First of Its Kind Smart Lighting Testbed Installed in Hospital Inpatient Setting

Smart Lighting Engineering Research Center System Installed at University of New Mexico Health Sciences Center

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By Jessica Otitigbe

Troy, N.Y. — In an effort to study the effects of lighting on human health and diseases, the Smart Lighting Engineering Research Center (ERC) at Rensselaer Polytechnic Institute (RPI) recently installed a novel hospital inpatient lighting test bed for the study of automated lighting at the University of New Mexico Health Center (UNMHC) in Albuquerque, New Mexico. The test bed is a demonstration of the success of the multi-institutional, interdisciplinary Engineering Research Center Program funded by the National Science Foundation.

The smart-lighting equipped hospital room will enable, for the first time ever, side-by-side controlled studies about how LED lighting impacts human health. Researchers at UNM will utilize this facility to conduct studies regarding the treatment of circadian rhythm disorders and health conditions such as depression, Parkinson's disease, and other neurological diseases that have previously been shown to respond to light exposure of the correct spectrum, intensity, and timing.

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Photo Credit: University of New Mexico Health Center

A view of a patient hospital room prior to the testbed installation at the University of New Mexico Health Center (UNMHC) in Albuquerque.

"At the ERC, we are building smart lighting systems that automatically adjust the right lighting for us at any given time, with light coming from the right direction, with the right color and intensity, optimized for human health and productivity," said ERC Director Robert Karlicek.

According to the ERC, what makes this lighting test bed so unique is the combination and integration of sensors and lighting controls. Not only can the lights be programmed to provide different spectral content and intensity, the sensors also constantly monitor the light in the room and provide feedback for maintaining and controlling the light. In addition, once the lighting is set to the preferred specifications, the lights will automatically adjust to maintain a balance of the desired lighting spectrum and intensity over the course of the day. For example, if it is cloudy, or if the blinds are raised or lowered, the lighting in the room remains constant.

The computer-controlled lighting system was designed using optimized products from ERC industry members Telelumen, Heptagon,

and Austria Microsystems. The system can mimic the diurnal and seasonal variations of natural outdoor light, or can provide light with qualities specially customized to treat sleep-wake disorders and medical problems such as depression.

"Not only will this new technology allow us to study classic circadian rhythm sleep-wake disorders, but now we will be able to also investigate the effect light plays on such behavioral health disorders as depression and dementia," said Lee Brown, M.D., professor of internal medicine and director of the UNM-HSC Sleep Disorders Program.

"The sensors in the test bed can also be used to determine occupancy in the room," said Steven R.J. Brueck, Ph.D., *UNM Distinguished Professor Emeritus of Electrical and Computer Engineering, UNM Lead for the Smart Lighting Engineering Research Center, and emeritus director of the Center for High Technology Materials. "*The system also can collect feedback on variables ranging from the number and position of room occupants to the test subject's sleep/wake patterns, and even alert a nurses' station if a patient falls – all without the need for cameras with their associated privacy issues."

The smart-lighting equipped hospital room will enable, for the first time ever, side-by-side controlled studies about how LED lighting impacts human health. Pictured above, members of the University of New Mexico research team that will conduct the study.. From L to R: Lee Brown, MD, Meeko Oishi, PhD, Steve Brueck, PhD

"The first research study involving the specially equipped room will investigate whether individuals with delayed sleep-wake phase disorder ('night owls'), a condition common to college students, can be treated by varying the spectrum of light they are exposed to throughout the day," Brown added. "Other potential research areas range from hospital-induced conditions such as post-operative delirium and ICU psychosis, to the effects of light on the sleep patterns of patients receiving chemotherapy or those suffering from depression."

"In the future, everyone may have access to this technology," said Brown. "Knowing more about the effects of lighting may actually help physicians to prevent disease and increase productivity in healthy persons."

According to the Smart Lighting Engineering Research Center, the hospital room will have the same abilities to tune the light spectra - both within the same color as well as for different colors.

"This new ability to dynamically control the color properties of lighting is being studied in health care, education, and workplace settings to improve well-being and productivity, but there is still a lot to learn," Karlicek added.

The Smart Lighting Engineering Research Center work exemplifies The New Polytechnic, a new paradigm for teaching, learning, and research at Rensselaer, the foundation of which is the recognition that global challenges and opportunities are so great that they cannot be addressed by the most talented person working alone, nor even by a single discipline, sector, or nation. The New Polytechnic enables collaborations and dialogue between talented people across disciplines, sectors, and global regions, in order to address the complex problems in the world.

About the Smart Lighting ERC
Funded primarily by the National Science Foundation, the ERC is an interdisciplinary, multi-university center developing *"Smart Lighting Systems that See and Think™."* The ERC is developing lighting systems that do everything from automatically maximizing light quality and minimizing energy use by sensing occupant needs, to lights that carry data, complementing and enlarging the Wi-Fi network with Li-Fi (or visible light communications), and controlling LED lighting to enhance plant growth for farming and "pharming" applications.

The ERC engages faculty members, staff, and students to work on research leading to smart lighting systems with adaptive and controllable properties. It joins academia, industry, and government in partnership to produce transformational engineered systems, along with engineering graduates who are adept at innovation and primed for leadership in the global economy. The Smart Lighting ERC is headquartered at Rensselaer Polytechnic Institute in Troy, N.Y., and partners with Boston University, Thomas Jefferson University, and the University of New Mexico to achieve its objectives. Visit the ERC website at: http://smartlighting.rpi.edu/.

About Rensselaer Polytechnic Institute
Rensselaer Polytechnic Institute, founded in 1824, is the nation's oldest technological university. The university offers bachelors, masters, and doctoral degrees in engineering, the sciences, information technology, architecture, management, and the humanities and social sciences. Institute programs serve undergraduates, graduate students, and working professionals around the world. Rensselaer faculty are known for pre-eminence in research conducted in a wide range of fields, with particular emphasis in biotechnology, nanotechnology, information technology, and the media arts and technology. The Institute is well known for its success in the transfer of technology from the laboratory to the marketplace so that new discoveries and inventions benefit human life, protect the environment, and strengthen economic development.

UNM Health Sciences Center Program in Sleep Medicine
The University of New Mexico Health Sciences Center Program in Sleep Medicine is headquartered in the University Hospital Sleep Disorders Center and the School of Medicine's Department of Internal Medicine, Division of Pulmonary, Critical Care, and Sleep Medicine. The program combines state-of-the-art outpatient sleep laboratories at University Hospital and Sandoval Regional Medical Center, an inpatient sleep laboratory, sleep medicine clinics, and trained medical and technical staff dedicated to the diagnosis and treatment of sleep/wake disorders in adults and children.

UNM Health Sciences Center
Research investigators at the University of New Mexico Health Sciences Center are committed to the mission of conducting basic and clinical research that will significantly impact the health of communities in New Mexico, as well as making significant contributions in healthcare worldwide.

UNM Center for High Technology Materials (CHTM)
CHTM was one of five Centers of Technical Excellence established by the state of New Mexico in 1983. It is internationally recognized as an outstanding research center in photonics and microelectronics.

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