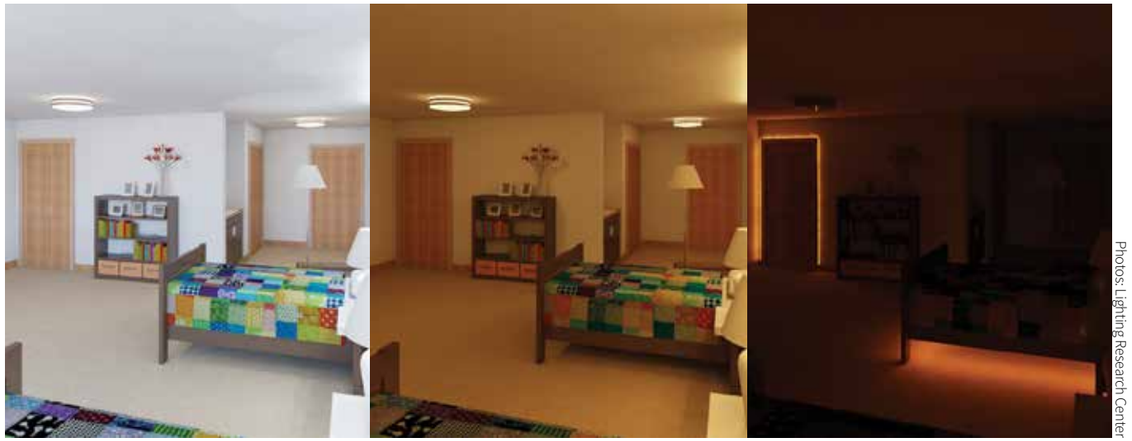

Photos: Lighting Research Center

An LRC website assists in luminaire selection and placement.

3

LIGHTING PATTERNS FOR HEALTHY BUILDINGS

Robust daily patterns of light and dark synchronize the human circadian clock to local sunrise and sunset. Disruption of this 24-hour rhythm of light and dark affects every one of our biological systems, from DNA repair in single cells to melatonin production by the pineal gland to our sleep quality. Circadian disruption is most obviously linked with disruption of the sleep-wake cycle—feeling sleepy during the day and experiencing sleep problems such as insomnia at night—but is also linked with increased risk for diabetes, obesity, cardiovascular disease and cancer. Beyond the many health benefits of circadian entrainment, light also has an acute alerting effect, like a cup of coffee. The constant, unvarying dim light found in many homes, offices, hospitals and schools means that humans in modern society are not experiencing the robust light-dark patterns necessary for circadian entrainment and optimal daytime alertness.

A team of researchers at the LRC comprised of Kassandra Gonzales, Russ Leslie and Mariana Figueiro have created a portfolio of lighting patterns, available via interactive website, to help lighting professionals select and place luminaires that will support circadian health and well-being, along with vision and orientation needs. The patterns are based upon the 24-hour lighting scheme proposed by Figueiro, which recommends high circadian stimulation during the daytime, low circadian stimulation in the evening, good lighting for visibility, and night-lights with horizontal and vertical cues to improve postural stability.

Applying the results of the LRC's circadian stimulus (CS) research, the new website—"Lighting Patterns for Healthy Buildings"—allows users to view lighting patterns showing the base case and new lighting design analyzed for CS. Each pattern presents lighting plans, renderings and generic luminaire information useful for providing healthy lighting throughout the 24-hour day. The project team chose two target populations that can benefit most immediately from healthy lighting: older adults in long-term care facilities and children in schools, but the basic principles are applicable to the general population.

The project was sponsored by the Light & Health Alliance: Acuity Brands, Cree, GE Lighting, Ketra, OSRAM Sylvania, Philips Lighting and USAI Lighting.

For more information, *visit http://lightingpatternsforhealthybuildings.org*.

Photos: Lighting Research Center

High CS values for daytime (left) and low CS values at night will comprise a 24-hour electric lighting cycle.

4

CYPRESS COVE

Sleep problems are all too common among older adults, especially those in long-term care facilities, and may contribute to depression, weight gain and, according to recent research, the onset and progression of Alzheimer's disease. Conversely, healthy, high-quality sleep improves overall health and well-being.

LRC Light & Health Program Director Mariana Figueiro began conducting research on her first R01 grant from the National Institute on Aging in 2010 and soon discovered that a tailored light treatment consisting of a robust light-dark pattern that changes in color and intensity over 24 hours can improve nighttime sleep and behavior in older adults with dementia. However, at that time, lighting technologies that would allow for widespread implementation of her research findings were not yet available.

Fast forward to 2015, when Figueiro was asked for a lighting recommendation for the new Cypress Cove memory care facility in Fort Myers, FL. The LRC project team was working on a lighting design for the facility using circadian stimulus (CS), a new metric developed by LRC researchers, to design and specify the lighting. LED technology and controls had vastly improved since Figueiro's initial research, and the LRC project team scoured the market for manufacturers of suitable products that could effectively meet the CS recommendations.

Today, thanks to major advances in lighting and control technologies, residents of Cypress Cove will soon enjoy the benefits of lighting designed to entrain the circadian clock. Currently under construction, the new facility will house 24-hour cycled electric lighting that will provide high CS values for daytime activities and low CS values for evening hours—the first real-world implementation of a lighting scheme based upon Figueiro's research. USAI Lighting's Color Select wall washers and recessed downlights will be used to control quality, color and quantity of the light in common area spaces. Additionally, Ketra's G2 high-output linear accent luminaires and N3 satellites will be used to control the lighting and enable the dynamic circadian content, while Ketra's X1 touchpads will provide an elegant interface between the lighting system and its users.

The lighting principles and technologies utilized at Cypress Cove can potentially be transferred to benefit other populations: newborns in the NICU, students in schools, office workers, and eventually, the general public in their own homes.

For more information about LRC Light & Health research, visit *www.lrc.rpi.edu/programs/lightHealth/index.asp.*