

**Light-Dark Cycle in the Built Environment
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This study examines how the quantity of light within an interior built space varies due to architectural conditions such as size of floor plate(s), number and configuration of exterior wall penetrations, solar orientation, type of electrical light fixtures, and reflectivity of vertical & horizontal surfaces. There is a growing body of evidence that insufficient light levels during the day and excessive light levels at night can adversely affect human health and well-being. Two historic landmark residences in southern California were selected as subjects for recording light levels using sensor watches.

1. EXTENDED ABSTRACT

Over thousands of years of evolution, homo sapiens and other organisms developed circadian clocks to anticipate daily changes in the environment and appropriately time biological processes to coincide with a day-night cycle. During this period, human beings spent the majority of their hours outside and only retired to some form of shelter at nightfall. Today we spend more than 87% of our time indoor (REF), most of which is experienced under artificial light; a shift in life style that began in the early 20th century. We now know that over-illumination has been linked to the occurrence of headaches, fatigue, medically defined stress, anxiety and decreases in sexual function.(1) That sleep deprivation may decrease performance & alertness and cause memory & cognitive impairment. (2) Moreover, that being exposed to less than 500 lux per day may trigger the risk of breast and prostate cancers, obesity (based on a desire to consume carbohydrates) and early-onset diabetes.(3,4)

The greater Los Angeles area is appreciated for its 'mediterranean' climate, and with an average 285 sunny days per year, designers have attempted to create architectural settings that take advantage of this factor. However, it was hypothesized that different design styles would translate into different exposures of indoor light. This study compared two National Historic Landmarks: The Gamble House, completed in 1908 and the Bailey House (Case Study House No. 21) completed in 1958. Designed by Greene & Greene, The Gamble House is 8,100 square feet, two stories and considered an example of American craftsman-bungalow made of wood and shingles. By contrast, the Bailey House is 1,320 square feet, one story, flat roofed and made of pre-fabricated steel and glass. To longitudinally monitor luminance, NIST-calibrated and FDA cleared light sensor devices manufactured by CamTech were placed in the Living Room, Kitchen and Master Bedroom of each residence for two continuous weeks. In the case of The Gamble House, only the living room registered above 100 lux for a period of two hours. The Bailey House, on the other hand, recorded lux levels of 1000 lux or more in every room for the majority of the day time period.

The study showed that in spite of 'ideal' climate conditions, the daily pattern of light indoors will vary depending upon the topology of a structure. Future measurements of this kind are appropriate for other geographic regions.

2. REFERENCES

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3. AUTHOR BIOS

Satchidananda Panda, Ph.D., is an Advisory Council member of ANFA. He earned his Ph.D. from The Scripps Research Institute, La Jolla, CA. His research focuses on the mechanism of circadian transcription in mammals and the interaction among clock, ambient light and nutrition in diurnal rhythms. Dr. Panda is an associate professor at the Salk Institute for Biological Studies and an adjunct associate professor at the University of California at San Diego. He has been a co-author of over sixty publications & manuscripts and is known internationally for discovering the role of a novel photopigment melanopsin in synchronizing the mammalian clock with the ambient light environment.

Frederick Marks, AIA, LEED AP BD+C, Six Sigma Green Belt, is a founding Board member and the current CFO of ANFA. He holds degrees in architecture and urban land economics, and was a scholarship student at the Richard T. Parker Center for Advanced Study & Research in Colorado Springs. Mr. Marks is a former assistant director for Knowledge Communities at The American Institute of Architects and a former director of Science & Technology for AC Martin Partners in Los Angeles. He currently runs a private consulting firm and is a visiting scholar & research collaborator at the Salk Institute for Biological Studies.