The Facts about Blue Light Effectiveness and Safety

The discovery that low intensity blue light (470 nm) is superior to white light at regulating melatonin and circadian rhythms has caused a firestorm of interest and debate. Unfortunately, much of the information on the internet is either false or misleading. The following evidence clearly substantiates the effectiveness and safety of BLUEWAVE® Technology:

Fact: **Blue is 2 X more effective:** Blue light alone is twice as effective as 10,000 lux at suppressing melatonin and twice as effective at shifting circadian rhythms.[1] [2]

Fact: The circadian response (SAD, sleep depression, etc.) is through **melanopsin photoreceptors** in the eye, and melanopsin responds to 470 nm light, not white light.[3] [4] [5] [6]

Fact: **All white light devices** produce blue light, which is why they work. [7] [8]

Fact: BLUEWAVE® isolates only the effective portion of blue light already present in 10,000 lux[9]

Fact: **All 10,000 lux light boxes** produce at least 50% more blue than is necessary, and most produce 3 – 5 times the necessary amount of blue light.[10]

Fact: **All 10,000 lux light boxes** produce significant peaks of near UV light (405 nm and/or 430 nm). Some lightboxes also produce significant amounts of UV light[11]

Fact: Noonday sunlight produces over 20 times more blue light than BLUEWAVE® Overcast outdoor light produces approximately 6 times more blue light. Fully shaded outdoor light produces approximately 3 times more blue[12]

Fact: 10,000 lux light is up to 50 times more intense than BLUEWAVE®. Low-intensity BLUEWAVE® causes fewer side effects.[13] [14] [15] [16]

Fact: Only Apollo's BLUEWAVE® produces the necessary bandwidth and intensity of light recommended by research. BLUEWAVE® produces no near-UV light.[17]

Fact: No other light therapy technology has been subjected to or passes such stringent ocular safety hazard testing[18]

Fact: BLUEWAVE is safer than all other lightboxes or white light devices. [19]

Why is BLUEWAVE So Important?

- Blue light alone, and at lower intensities is more effective than white light and white LED light, even when these light sources produce more of the effective wavelength of blue[20]

- Blue light alone is 2 x more effective at suppressing melatonin and 2 x more effective at regulating circadian rhythms (Melatonin and circadian rhythms are the major factors in disorders like SAD and insomnia). [21]

- Science has proven that this response is activated by the melanopsin photoreceptors in the eye.[22]

- Melanopsin photoreceptors only respond to blue (~470 nm) light [23] [24]

- The necessary amount of blue light is 1/50th as bright as 10,000 lux[25]

- BLUEWAVE has few or no side effects compared to 10,000 lux light.

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[1] S. Lockley et al. High Sensitivity Of The Human Circadian Melatonin Rhythm To Resetting By Short Wavelength Light. The Journal of Clinical Endocrinology & Metabolism 88(9):4502–4505

[2] H. Wright et al. Light emitting diodes can be used to phase delay the melatonin rhythm
J. Pineal Res. 2001; 31:350–355

[3] Panda S et al. Illumination of the Melanopsin Signaling Pathway. SCIENCE 2005; 28 January (307) 600-4

[4] Dacey DM et al. Melanopsin-expressing ganglion cells in primate retina signal colour and irradiance and project to the LGN. NATURE 2005; 433: 749-754

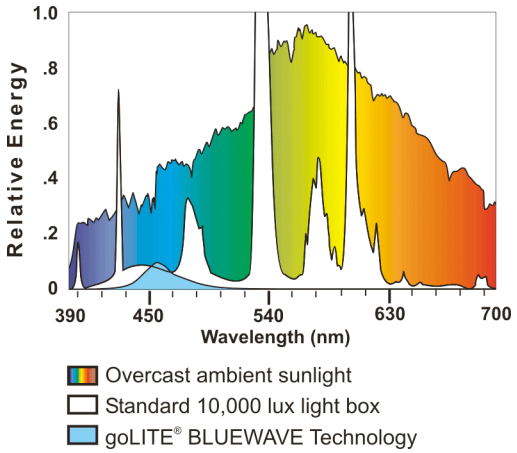
[5] Qiu X et al. Induction of photosensitivity by heterologous expression of melanopsin. NATURE 2005; 433: 745-749

[6] Melyan Z et al. Addition of human melanopsin renders mammalian cells photoresponsive. NATURE 2005; 433: 742-745

[7] Wright H R et al. Differential effects of light wavelength in phase advancing the melatonin rhythm. J. Pineal Res. 2004; 36: 140-144

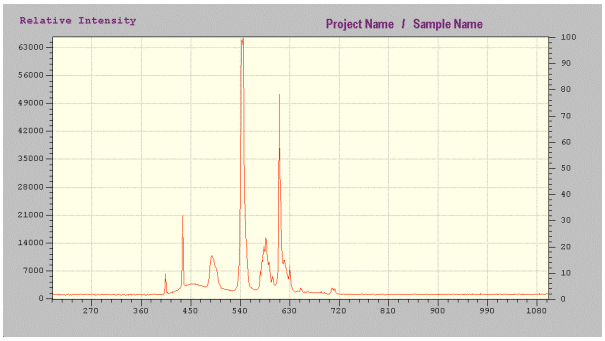
[8] Kayumov L et al. Blocking low-wavelength light prevents nocturnal melatonin suppression with no adverse effect on performance during simulated shift work. J Clin Endocrinol Metab 2005 May; 90(5):2755-61

[9] Spectral power distribution comparison of sunlight, 10,000 lux and BLUEWAVE® shows that BLUEWAVE® only isolates the effective blue present in 10,000 lux and sunlight. By contrast, the total amount of blue (400-500 nm) in this 10,000 lux light box is over three times that of the goLITE®



[10] Ibid

[11] 10,000 lux, fluorescent spectral distribution: All 10,000 lux light boxes use tri-phosphor fluorescent lamps which produce spikes at @ 405 and @430 nm, substantially more energy than found in overcast ambient sunlight. (Source: International Light Meter RPS 900 11/05/2005)



[12] Energy readings for blue light (400-500 nm):

Noonday sunlight	5.68 mW/cm^2/sec
Ambient overcast sunlight	1.69 mW/cm^2/sec
10,000 lux light box	.822 mW/cm^2/sec
BLUEWAVE®	.271 mW/cm^2/sec

Source: International Light IL1700, SED033 input optic with SCS395 sharp cut filter and TBLU calibrated to 400-500 nm. Noonday sunlight measurements taken 11/23/05. Overcast measurements taken 11/05/2005. Results averaged highest and lowest horizontal measurements. Measurements taken at 40° 21′29.6″ N, 111°47′04.5″ W. Elevation = 4533 feet

[13] As measured in lux, the goLITE's BLUEWAVE® = @200 lux

[14] G. Brainard, Action Spectrum for Melatonin Regulation in Humans: Evidence for a Novel Circadian Photoreceptor Journal of Neuroscience, August 15, 2001, *21*(16):6405–6412

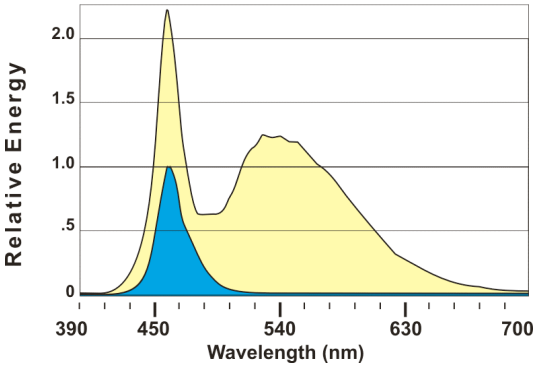
[15] Lockley S W

[16] K Thapan et al, An action spectrum for melatonin suppression: evidence for a novel non-rod, non-cone photoreceptor system in humans. J Physiol. 2001 Aug 15;535(Pt 1):261-7.

[17] Glickman G. et al. Light Therapy for Seasonal Affective Disorder with Blue Narrow-Band Light-Emitting Diodes (LEDs). Biol Psychiatry 2005 (In Press) http://www.sobp.org/journal

[18] Glickman et al, "**Hazard Analysis**: Before patients began light treatment trails, an independent hazard analysis following the current accepted national and international guidelines was applied to each LED light source... Although the study anticipated a viewing distance of 50 cm, light safety was assessed at shorter distances as well, including at the panel surface (0 cm). The Food and Drug Administration's Center for Devices and Radiological Health reviewed the full report and concurred with the analysis and findings, based on the radiological measures provided…"

[19] See references 9,11 BLUEWAVE® produces less intensity and no UV light compared to all other white light devices. Also when compared to white LED light therapy devices, BLUEWAVE® produces less blue and up to 12 times less overall intensity. Source International Light RPS 900 spectral comparison, 11/05/2005



[20] Lockley S W

21 Wright H R et al. Differential effects of light wavelength in phase advancing the melatonin rhythm. J. Pineal Res. 2004; 36: 140-144

22 Dacey DM et al
23 Panda S et al
24 Qiu X et al

25 B. Byrne et al, Light therapy for seasonal affective disorder with 470 nm narrow-band light-emitting diodes (LEDs) Chronobiology International, Volume 21/Numbers 4-5/2004, 783