Lighting and Health

Typical illuminance for light sources used in human evolutionary timeline

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Sunlight and vitamin D</th>
<th>Artificial light</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00 - 06:00</td>
<td>3800 lux (full moon)</td>
<td>~ 0.1 lux</td>
</tr>
<tr>
<td>06:00 - 12:00</td>
<td>~ 1000 lux</td>
<td>100 – 500 lux</td>
</tr>
<tr>
<td>12:00 - 18:00</td>
<td>Daylight (full sun)</td>
<td>~ 1 lux</td>
</tr>
<tr>
<td>18:00 - 24:00</td>
<td>~ 10 lux</td>
<td>~ 1 lux</td>
</tr>
</tbody>
</table>

The variation of light from day to night helps maintain the circadian rhythms in our bodies

- **Diurnal cycle**: Daytime light helps activates our circadian clock, signaling it to be active. This helps us feel alert and energized during the day.
- **Nacht independence**: Nighttime darkness helps deactivate the circadian clock, signaling it to be passive. This helps us feel tired and ready to sleep at night.

Non visual light receptors

- **Intrinsically Photosensitive Retinal Ganglion Cells (ipRGCs)**: These are photoreceptors in the eye used for vision, a third non visual light receptor has relatively recently been discovered.
- **Photoreceptors in the eye**: In addition to the rod and cone photoreceptors in the eye, there are also two non visual light receptors in the eye: melanopsin and intrinsically photosensitive retinal ganglion cells (ipRGCs).

Daylight and sunlight used on this planet for millions of years

- **Sunlight**: The main light source for millions of years, used to maintain the circadian rhythms in our bodies.
- **Sunlight and vitamin D**: Exposure to sunlight has health benefits too. In the UK, 13 minutes of sunlight per day between 11am and 3pm Apr - Dec will give you a reasonable vitamin D level.

Night workers and early morning shift workers

- **Sleep deficiency**: Less than 6 hours a night sleep is now a common occurrence for millions of people, with 44% of night workers and often with 30% of all employed US adults reporting sleep less than 6 hours a night, when 50 years ago less than 3% of the adult population slept so little.
- **Depression**: Increasing use of electric light at night can cause sleep deprivation and sleep disorders, which helps contribute to depression. Czeisler (2013) notes that 15 to 20 minutes of bright light in the morning can help prevent depression.

Daylight reduces the risk of developing myopia in children

- **Exposure to high levels of daylight as children grow has also been shown to reduce the risk of developing myopia**.
- **In a study in Guangzhou, China***, amongst children a 25% reduction in new cases of myopia was found.
- **45 minutes outdoors each day resulted in a 25% reduction in new cases of myopia**.

Sunlight and vitamin D

- **Recommendation**: To maintain vitamin D levels, use 3 and 1/8 medium eggs, or 200g of salmon.
- **Benefit**: Adding 15 minutes of sunlight to your day can give you a reasonable vitamin D level.

Reduce SAD symptoms

- **Exposure to bright light during the day can help reduce the symptoms of SAD (Seasonal Affective Disorder)**.
- **Midwinter: Exposure to 30 minute and 1-hour artificial light at the equivalent of 1000 lux reduced SAD symptom scores by 37% compared to a control group who did not receive bright light**.

Daylight reduces muscle strength, cardiovascular efficiency and could cause cancer

- **Night workers**: A study from the US shows that 44% of night workers have health impairments associated with shift work, including cancers, colitis, gastroduodenitis, peptic ulcer, hypertension and ischaemic heart disease as well as metabolic diseases such as type 2 diabetes and obesity.
- **Diabetes and obesity**: The International Agency for Research in Cancer (IARC) notes health impairments associated with shift work, including cancers, colitis, gastroduodenitis, peptic ulcer, hypertension and ischaemic heart disease as well as metabolic diseases such as type 2 diabetes and obesity.

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