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Topic: Performance / Psychology / Psychophysiology

Title: Spectral sensitivity of the human circadian timing system

Text: In humans, the photoreceptor system that mediates circadian responses to light is hypothesized to be distinct from that used for color vision (λmax = 555 nm). To test this, we examined the dose-response relationship of circadian phase shifting and melatonin suppression in response to short wavelength light (blue, 460 nm) as compared to mid-wavelength light (green, 555 nm) across photon densities from 0 - 1.5 x 1014 photons/cm2/s. Healthy volunteers (18-30 yrs; n = 46) participated in a 9-day laboratory study in which monochromatic light was administered for 6.5 hrs during the early biological night. Circadian phase was assessed by a constant routine procedure before and after the experimental light session. Both circadian phase resetting and melatonin suppression exhibited a dose-response dependent on photon density and wavelength. A wavelength-dependent shift in the sensitivity of the dose-response curves showed that 460 nm light was at least twice as effective as 555 nm light for circadian phase resetting and melatonin suppression (range, ~1.0-3.0 x 1013 photons/cm2/s). The short wavelength-sensitivity of human circadian responses to light is consistent with a role for the blue light-sensitive photopigment melanopsin in circadian phototransduction. These findings have important implications for light therapy-based treatments for sleep and circadian rhythm disorders associated with shiftwork, insomnia, and jet-lag. Support: NCCAM (AT002129, SWL); RO1NS36590 (GCB); NSBRI through NASA NCC 9-58 (SWL, CAC, GCB); NIMH (MH045130, CAC); NIH/NHLBI (T32 HL07901, CAC).

Learning Objectives:

Order	Learning Objectives
1	The effects of light in human physiology, sleep and performance will be discussed

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