. The looming inkiness that, like the tide, crawls up your legs a little higher each day, turning that honeyed light to molasses and molasses to muck until you realize, too late, that the birds have left and the world has gone dark. Dark when you wake up, dark when you go home.

In simpler times we slept more in winter, but modern living denies us that luxury. So increasingly each day, soft-white lights from yonder windows break -- along with halogens, tungstens and compact fluorescents. And when we can't stand it anymore, we resort to manipulation, declaring that 6 in the morning is now 5.

You got a problem with that, take it up in the spring.

Now science is finding that our manhandling of light and time is making us sick.

Artificial illumination is fooling the body's biological clock into releasing key wakefulness hormones at the wrong times, contributing to seasonal fatigue and depression. And daylight saving time, extended by Congress this year for an extra four weeks, risks dragging even more Americans into a winter funk.

Much more than mental health is at stake. Women who work at night, out of sync with the light, have recently been shown to have higher rates of breast cancer -- so much so that an arm of the [World Health Organization](#) will announce in December that it is classifying shift work as a "probable carcinogen."

That will put the night shift in the same health-risk category as exposure to such toxic chemicals as trichloroethylene, vinyl chloride and polychlorinated biphenyls (PCBs).

"Electric lights are wonderful, but as with a lot of other things, we really mess things up," said David [Avery](#), a psychiatrist at the [University of Washington School of Medicine](#) who studies light's impact on health. "Our ancestors evolved in a very regular light-dark cycle, and our bodies just work better that way. But more and more, we are creating very irregular, erratic lighting cues."

Researchers have long known that virtually all living organisms have biological rhythms that are linked to light. But the human health implications remained opaque until the 1970s, when scientists discovered the brain's internal clock: the suprachiasmatic nucleus (SCN), a tangle of neurons in the hypothalamus connected directly to the eyes.

The SCN controls the ebb and flow of hormones that influence sleepiness, alertness and hunger. Prime among them is melatonin, levels of which rise each evening, easing the onset of sleep, and then fall before dawn in advance of awakening.

Rats whose SCNs are surgically removed become unhinged from time, sleeping at odd intervals. And when one animal's SCN is transplanted into another's brain, the recipient takes on the donor's

wake-sleep schedule.

But the SCN does not work in a vacuum. It takes its cues from light signals passed along by the eyes.

For decades scientists presumed that those clock-setting signals came from rods and cones, the light-sensitive cells in the retina that provide black-and-white and color vision. Then, in 2002, researchers at [Brown University](#) discovered an entirely different set of light-detecting cells in the eyes of humans and other mammals: ganglion cells.

Unlike rods and cones, ganglion cells specifically detect sky-blue light. The amount of light needed to get them firing is about 500 billion photons per second per square centimeter, or the intensity of sunlight reaching the eye at about daybreak. Taken together, those traits make them the perfect cells to tell the brain when dawn has arrived, which they do via a dedicated neural conduit to the SCN.

Unfortunately, this system does not always work like clockwork.

Because of genetic differences, many people's clocks are set differently from others'. In some, the evening melatonin spike is delayed and sleep comes late. Early awakening is also often difficult for these night owls, perhaps in part because their melatonin levels have not had time to drop sufficiently by morning.

Others have the opposite problem: The clocks in these morning larks run fast compared with solar clock time, lulling them to sleep early and then awakening them well before dawn's early light.

Being out of phase with the natural day-night cycle can take a big toll, causing fatigue, mood disturbances and depression. But for millions of Americans, these symptoms become even worse in winter, blossoming into what is in effect a months-long case of jet lag.

Scientists disagree on the cause of seasonal affective disorder, or SAD, as it has come to be known. Some focus on winter's late sunrises, which appear to push various hormone cycles out of phase with the daily wake-sleep cycle. Others focus on the early sunsets, which may affect the timing of melatonin production in the brain.

But while genes clearly play a role (night owls are more often affected), location also matters.

Recent work by Thomas White of the New York State Office of Mental Health and Michael Terman, director of the Center for Light Treatment and Biological Rhythms at Columbia University Medical Center, has shown that seasonal depression and mood disorders become more prevalent not only at northern latitudes -- not surprising, as days are shorter there -- but also toward the western edges of time zones, where people remain in darkness almost an hour later each morning than their same-timed counterparts farther east.

Daylight saving time, which has been stretched this year to Nov. 4 for a number of reasons, including an effort to save energy, exacerbates the problem by further delaying the time of sunrise, a key signal that resets the body's clock each day.

"From the psychiatric perspective, the extension of daylight saving time this year was a very bad decision," Terman said. "Our expectation is we will see increased depression and mood disorders."

The good news is that treatments for seasonal depression -- primarily the use of bright light, and in some cases melatonin supplements, to reset the body's clock -- can be effective.

For most people with SAD, the trick is to get bright light exposure first thing in the morning to simulate an earlier dawn and shift the body clock forward, said Alfred Lewy, a psychiatrist and chronobiologist at [Oregon Health & Science University](#) in [Portland](#). For some people, taking 0.3 to 0.5 milligrams

of melatonin in the midafternoon can also help, he added.

For the minority of SAD sufferers who are larks, light in the early evening can help. (Some larks may also benefit from melatonin in the morning, keeping in mind that even small doses can make some people sleepy.)

Diagnosing yourself as owl or lark can be tricky. Wake-up times are affected by much more than your natural clock (whether your sixth-grade daughter has to be fed before trudging off to school in the dark, for example), so your sleep schedule is not a surefire clue. Lewy suggests trying morning light first, but switching to the lark regimen if symptoms worsen.

Many kinds of lights are available for SAD treatment. Although some experts recommend those rich in the sky-blue wavelengths (the color that ganglion cells respond to), others warn that intense blue light can damage the eye. Most research indicates that 30 to 90 minutes' exposure to fluorescent "white" lighting of about 10,000 lux works fine, ideally with a plexiglass diffuser to filter ultraviolet rays and dissipate glare.

So effective is light as a mood improver that many psychiatrists now suspect that their understanding of depression has been backward: The disturbed sleep and withdrawal into darkened rooms so often seen in patients with depression, bipolar disorder and related problems may be not a symptom of those diseases but a cause. Reset the clock, and the depression lifts.

A 2005 review commissioned by the [American Psychiatric Association](#) concluded that daily exposure to bright light was about as effective as antidepressants against several forms of depression.

Recent studies have suggested that light therapy can also help patients with Alzheimer's disease. "They have these random sleep and rest and activity patterns throughout the day," said Mark Rea, director of the Lighting Research Center at [Rensselaer Polytechnic Institute](#) in Troy, N.Y. When Rea and colleagues gave Alzheimer's patients daily doses of blue light at about the intensity of a standard fluorescent bulb, the patients' ability to sleep through the night was significantly enhanced.

Blue light also looks promising for its ability to induce alertness, said Mariana Figueiro, a program director at the Rensselaer research center. She is testing the light on submariners, who have trouble remaining vigilant because their biological clocks don't get cued to dawn and dusk.

Of course, the fact that artificial lighting can reset people's clocks and boost alertness at night speaks to its potential to throw normal rhythms into disarray. As though it were not bad enough that lighting is a 24-7 feature of modern life, said Avery of the University of Washington, people spend evenings staring at their "[Microsoft](#) blue" computer monitors, then wonder why they can't fall asleep.

"We've deseasonalized ourselves," said Thomas Wehr, a psychiatrist at the [National Institute of Mental Health](#) in [Bethesda](#). "We are living in an experiment that is finding out what happens if you expose humans to constant summer day lengths."

The perfect solution, as any camper knows, is to give up artificial light, an approach that quickly brings one into a cycle of long, restful nights and easy awakenings at dawn. More realistically, experts recommend avoiding bright lights after dusk and perhaps wearing yellow sunglasses at brightly lit evening events to filter out the blue light that might fool your ganglia into thinking it is morning.

For those working at night, "the idea might be to have a work environment where at the beginning of the shift the lighting is heavier in blues that suppress melatonin, then gradually it changes and becomes redder and redder," a hue that does not stimulate the eye's ganglion cells, said Richard Stevens, an epidemiologist at the University of Connecticut Health Center in [Farmington](#).

Stevens knows how important night-shift lighting can be. It was his focus on the issue that helped

reveal that women who work night shifts for 20 to 30 years have breast cancer rates 30 to 80 percent higher than their day-shift counterparts. The mechanism is still not fully explained, but studies have since shown that melatonin -- whose secretion is suppressed by nighttime illumination -- is a potent anticancer hormone.

Consistent with that, profoundly blind women also have very low rates of breast cancer, presumably because their melatonin levels are never suppressed by light.

A panel of experts convened this month by the International Agency for Research on Cancer, part of the World Health Organization, reviewed studies on animals that were kept awake at night or subjected to repeated six-hour jet lags, and several large human studies of nurses and airline flight attendants. It concluded there is strong evidence that shift work can cause cancer.

The agency's pending declaration that shift work is a probable carcinogen may not have immediate impacts, said Vincent Coglianò, who leads the IARC Monographs program. "But our findings are looked at by government agencies and scientific researchers and could stimulate additional studies."

It may also send workplace lighting officials into a quandary.

"Should we use bluish lights in night-shift work to get the alertness, or avoid it for its potential to cause cancer?" asked John Bullough of the Rensselaer center, whose research has focused on the conflicting lighting needs of hospitalized infants, who seem bothered by bright lights, and their nurses, who need good lighting to see what they're doing.

The timing, color and intensity of light are not the only variables that affect people's health. Several studies have found that the subtle flicker common in fluorescent bulbs, especially older, low-frequency bulbs with magnetic ballasts, can have detrimental effects, even though that flicker is just below most people's threshold of conscious perception.

Stories that the flicker can trigger seizures are more legend than fact, said Arnold Wilkins, director of the Visual Perception Unit at the University of Essex in [England](#). But fluorescent flicker can interfere with eye muscle control while scanning text or images, he said, and can cause eyestrain and headaches.

Flicker is not a problem with the new compact fluorescents, though some are painfully heavy on glare. The real revolution in lighting, many experts agree, is in the form of light-emitting diodes, or LEDs, which can be tuned to any color. As they become more affordable, many say, light will become a bona fide tool for manipulating health and mood.

Until then, people struggling to get through the winter will for the most part be best off sinking obligingly into the long, gray flannel night and avoiding the midnight lighting they think they crave.

Darkness doesn't have to be about depression and loneliness, said Dave Crawford, executive director of the International Dark-Sky Association, a [Tucson](#)-based nonprofit group that advocates against unnecessary illumination.

It can be about stars, about contemplation, about quiet conversation with a friend.

"If we sprayed water all over the place here in the desert, we'd be put in jail. So why is it okay to spray light all over the place at night?" asked Crawford, adding that more than half of all mammals spend most of their waking hours at night or twilight, "including teenagers."

Light is fine -- in the day -- Crawford said. "We're trying to bring to everyone's attention that there is a night."

For the next few months, that is going to be hard to forget. Â¿