

Light and health

For most of the last century, light was considered solely in terms of its impact on our ability to see. However, it has been known for some time that exposure to optical radiation can have both positive and negative impacts on human health, impacts that can become evident soon after exposure or only after many years. Optical radiation covers the ultra-violet, visible and infrared regions of the electromagnetic spectrum (see Figure 1.1). An example of the impact of optical radiation is the production of vitamin D following exposure of the skin. Vitamin D is essential for healthy bones and influential in many other aspects of health (Holick, 2005). Unfortunately, optical radiation incident on the skin and eye is also known to produce tissue damage, both acute and chronic, through either thermal or photochemical routes. There exist occupational safety guidelines limiting the exposure to optical radiation (ACGIH, 2004) and methods for evaluating electric light sources for their potential to cause tissue damage (IESNA, 1996).

These effects are well known, so it is the more recent discovery of a new class of photoreceptor in the retina of the eye that has renewed interest in light and health (Brainard et al, 2001; Thapan et al, 2001). The output from these photoreceptors is linked to the suprachiasmatic nuclei in the brain. These nuclei are believed to form the master clock for the body's circadian system. The relevance of this finding for lighting practice is evident from the fact that patterns of light exposure have been shown to alleviate problems associated with diminished operation of the circadian system. For example, people with Alzheimer's disease show a fractured sleep/wake cycle, often being active at night. It has been shown that exposure to bright light during the day and little light at night restores the sleep/wake cycle to a more stable state (van Someren et al., 1997). Similarly, some people suffer from timing problems with sleep, young people having delayed sleep phase syndrome and elderly people having advanced sleep phase syndrome. Exposure to bright light at the correct time has been shown to correct these timing problems, the exposure being in the morning for the young and the evening for the elderly (Czeisler et al., 1988; Campbell et al., 1993).

There is also the presently unexplained phenomenon of the use of light treatment to overcome seasonally affective disorder (SAD), a condition in which people feel depressed during a specific season, usually winter, but not during the rest of the year. Exposure to bright light has been shown to diminish this depression in a significant number of people. Guidance on its use has been developed (Lam and Levitt, 1999).

But it is not all good news. Concern has also been raised about the impact of light exposure at night on the development of breast cancer (Figueiro et al, 2006). A lot more needs to be known about how the circadian system and all the other bodily functions linked to it might be influenced by light exposure before advocating the widespread use of light exposure for purposes other than vision (Boyce, 2006; Figueiro et al, 2006). Once that knowledge is gained, then lighting is likely to be designed not just for vision but for human health as well.

Individual control

Lighting has usually been specified and designed on a one-size-fits-all basis. However, research has shown that when office workers are given individual control of their lighting, the preferred illuminances can vary widely but the bulk of the illuminances chosen are below the levels recommended (Boyce et al, 2006a). These findings have two implications. The first is that one-size-fits-all lighting cannot hope to satisfy everyone, a fact made evident by the finding that for the most common form of office lighting in North America, only about 70% of occupants finding the lighting comfortable (Eklund and Boyce, 1996). The second is that the change in office work produced by the almost universal use of self-luminous displays represents an opportunity to re-examine lighting recommendations.