WHY KUMUX

LIGHT AND CIRCADIAN RHYTHM

HOW CAN LIGHT AFFECT OUR CIRCADIAN RHYTHMS?

Just like food and water, **light is a nutrient for the human body**. For humans, light reaching the back of our eyes is the primary external cue that **synchronizes the body's internal biological clock and thus our circadian rhythms** to the solar day, essentially **telling our bodies to do the right thing at the right time**.

LIGHT CHARACTERISTICS

We can define natural light as a dynamic light, since it has three main **charactersitics that change continuosly during the day**.
These following charactersitics have a huge **positive impact** on people health and well-being:

Dark-light cycle **Color temperature** **Light intensity**

On the contrary, **in artifical light these elements are always fixed**. The result is a static light that affects our body in a **negative way**.

In the next pages we will examine these characteristics both in natural and artificial light and their different effects on our health.

NATURAL LIGHT

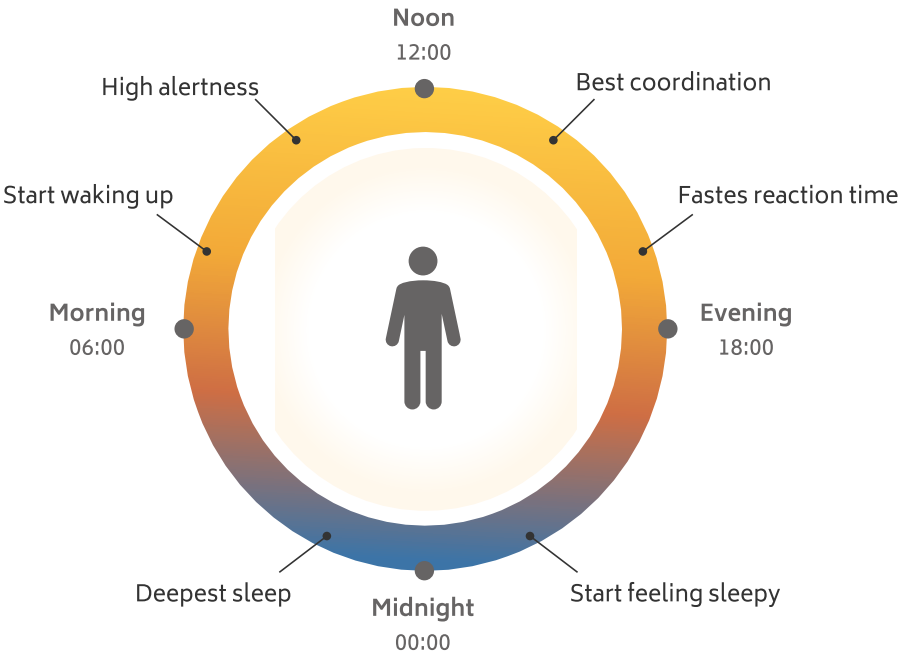
Dark-light cycle

Dark-light cycle is a **24-hours cycle** with a light period during day and a dark period during night.
Since humans have lived outdoor for thousands of years, **our bodies have evoloved in response to the changing rhytms of natural light**, which affects most living things, including animals, plants, and microbes.

Night Sunrise Morning Noon Afternoon Sunset Night

Dark-light cycle effects on circadian rhythms

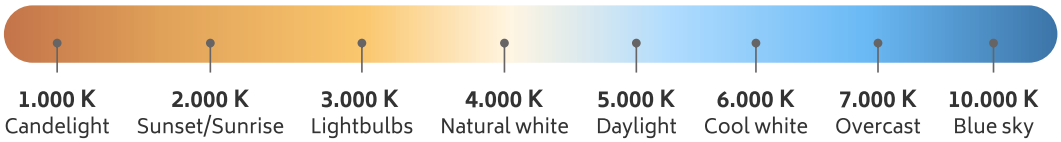
Circadian rhythms are physical, mental and behavioural changes that follow a 24 hour cycle.
Light is one of the main drivers of this internal clock, which starts in the brain and regulates physiological rhythms throughout the body's tissues and organs. This affects also hormone levels and the sleep-wake cycle.



NATURAL LIGHT

Color Temperature

Correlated Color Temperature (**CCT**) is a measurement of the average **hue of light** as it appears to the human eye, expressed in Kelvins. **Natural light CCT varies continuously** along the day in that range.



Color Temperature effects on circadian rhythms

Warm light (around 2700 k) is light with warm color components and is **perceived as yellowish**. Natural light at **sunrise and sunset** has this color temperature. We need this light to keep seeing, but its components allow us to **release melatonin**, helping us to **rest** .

Cold light (above 5000k) is light with cold color components and is **perceived as bluish**. Natural light at **noon** has this color temperature. Our brain receives that light and reacts with the **suppression of melatonin and release of cortisol**, which stimulates attention and daily activity.

NATURAL LIGHT

Light intensity

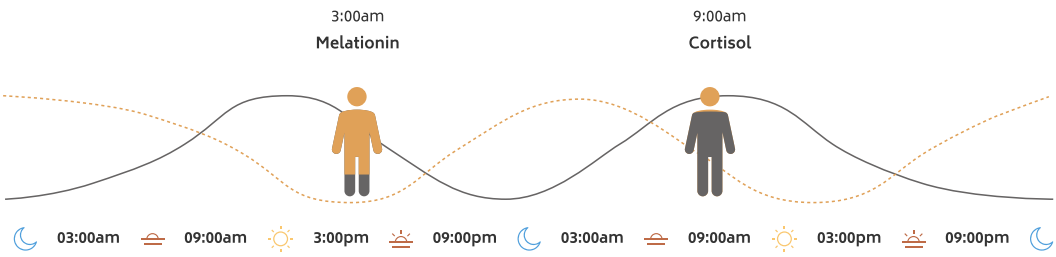
Light intensity **changes in a constant way**, from weaker light at sunrise to brighter light at noon and again to weaker light at sunset. **It affects our body's hormones**.
Illuminance is a measure of light intensity in luxes. It can vary along the day from 10.000 lux on a sunny day to 0.001 lux on starlight.

Lux	10.000	1.000	100	10	1	0.1	0.01	0.001

Light intensity effects on circadian rhythms

Light **below 30 luxes** helps us to **release melatonin** so that we can have a more quality **rest**.

Light **over 30 luxes** can be **melatonin-suppresive** to keep our body **active** during the day.



ARTIFICIAL LIGHT

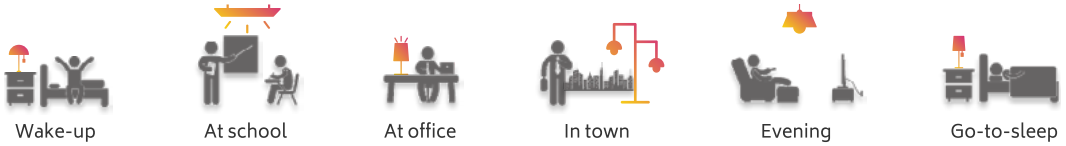
Dark-light cycle

Due to our **modern lifestyle**, we spend most of our **time indoors, under artificial light**. Compared with natural light, artifical light is not dynamic and **the lack of dark-light cycles will alter our internal clock** and circadian ryhthms.

90%
Time indoor

Color Temperature

With artificial lighting, **light color temperature (CCT) is fixed** from wake-up to go-to-sleep. It is generally a **cold light** (above 5000K) all day long.



Light intensity

Also the light intensity we recieve by artificial light in indoor spaces is fixed and **the illuminance**, compared to natural light, is **very low**.

In offices, people indoor get

500 lux

In schools, people indoor get

300 lux

On a **sunny day**, people outdoor get

10 000 lux

On a **cloudy day**, people outdoor get

1 000 lux

KUMUX

Artificial light effects on circadian rhythms

With artificial and fixed lighting, **light intensity, light spectrum and dark-light cycles are altered**. We are exposed to less light during the day and too much light during the night, compared to natural light.

These non-natural light cycles cause **deregulation of the natural circadian rhythm**. The consequences are some of the problems people are struggling with nowadays: sleep disorders, apathy and even depression.

40%

Of people suffer of **sleep disorder**

70%

Of people suffer of **depression**

KUMUX
www.kumux.io