Looking Into Light

Rensselaer's Lighting Research Center is the leading university-based research center devoted to the study of lighting technologies, applications, and products.

By Sheila Nason

Test subject under blue LEDs at the Lighting Research Center.

Subjects are bathed in blue LED light.

Exposure to blue light can improve the sleep cycles of Alzheimer's patients, reports Rensselaer's Lighting Research Center (LRC). In a recent publication, Mariana Figueiro, PhD., who heads the LRC's light and health program, described for the first time one of the mechanisms within the eye that affects the human circadian system.

Rhythms in our body that repeat at approximately every 24 hours are called circadian rhythms. The most prominent of these rhythms is the sleep/wake cycle. Circadian rhythms are synchronized to the solar day by light/dark cycles. Figueiro says exposure to blue light is much better at improving the sleep cycles of Alzheimer's patients through the circadian system than exposure to other colors and even to much brighter white light.

"Within the mechanism that affects the circadian system are two color opponent channels. One of those is the blue vs. yellow (BY) channel, which seems to participate in converting light into neural signals to the part of the brain that generates and regulates circadian rhythms," explained Figueiro. "Through the BY channel, blue light increases the circadian response, while yellow light decreases the response."

Findings such of these, which define the qualities of light that produce the most benefits in specific applications, provide useful guidance for the "smart-lighting" researchers in Rensselaer's Future Chips Constellation as they develop improved methods to control such factors as color (spectrum), emission patterns, and intensity.

Rensselaer's smart-lighting research concentrates on compound semiconductor materials and device design, the inside of devices such as LEDs (light-emitting diodes).

The LRC is the world's leading university-based research center devoted to lighting. Its researchers explore the science and applications of lighting systems and the metrics for assessing them, so they focus on the outside of LEDs. The synergy between the two research groups offers an exciting opportunity to understand lighting from the basic level of the photon to the design of entire lighting systems.

Nadarajah Narendran, PhD., is the LRC's director of research. "The white light LED has been developing much more rapidly than any other light source in the past," said Narendran, who heads the LRC's Solid-State Lighting program. "LEDs are energy efficient and require little maintenance, and they can provide unique lighting solutions not possible with presently available light sources." Narendran recently served as the chairman and keynote speaker of LED Expo 2004, an international annual conference devoted to LED technology.

"The LRC is widely recognized for its studies on the life expectancy of LEDs," says Mark Rea, PhD., director of the LRC. "We not only test various LEDs under controlled conditions to determine how long they will operate before their light begins to dim, we also analyze the basic physics to make it possible to predict life expectancy."

The LRC collaborates with industry, businesses, and utilities to identify lighting applications that can benefit from LED technology. Through field studies, the LRC develops, tests, and demonstrates LED-based, energy-efficient lighting alternatives for everything from retail displays to elevators to aircraft. LRC researchers recently completed a retail lighting project with the Los Angeles Department of Water and Power and the Gap retail chain to demonstrate up to 50 percent energy savings by lighting window displays with colored LEDs. The LRC has also worked with Boeing to evaluate new LED-based passenger reading lights for commercial aircraft.

In other health-related research, the LRC has examined the effects of lighting on premature infants and lighting changes that could help prevent dangerous falls by older adults.