

# Mechanisms Associated with the Acute Alerting Effects of Light

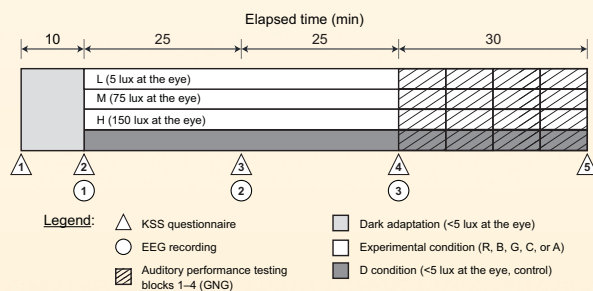
Studies suggest that light can affect brain functions via pathways other than melatonin suppression, and that light promotes alertness without disrupting the melatonin cycle. This study represents the first step in our research to determine the spectral and absolute sensitivities of light-induced acute alertness.



Diffused light was delivered through the front opening (8 in. diameter) of a custom-built sphere (16 in. diameter) fitted with high-power LEDs.

## Methods

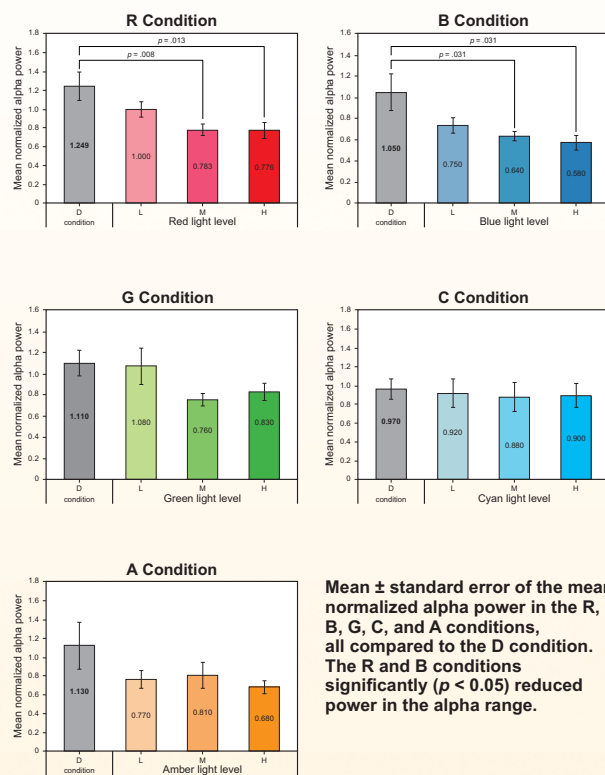
Sixty-three participants (36 females, 27 males, mean  $\pm$  SD age of 23.7 years  $\pm$  8.6) completed this 4-week nighttime laboratory study. They were exposed to either red (R) ( $\lambda_{max}$  = 637 nm), blue (B) ( $\lambda_{max}$  = 450 nm), green (G) ( $\lambda_{max}$  = 523 nm), cyan (C) ( $\lambda_{max}$  = 499 nm), or amber (A) ( $\lambda_{max}$  = 593 nm) spectra at low (L) (5 lux), medium (M) (75 lux), and high (H) (150 lux) light levels as measured at the eye. Participants also experienced a control session in which they were kept in dim (D) (<5 lux at the eye) polychromatic white light (2700 K) while wearing orange-tinted glasses. Three electroencephalographic (EEG) recordings were taken for each participant before they underwent GO/NOGO auditory performance testing (results not shown).



The study protocol, showing the schedule for the experimental conditions, auditory performance testing periods (4 per session), administration of Karolinska Sleepiness Scale (KSS) questionnaires, and EEG recordings.

## Preliminary Results

- Red and blue light were confirmed as promoting alertness, with red light being especially valuable for avoiding circadian disruption among shift workers who work through the night
- Spectra other than red and blue also appear to promote nighttime alertness, but the alerting effect of those spectra is not as strong



## Next Steps

- Finalize analyses of the KSS questionnaire and GO/NOGO auditory performance testing data
- Test the blue and red lighting conditions in a functional magnetic resonance imaging machine
- Develop a spectral sensitivity function for alertness

## Sponsor

Office of Naval Research