

Tunable White LED Lighting Improves Human Health and Well-Being

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Day or night, young or old, awake or asleep, health and wellness can be helped – or hurt – by exposure to lighting.

The influence of lighting is so pervasive – and so powerful – that developing and delivering healthy lighting has become the shared mission of professionals from lighting design, engineering, architecture, medicine, science, and technology.

To realize the benefits of human-centric lighting, modern medical facilities increasingly utilize lighting technology called color tuning, which is the ability to adjust color hues and the intensity of light emitted by LEDs. Dimming and color tuning can provide significant psychological and biological benefits and can also influence behavior, researchers report.

According to the U.S. Department of Energy, color-tunable LED luminaires are still in the nascent stage but they comprise a growing product category. “These luminaires offer...potential benefits including improved health and well-being, increased productivity, enhanced mood or alertness, and higher occupant satisfaction,” the Department said in a report on its website.

Modern-day lifestyles and workplaces – with minimal exposure to sunlight – can disrupt circadian rhythms that influence physical, mental and behavioral health. Such disruptions can scramble an individual’s so-called



biological clock and may trigger negative health issues.

“Circadian rhythms can influence sleep-wake cycles, hormone

release, eating habits and digestion, body temperature, and other important bodily functions,” according to the National Institute of General Medical Sciences. “Irregular rhythms have been linked to various chronic health conditions, such as sleep disorders, obesity, diabetes, depression, bipolar disorders and seasonal affective disorders.”

Lighting as a Remedy

Modern, tunable LED lighting technology is being deployed in hospitals and healthcare settings to enhance the patient and work environment. From California’s sunny summers to Copenhagen’s sun-starved winters, researchers have reported findings that reinforce the use of tunable lighting in health care facilities.

In Sacramento, a joint study by the U.S. Department of Energy and a local public utility examined the impact of color temperatures on melatonin levels of patients in a senior-care facility. Melatonin, a naturally occurring hormone, helps regulate sleep. Melatonin levels fall during the day, increasing alertness. Increased levels at night help support sleep.

In describing the Sacramento study, *Electrical Contractors Magazine* reported that researchers – following guidelines set by the Lighting Center of Rensselaer Polytechnic University in New York – tuned LED lights in the senior center to suppress melatonin production from morning to midday. In the evening, they tuned lighting to prompt a rise in melatonin levels through the installation of

amber LED rope lights under beds, recessed amber LED night lights and motion-sensor lights in bathroom handrails.

Researchers said the new nighttime lighting scheme made it easier for residents to navigate the room at night without overhead lighting that emitted wavelengths that make it difficult to go back to sleep.

Among the results: A decrease in agitated behaviors such as yelling and crying, a significant reduction in the need for psychotropic and sleep medications, and a reduction in the number of recorded patient falls.

In Denmark, according to *LEDs Magazine*, medical staffers at Aarhus University Hospital used a circadian lighting system to modulate light frequencies and levels to provide patients “gradually brighter and more blue-enriched light from the morning into the afternoon.” Later in the day, the intensity was dropped to mimic natural sunlight patterns. At night, monitored darkness helped patients maintain sleep and keep their biological clock in balance, *LEDs Magazine* reported.

Furthermore, hospital professionals said patients displayed greater cooperation and less agitation.

“I think we are giving them a better circadian rhythm,” Research Nurse Lone Moeslund told *LEDs magazine*. “If they get a better sleep ... we think they recover faster.”

Separately, a study of a German facility by the Lighting Research Center of Rensselaer

Results of Tunable LED Lighting that Influence Melatonin Production in Senior Centers



Polytechnic University said such “tailored lighting” was shown to help Alzheimer’s patients.

“Recent research has shown that poor sleep may directly impact the onset and progression of Alzheimer’s disease, and conversely, healthy sleep may prevent or slow progression of the disease,” RPI said. Since the number of persons with dementia is expected to more than double by 2050, according to Alzheimer’s Association, providing health-promoting tunable LED lighting for this patient population is therapeutically significant.

Putting Health in the Right Light

The Kirlin Company, a global leader in healthcare lighting, embraced and advanced the concept of human-centric lighting in developing a line of tunable lighting products for use throughout the medical community.

“Our experience and our commitment to innovation are at the heart of our health-focused work with color tuning,” said Jana Brownell, Kirlin’s President. “We understand the role of lighting in the rhythms of life and health – to not only see better, but to also feel better.”

Working with forward thinkers across the medical industry, Kirlin’s team created a lineup of tunable LED luminaires and controls for a range of healthcare applications. Kirlin’s

tunable products are offered for senior living facilities, cancer treatment centers, ICU, behavioral health facilities, patient rooms, ambulatory care facilities, birthing suites, critical care units, neonatal intensive care units, post-acute care units and recovery rooms.

For example,

Kirlin developed a medical LED chart light: a small red-amber rectangular light mounted in the headwall that directs melatonin-supporting illumination to the floor alongside the bed. The light provides enough illumination for a healthcare practitioner to care for the patient without turning on overhead lights that disturb the patient during the night. That, in turn, helps patients rest and sleep, enabling them to heal faster, feel better – and rate their hospital experiences more favorably.

Getting Tuned Up for Improved Health

Worldwide, lighting and medical experts are combining efforts to design tunable lighting into new and renovated medical facilities.

The advent of light-emitting diodes (LEDs) – a semiconductor light source that emits light when current flows through it – has provided greater control over the color of light distribution. Tuning those colors, it has been found, can promote alertness, increase appetite and cognitive function

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– RPI





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All Kirlin products are designed and manufactured in Detroit, Michigan, USA

and assist in regulating circadian rhythms that support wellness.

LEDs make it easier to control light wavelengths to support healthy outcomes, said Mariana Figueiro, of RPI's Lighting Research Center.

"The LED allows us to be a little bit more precise than incandescent because you can tune the spectrum," she said. "You can change the spectrum over the course of the day."

Innovation and technical know-how at Kirlin is providing the medical community with the products to manage such changes. By any measure, those products come at the right time in the evolution of medical lighting.

Writing in LEDs magazine, contributing editor Mark Halper observed: "Call it what you will – human-centric lighting, circadian lighting, lighting for biology, or choose your own catchphrase. But whatever you call it, there's no escaping that properly tuned lighting can foster desirable conditions in human beings."

Dr. Figueiro and other leading researchers emphasize that the potential for lighting

technology is far from fully realized and advanced scientific

study continues to identify ways to meet the expanding needs of the health care sector.

In a trial published by the National Center for Biotechnology Information, programmed illumination – light therapy – was shown to reduce levels of depression among cancer patients undergoing stem cell procedures.

"The present findings demonstrate that an easy-to-deliver, low-cost intervention alleviates depression during hospitalization for autologous stem cell transplantation," according to the report. "The light intervention may have application across a wide range of clinical settings and patient populations."

Dr. Figueiro, in a blog for a TEDMED talk to recognize the United Nations-sponsored International Year of Light, noted that light has "revolutionized medicine."

The potential for cycled lighting, she said, offers "general health benefits, such as improved mood and reduced risk of diabetes, obesity, cardiovascular disease and cancer."

In closing, she told the TEDMED audience: "Today, many people think of light as just a part of a building. In the future, we believe light will become more personalized (and) customizable and tailored to the needs of the individual."

To integrate color tuning into your lighting plan, contact Kirlin's John Moline for a free consultation. He can be reached at (313) 259-6400, ext. 370 or jmoline@kirlinlighting.com.

Also, please see www.kirlinlighting.com.

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