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The Effects of Artificial Night Light on Sleep Patterns

While Northfield Minnesota is not a highly urban area, it does include numerous stores, a factory, a large hospital and two college campuses. Lights and lit signs create light pollution for all residents, especially on St. Olaf and Carleton's campuses where commonly visited areas are well lit. Light is important for the safety and comfort of students and residents of Northfield, but it may create some outside night light which could be detrimental to people's sleep patterns.

The internal clock that influences sleeping patterns is called the circadian rhythm, and it is influenced by a force called the zeitgeber. In regards to the circadian rhythm the zeitgeber is the amount of light in different times of day (Gregory et al., 2016). These forces must maintain a constant pattern so as to maintain stability of the cycle, but unfortunately artificial light can be irregular and sporadic. Light that enters through windows may be involved in disrupting sleep cycles of individuals. In a meta analysis of studies on outdoor artificial light and the effects on human populations, Gregory et al. (2016) discussed and compared experiments providing evidence that



Figure 1 is a NASA photo of light pollution in the world revealing that limited dark skies still present.

circadian rhythms are affected by light interference at night. One of the main causes of disrupted circadian rhythms is the “environmental LD cycle” (Gregory et al., 2016). This cycle refers to high light exposure during the day and limited light at night (Gregory et al., 2016). Surveys of the blind who do not have the ability to perceive light reveal they often have disrupted circadian

rhythms and variable sleeping quality (Gregory et al., 2016). People lacking the ability to perceive light exposure are unable to regulate their sleeping patterns suggesting humans “anticipate and adapt to daily and seasonal cycles” based on the day light patterns they experience (Gregory et al., 2016). These cycles have evolved over thousands of years and existed well before the invention of the light bulb, and therefore it should come at no surprise that increases in artificial light disrupt a biological phenomenon which is dependent on outside stimulus to allow the individual to adapt (Gregory et al., 2016).

Artificial lights can have specific effects on sleep patterns including delays in sleep and disrupted hormone secretion. Min & Kyoung-Bok (2018) observed 52,027 patients above the age of 60 and the prevalence of hypnotic drugs for sleeping aids depending on the amount of outdoor light their quartile was exposed to. Light interference during night hours can lead to insomnia, delay “sleep onset, and poor sleep quality in terms of sleep depth and arousal frequency” (2018). Figure 1 shows this process and how light enters the eyes stimulating neurons

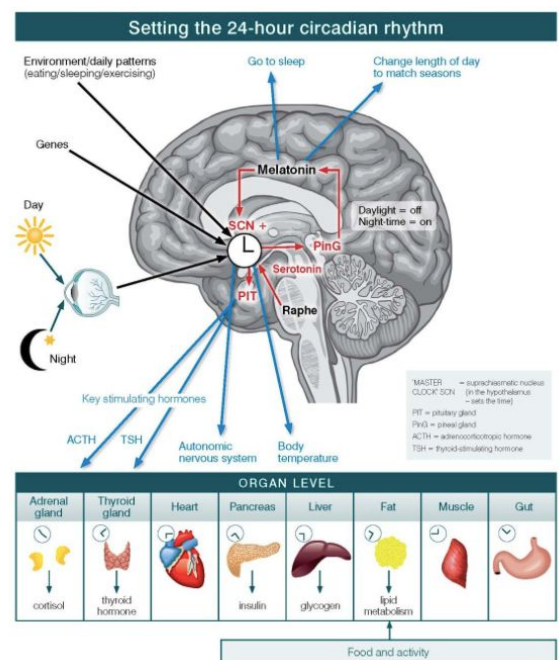


Figure 2. Is an image of the interaction between light and Circadian Rhythm (from Hickie, 2013)

that lead to the suprachiasmatic nucleus in the hypothalamus responsible for melatonin secretion (2018). Ohayon’s (2016) collected over 19,000 people’s self reported sleep quality and compared it to the amount of light pollution in the area they lived in. The comparison revealed that artificial light causes delays in sleep due to lower levels of melatonin secretion (2016). The light that is

present outside may appear insubstantial, but could be greatly impacting the timing and quality of sleep that residents receive.

The reason that insomnia is important to notice is due to the consequences it can have on other bodily functions meaning that light exposure may not just impact a good night's sleep. Numerous studies have found that “disruption of circadian rhythms, potentially leading to metabolic and chronic diseases, including cancer, diabetes, obesity, and depression” (Min & Kyoung-Bok, 2018). Not only is the metabolism affected, but also the quality of sleep that one receives can increase the risk of major diseases that are large issues in the United States. Min and Kyoung-Bok (2018) found that dependency on sleep aids is another consequence of outdoor light pollution. The consequences of unnatural light go beyond the night to effect several facets of people's health and lives.

Light pollution has numerous positive effects on human life including safety, but it has negative effects on sleep cycles when it interferes at night (Hölker, 2010). Ways to fix this could include limiting late night waste of lights and replacing blinds with blackout blinds. When Min and Kyoung-Bok (2018) observed different quartiles, those with less outdoor artificial light were less likely to use hypnotic drugs for sleep aid. Since the cycles of light exposure strongly influences the circadian rhythm according to Gregory et al. (2016), blackout blinds limiting high exposure to light at inappropriate times could stop some disruption of the cycle commonly caused by artificial outdoor light. Further research needs to be done to find out what kind of damage is being done by outdoor artificial light as well, so that solutions can be found to stop the never ending cycle of sleep deprivation occurring in overly lit areas.

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