designs for health® Australia

From Sunrise to Screenlight:

Restoring circadian alignment for better patient outcomes

Presented by:
Amie Skilton,
Naturopath

Presenter | Amie Skilton

Amie Skilton’s professional journey spans nearly two decades as a functional medicine practitioner and educator in naturopathic medicine. Her expertise has brought her to conference stages, television, and digital platforms, where she has addressed a broad audience that includes functional medicine practitioners and the general public. Amie’s approach deeply integrates environmental factors with traditional health practices, emphasising the significance of a harmonious relationship between individuals and their surroundings for optimal health.

In 2017, Amie’s personal health journey took a significant turn when she was diagnosed with Chronic Inflammatory Response Syndrome (CIRS), a condition often associated with mould exposure. This diagnosis transformed her health perspective and led her to become a certified Mould Testing Technician. Amie’s experience with CIRS has greatly influenced her practice, emphasising the built environment’s impact on health. Thus, she has expanded her clinical focus to include environmental health hazards alongside conventional naturopathic treatments.

Our Host | Linda Dal Molin

Linda Dal Molin is the Director of Sales and Education for Designs for Health Australia.

Linda has a Masters in Human Nutrition, Bachelor of Health Science (Complementary Medicine), Advanced Diploma Naturopathy. She has been a practitioner for 25 years and worked in the natural health space for 27 years.

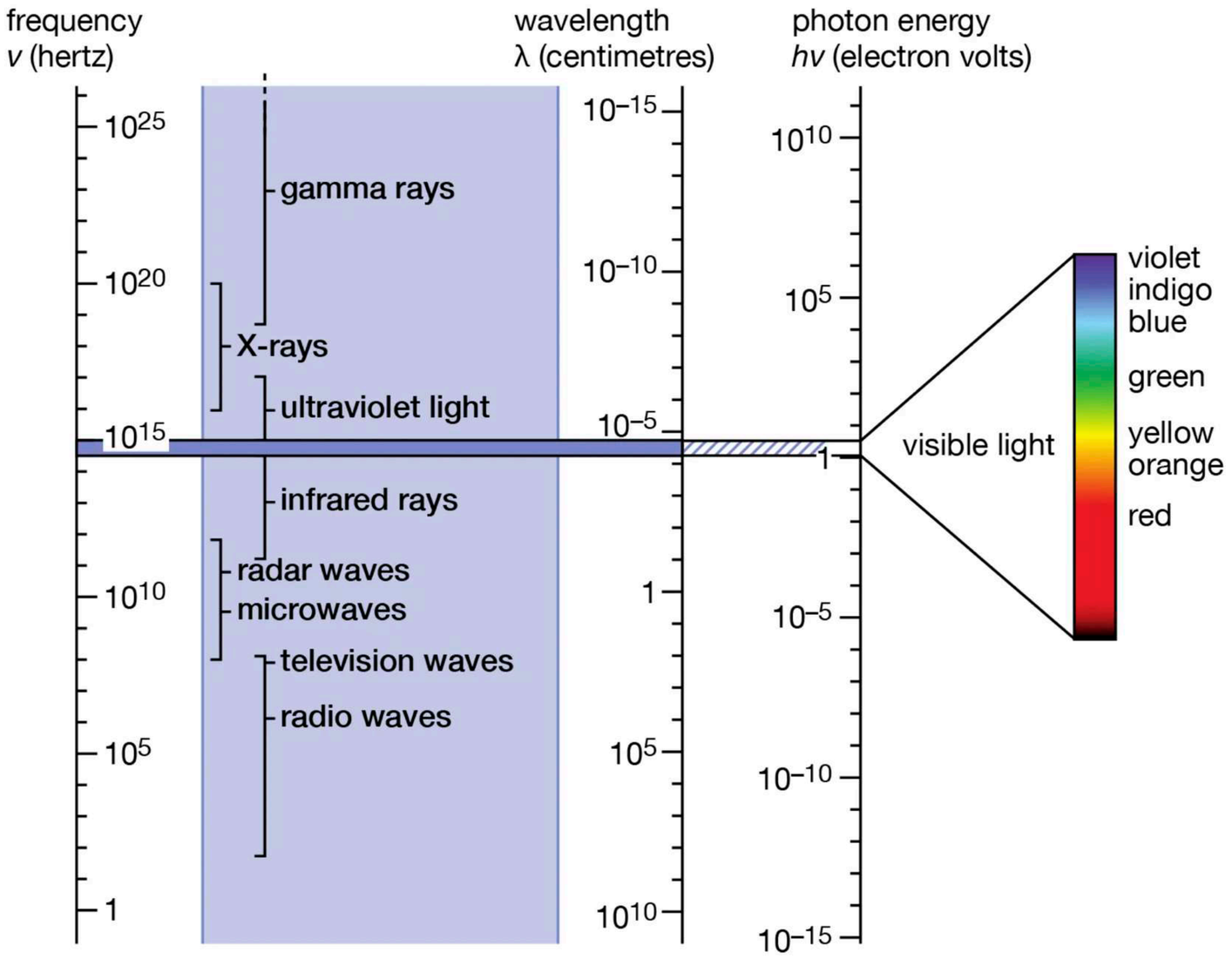
Linda has developed a strong relationship with the Designs for Health practitioner community. She will moderate the Q&A discussion with Amie in this webinar and engage our live Designs for Health practitioner community to bring insight and practical clinical pearls for all.

Outline

- The various wavelengths of natural vs artificial light and their impact on health.
- The various mechanisms by which natural light directs cellular physiology and what timing, duration and frequency matters when it comes to optimal health.
- How to optimise your patient’s circadian rhythm through ALAN mitigation and other circadian-friendly guidelines.

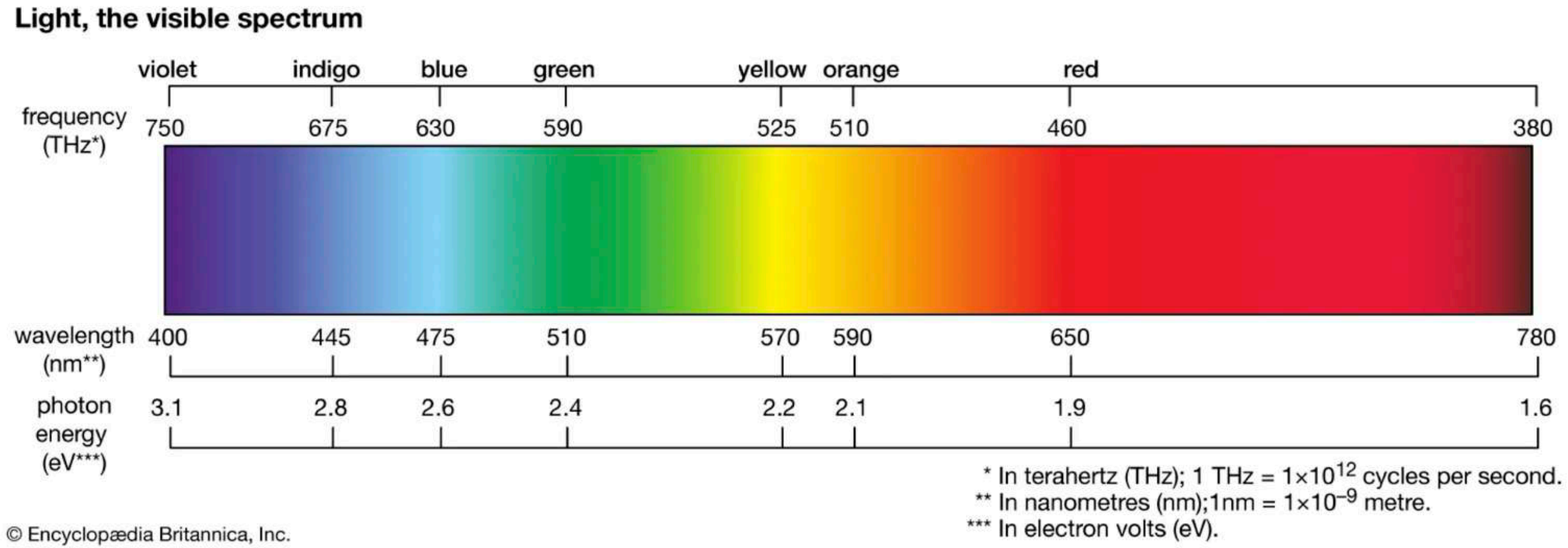
The nature of light

Light and the EMR Spectrum[1]

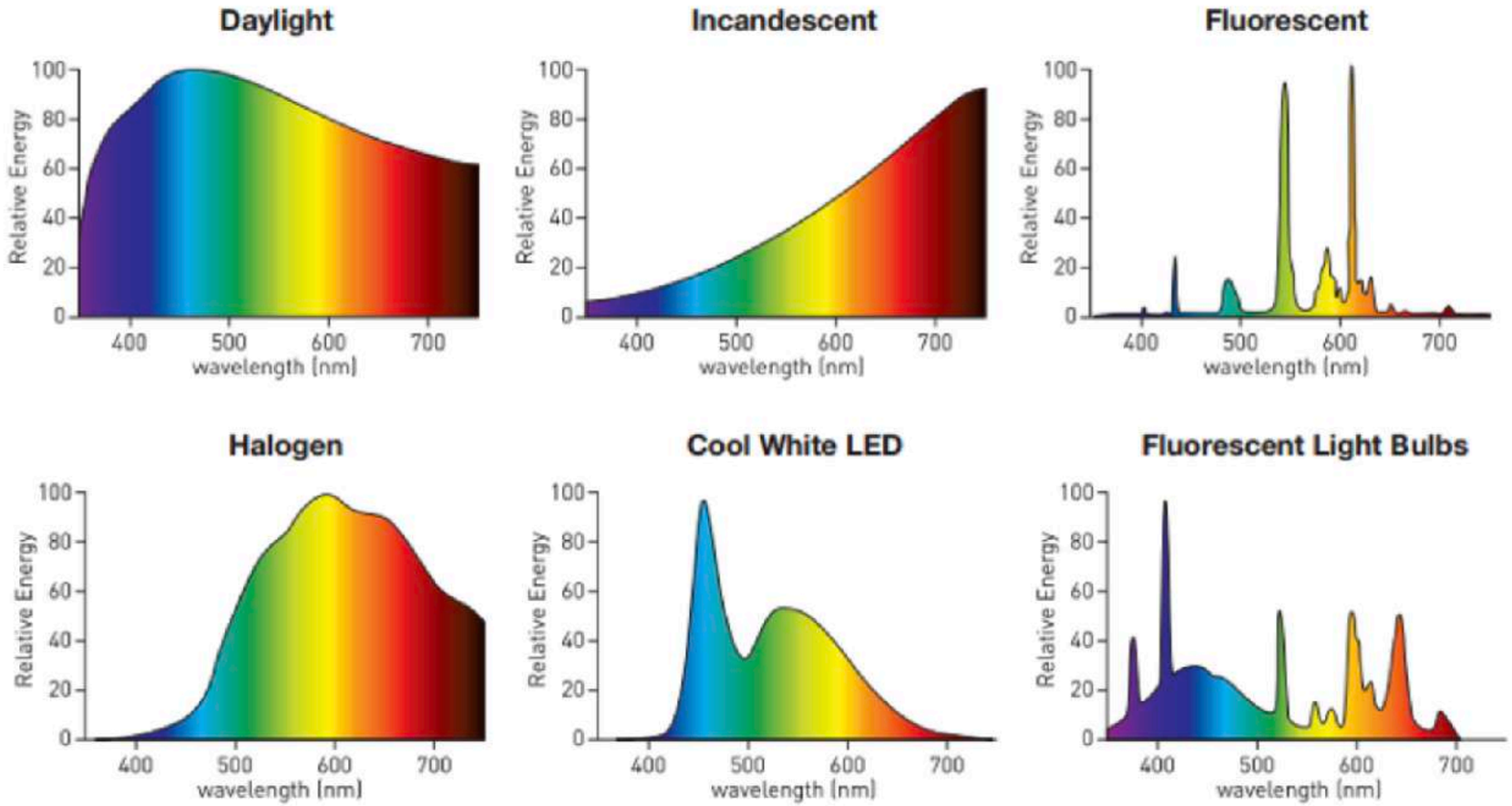


https://www.britannica.com/science/spectrum

The Light Spectrum[1]



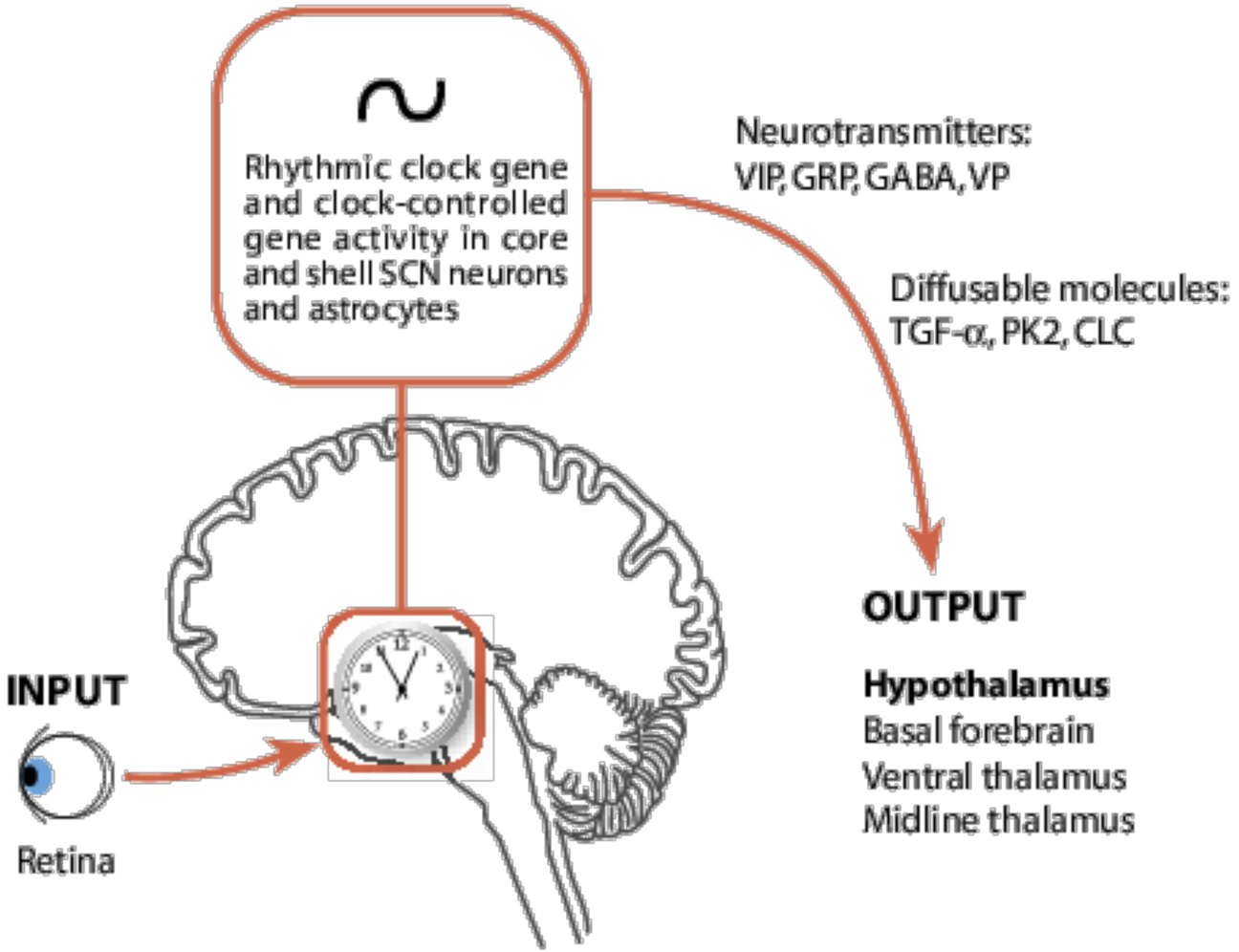
The Light Spectrum



390 nm to 700 nm

Natural Light

- The suprachiasmatic nucleus (SCN) is a bilateral structure located in the anterior part of the hypothalamus.
- It is the central pacemaker of the circadian timing system and regulates most circadian rhythms in the body.



Natural Light[2]

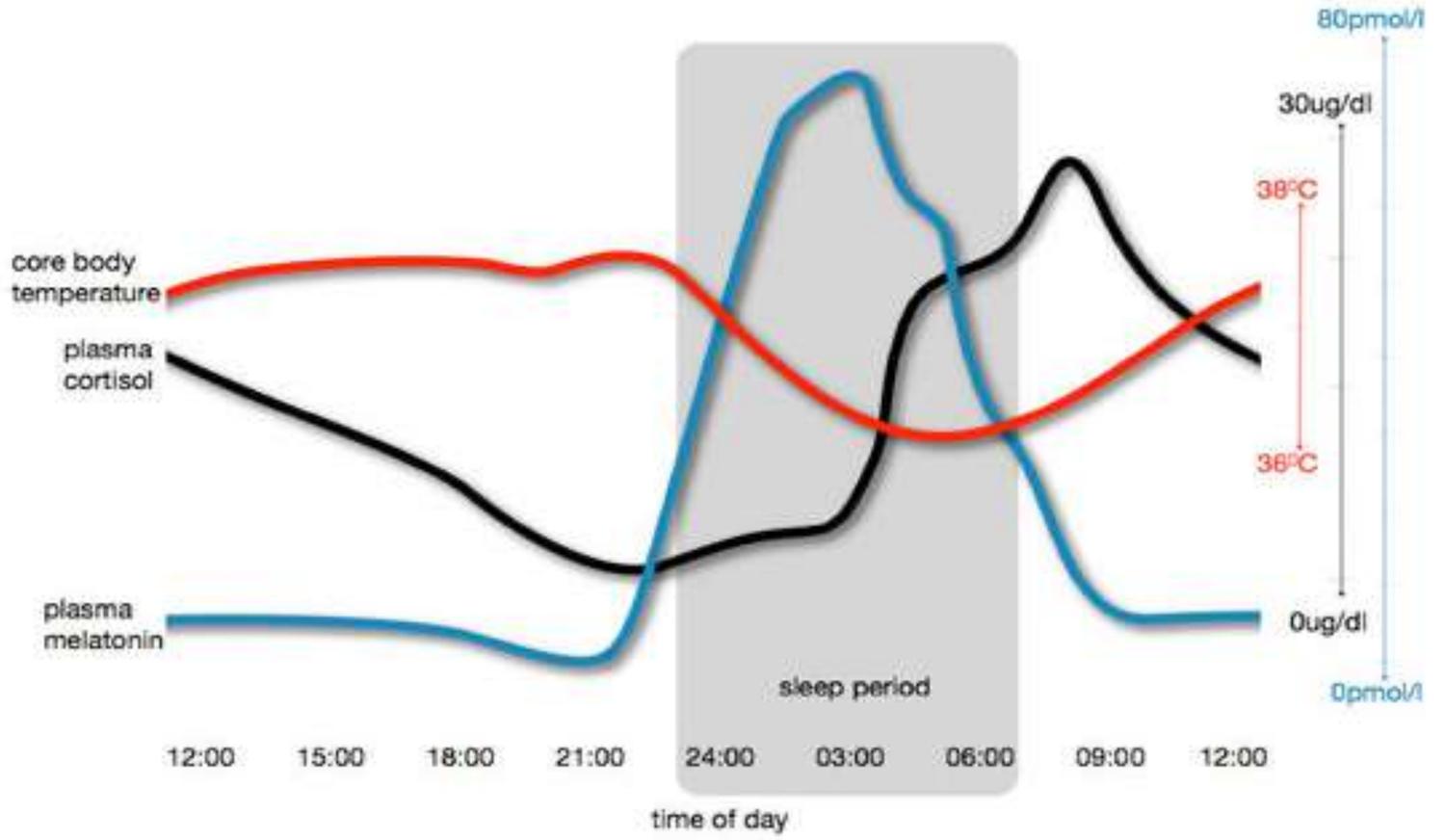


Figure 3: The normal synchronous relationships between sleep and daytime activity and varying levels of cortisol, melatonin and body temperature

Natural Light[2]

DAY

Muscle
- Fatty acid uptake
- Glycolitic metabolism

Fat
- Lipogenesis
- Adiponectin production

Liver
- Glycogen synthesis
- Cholesterol synthesis
- Bile acid synthesis

Pancreas
- Insulin secretion

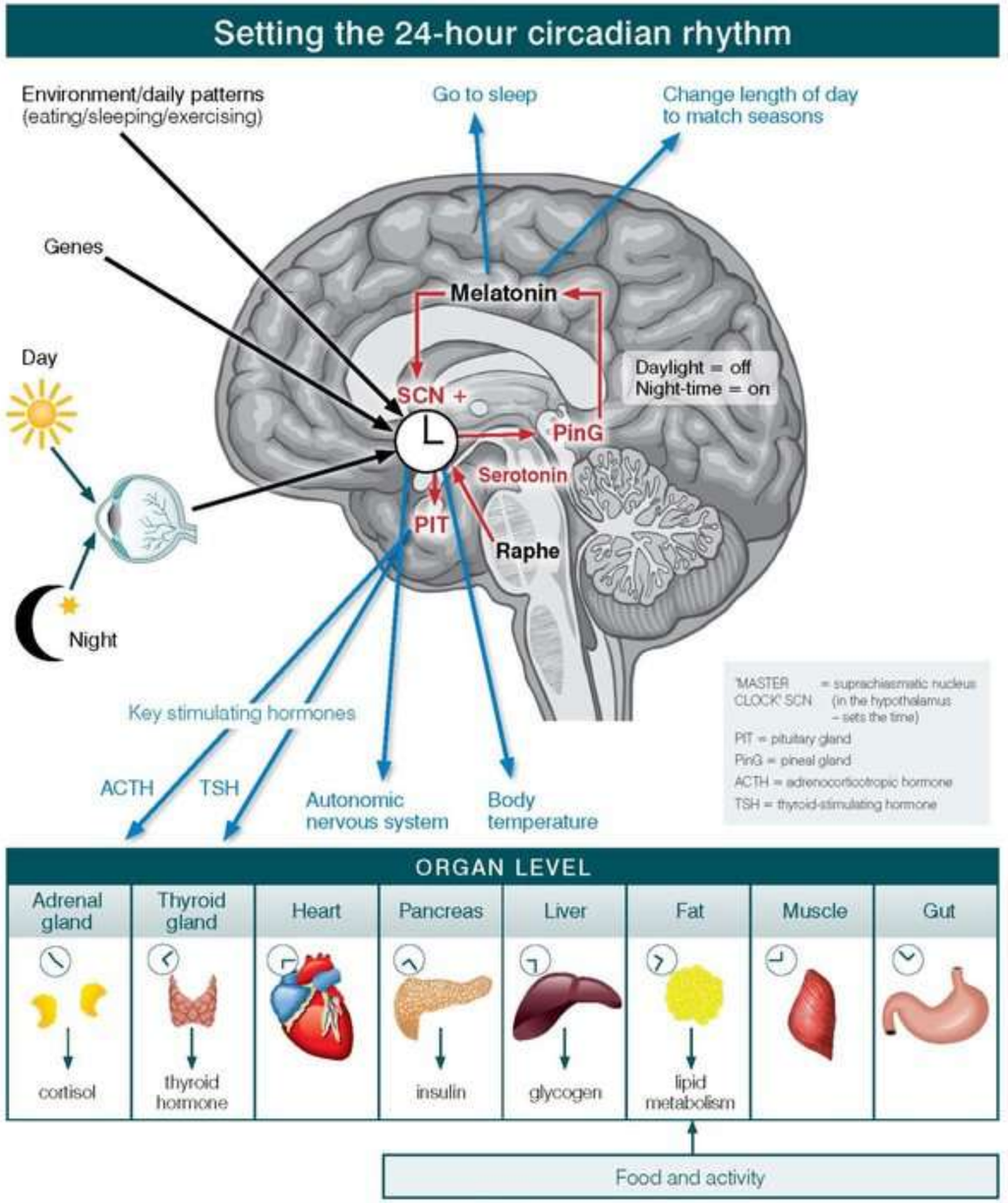
NIGHT

Muscle
- Oxidative metabolism

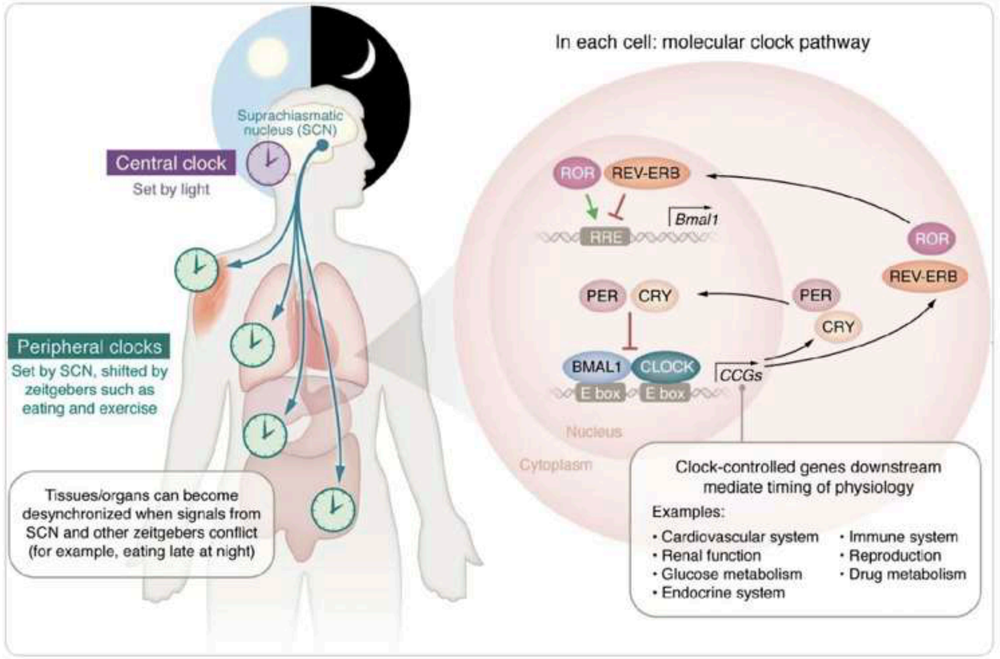
Fat
- Lipid catabolism
- Leptin secretion

Liver
- Gluconeogenesis
- Glycogenolysis
- Mitochondrial biogenesis

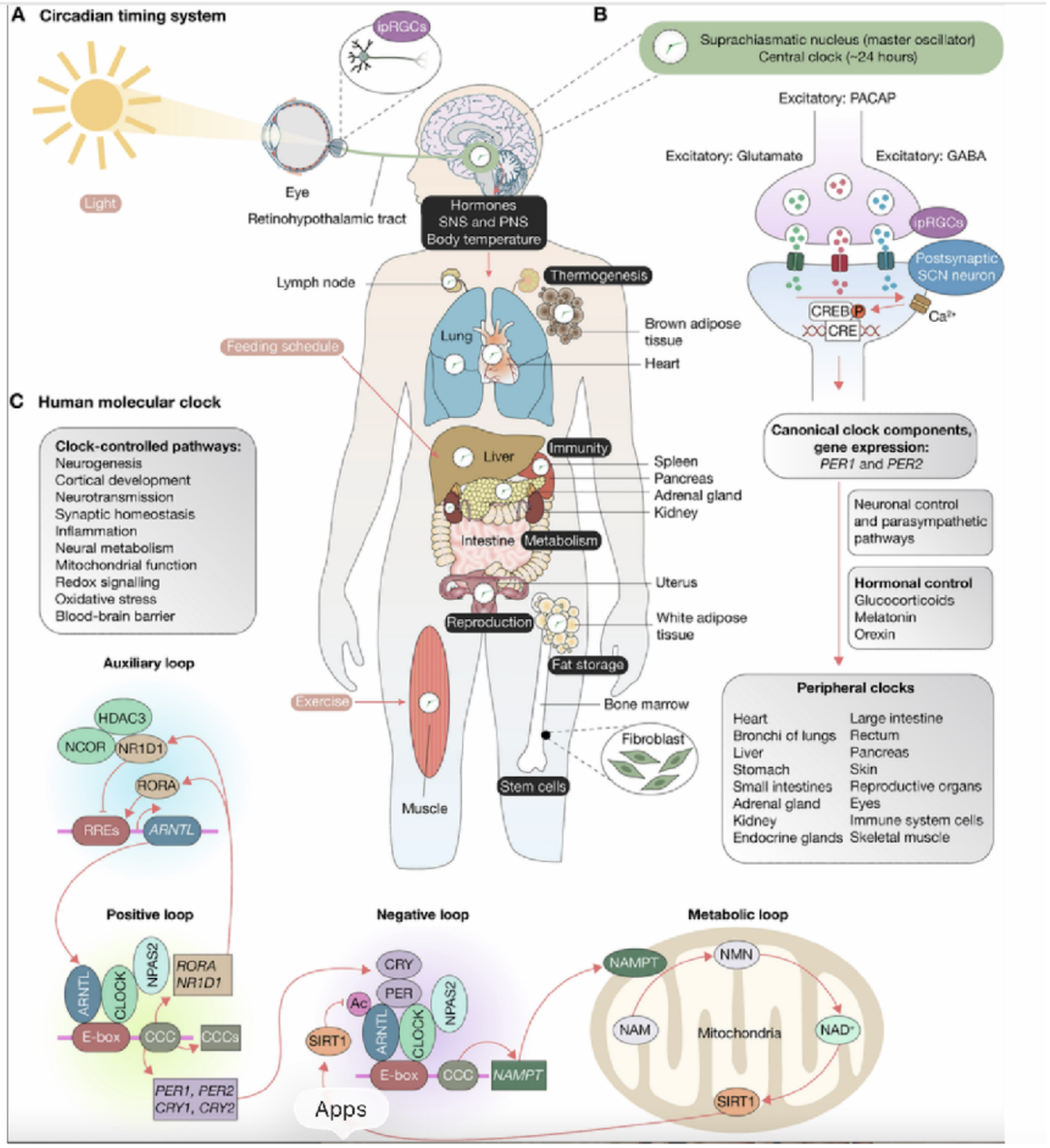
Pancreas
- Glucagon secretion



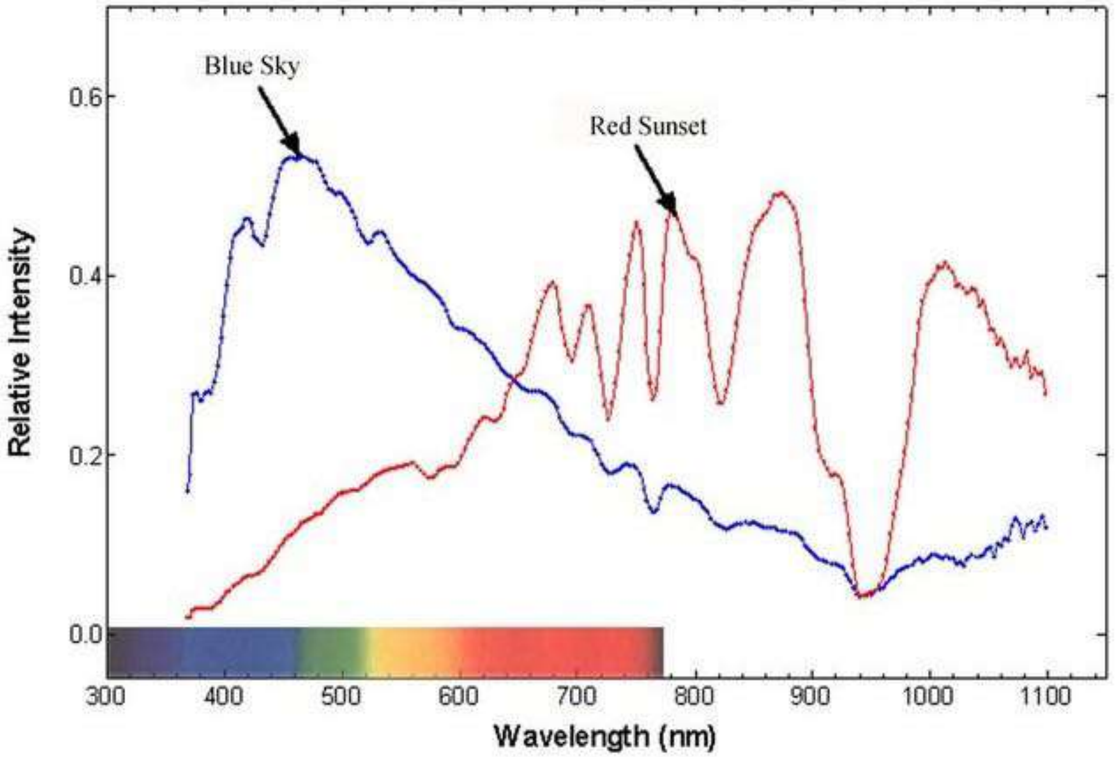
Natural Light



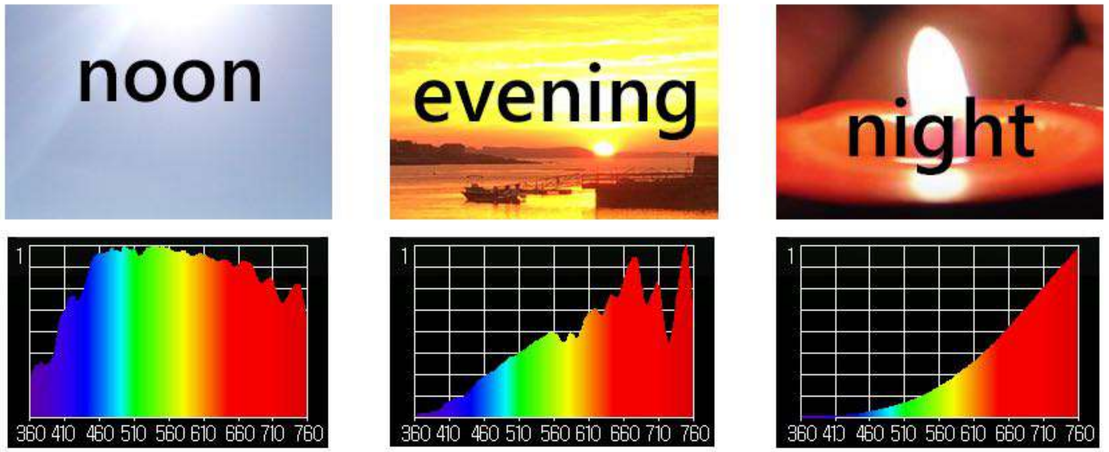
- Sunrise and sunset have a distinct red/orange tinge of colour, while the midday sun has more of a blue colour and the combination of these form of full spectrum lighting has provided the perfect balance to manage our circadian rhythm throughout the course of evolution.



Natural Light During the Day



Natural Light During the Day



The change of the light spectrum during the day.

Natural Light

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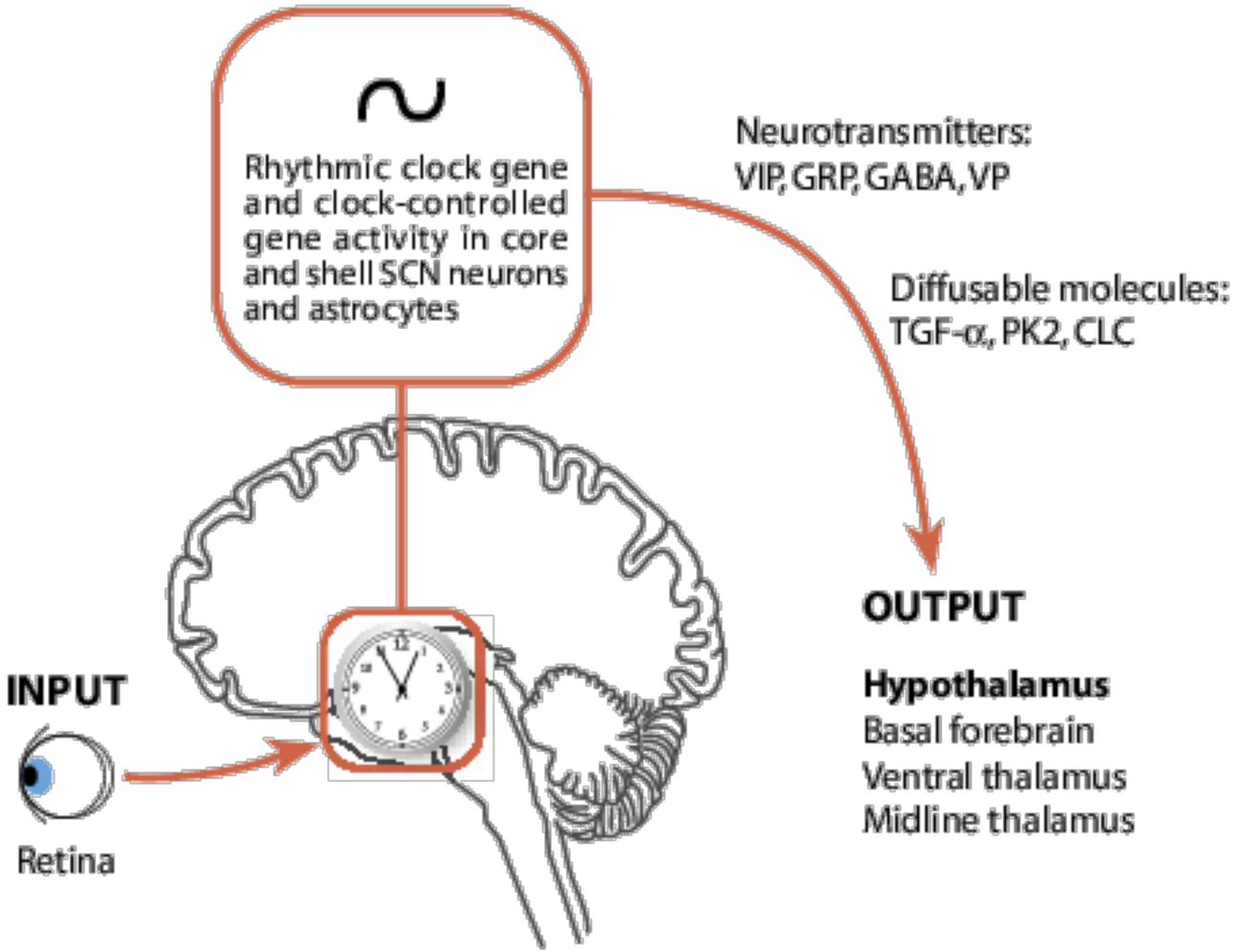
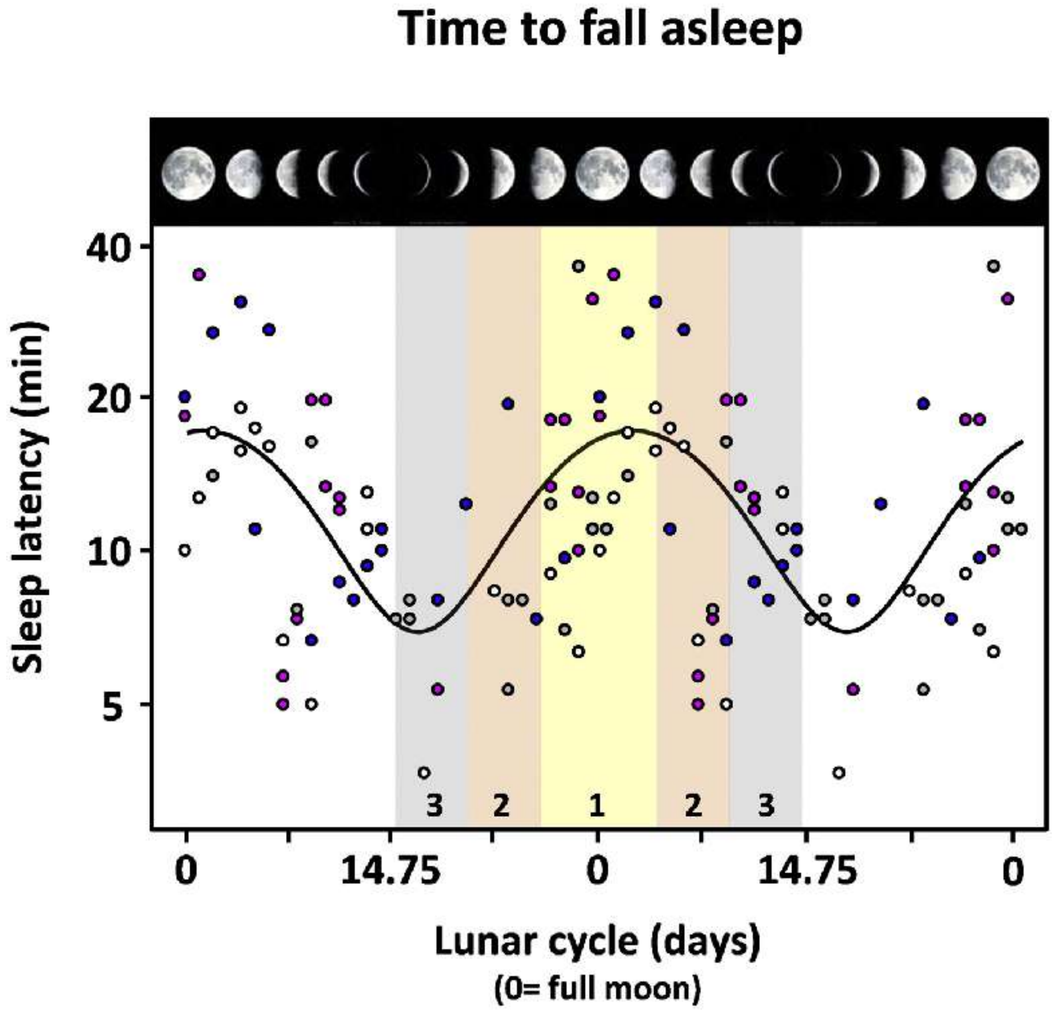


Natural Light[3]

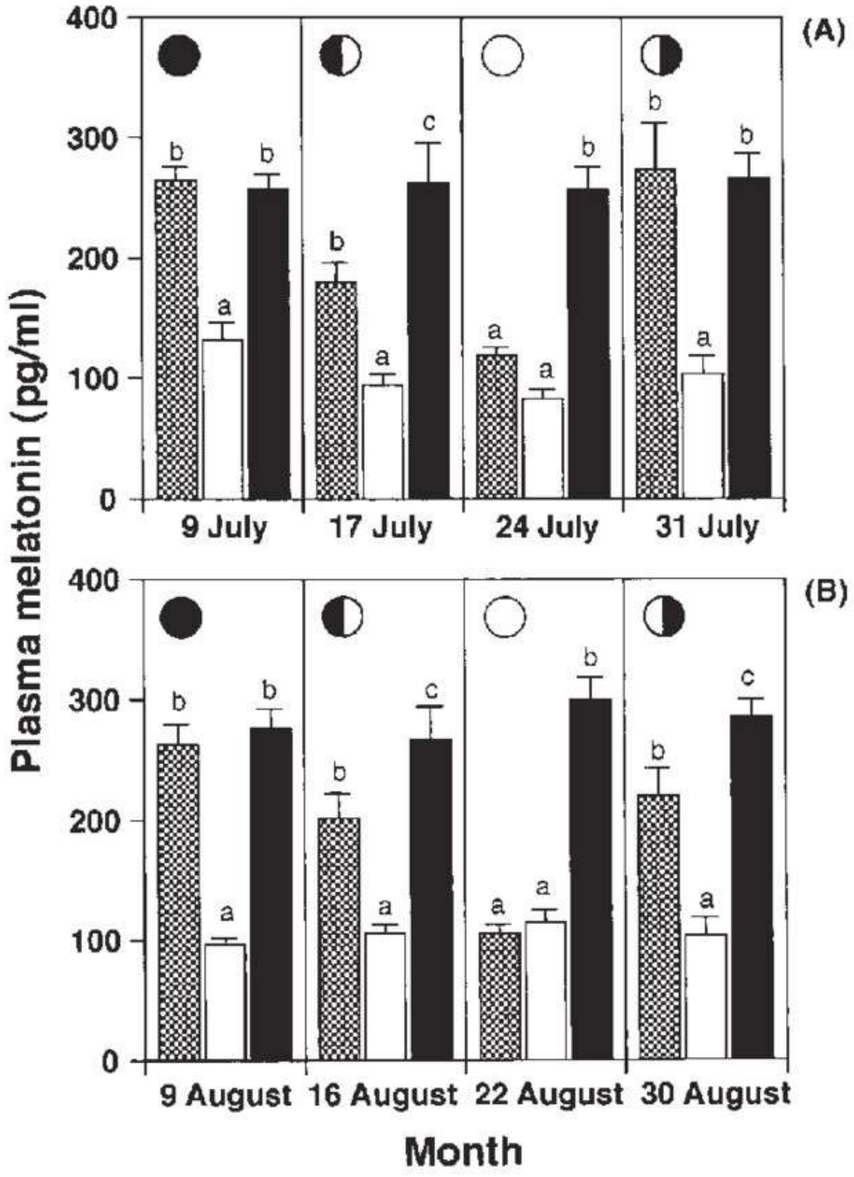


Natural Light[4]

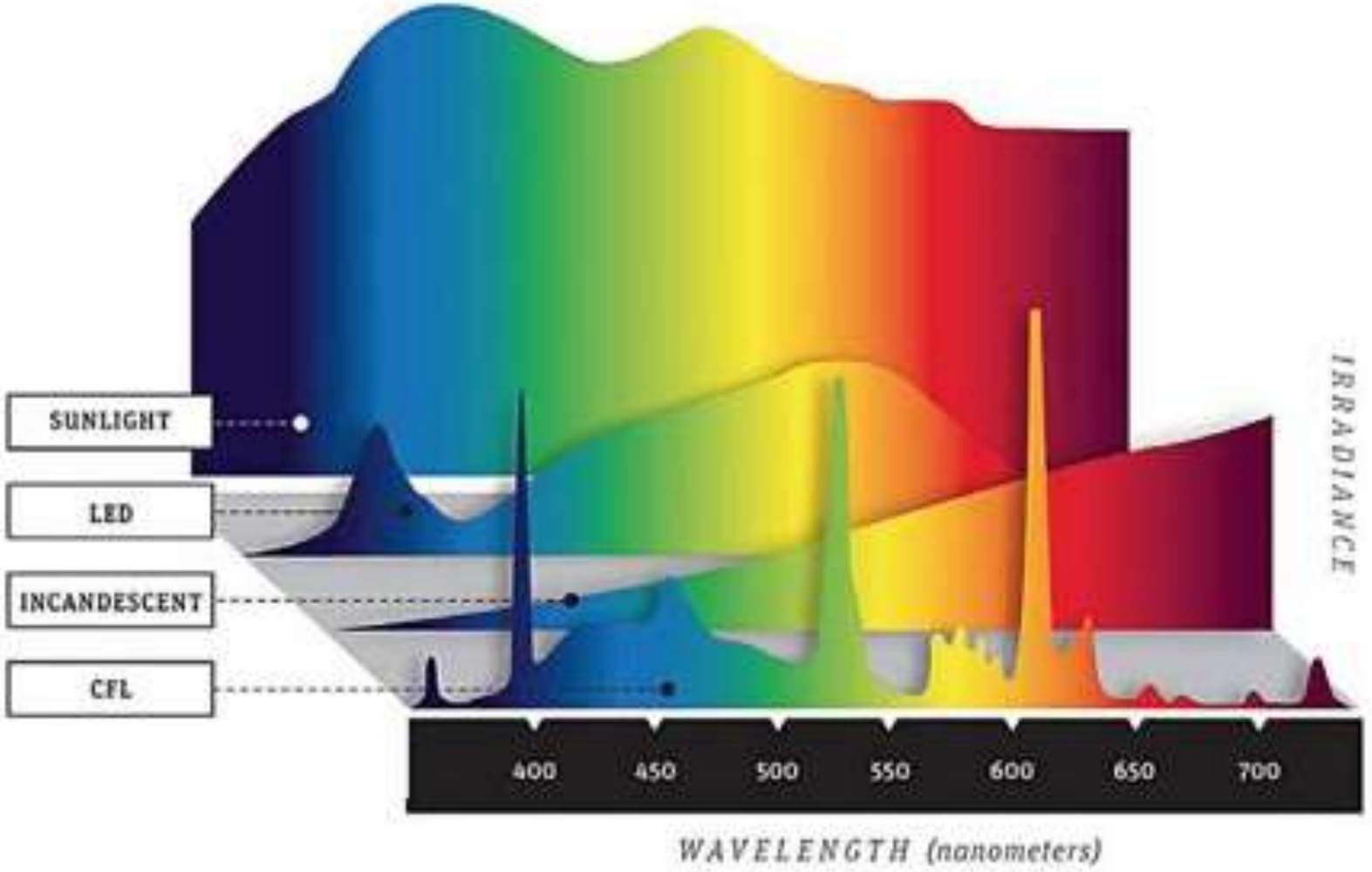
Comparison of plasma melatonin levels in the seagrass rabbitfish during natural, experimental full moon, and experimental new moon conditions around the 4 lunar phases.

Each value represents the mean ± SE (n = 8). Moon phases are indicated as new moon; first quarter moon; full moon; and last quarter moon.

Under natural condition, plasma melatonin levels at the new moon are significantly higher than during the full moon.



Natural Light vs Artificial Light



Artificial Light

Wavelengths of artificial light are different to the sun:

- Exposure during the day does not provide the same benefits.
- Using these at night is problematic as it is a mismatch in biological signalling.
- In addition to artificial lights at night, digital devices i.e. new generation of cell phones, TV, tablets (iPad) have altered our natural circadian rhythm - interfering with the messaging of natural light (and dark).
- Modern electronics like cell phones and tablets emit light peaks in the violet (380–450 nm) and blue range (450–495 nm).[5]
- Research is exploding on the detrimental effects AL has on the human body. The 2017 Nobel in medicine has been given for the discovery of circadian clocks![6]
- Shift work which involves circadian disruption has been Class 2A “probable” carcinogen since 2007.[7]

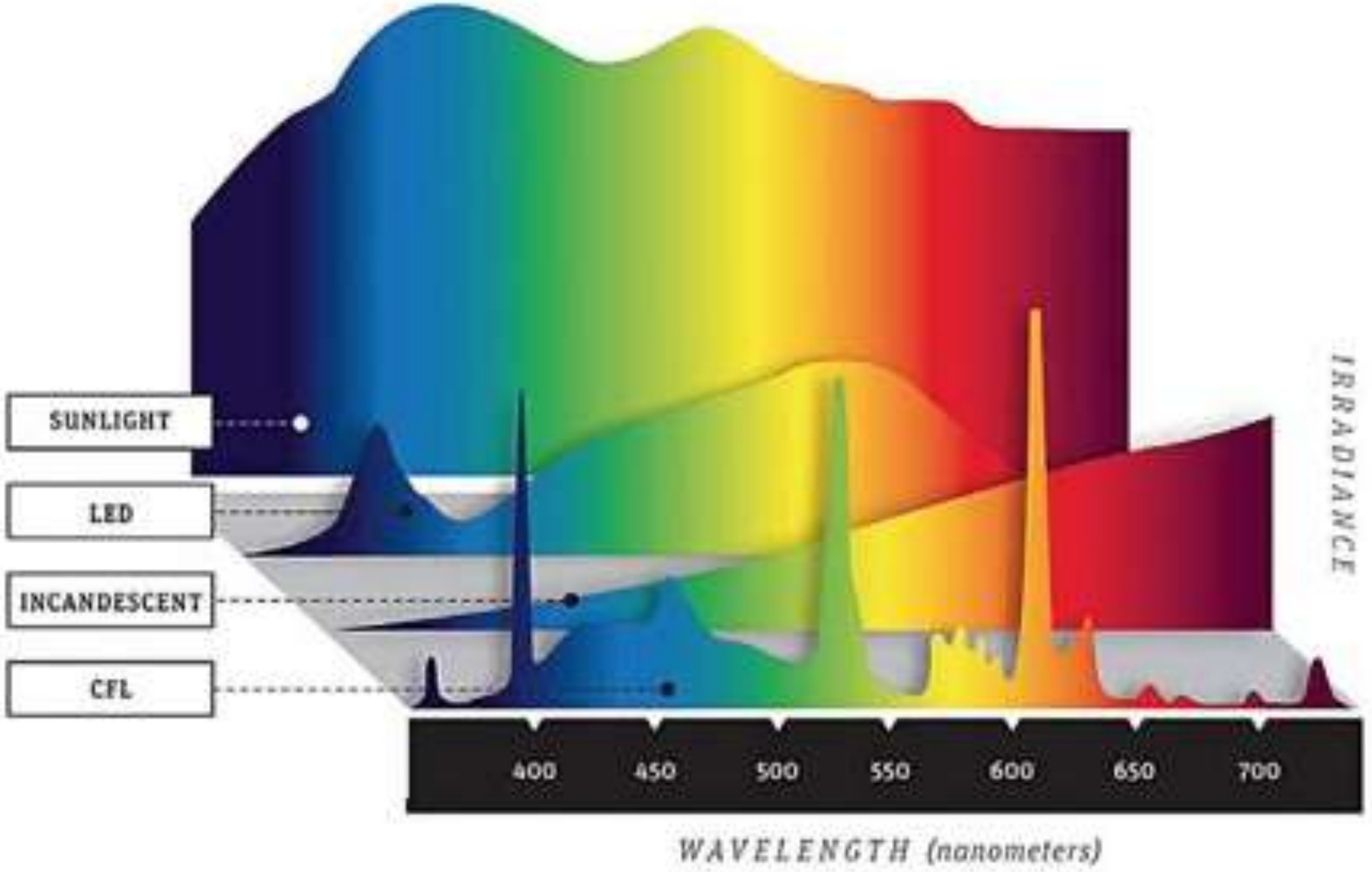
Benefits of Sunlight

- Morning sunlight activates melanopsin cells in the retina.
- Once the SCN is synced, it coordinates clocks in the skin, gut , liver, adrenals, and ovaries.
- This supports melanin production, DNA repair, antioxidant defence, and skin barrier function. This signals the brain to set your circadian rhythm and align all systems.
- Morning sunlight supports hormone production like serotonin (for mood) and melatonin* (for sleep), and helps regulate leptin.
- UVA light is crucial for optimal thyroid function.
- Retinal light triggers dopamine, boosts mood, sharpens focus, and prepares your skin for UV exposure later.

*melatonin is a crucial antioxidant and vital for cellular repair.

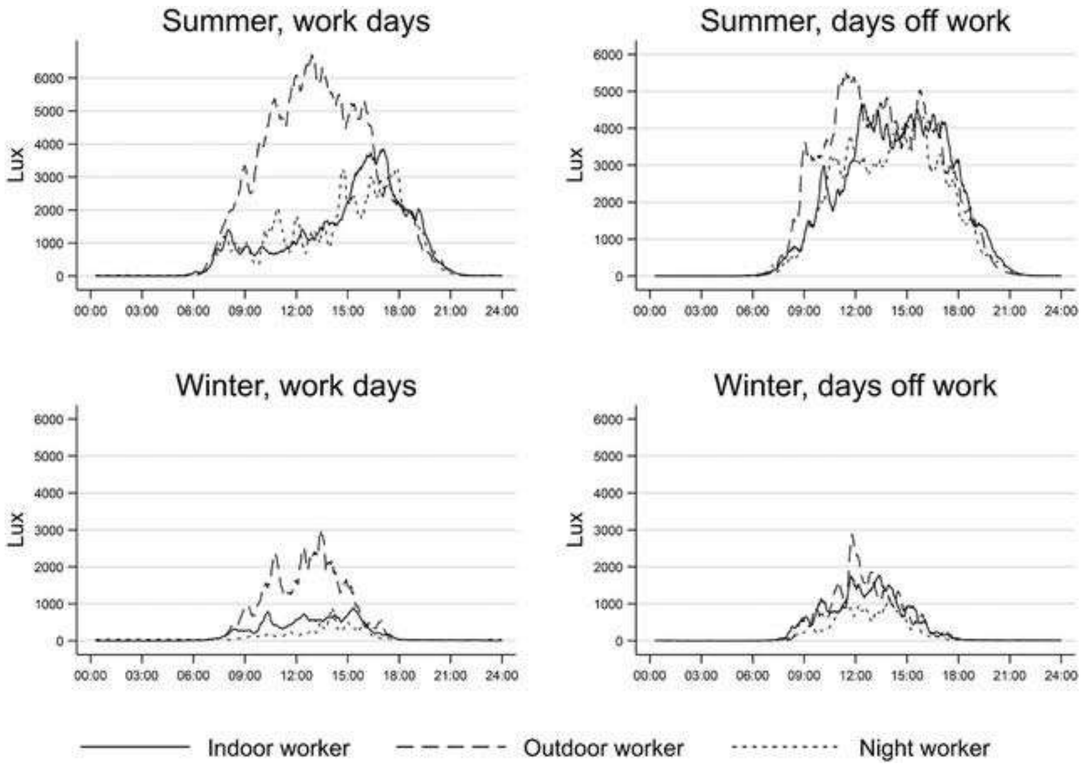
Physiological effects of light

Natural Light vs Artificial Light



Lux[8,9]

- Indoor light averages 300-500 lux
- Outdoor light averages 1000-100,000 lux
- Our days are too dark - we need at least 1300 lux to optimise metabolism
- Our nights are too bright - exposure to just 40 lux of blue light is sensitive enough to impact circadian rhythms, while red light does not cause any melatonin suppression



Light and Sleep[10,11]

Light used at night suppresses the sleep hormone melatonin, which contributes to sleep-related disorders, changes to the circadian rhythm, and compromises your ability to regenerate every cell in your body.

As melatonin is nature's most potent anti-cancer agent and antioxidant, suppressing melatonin significantly increases the level of oxidative stress in the body which is what causes ageing and chronic disease, and age-related macular degeneration (eyes).

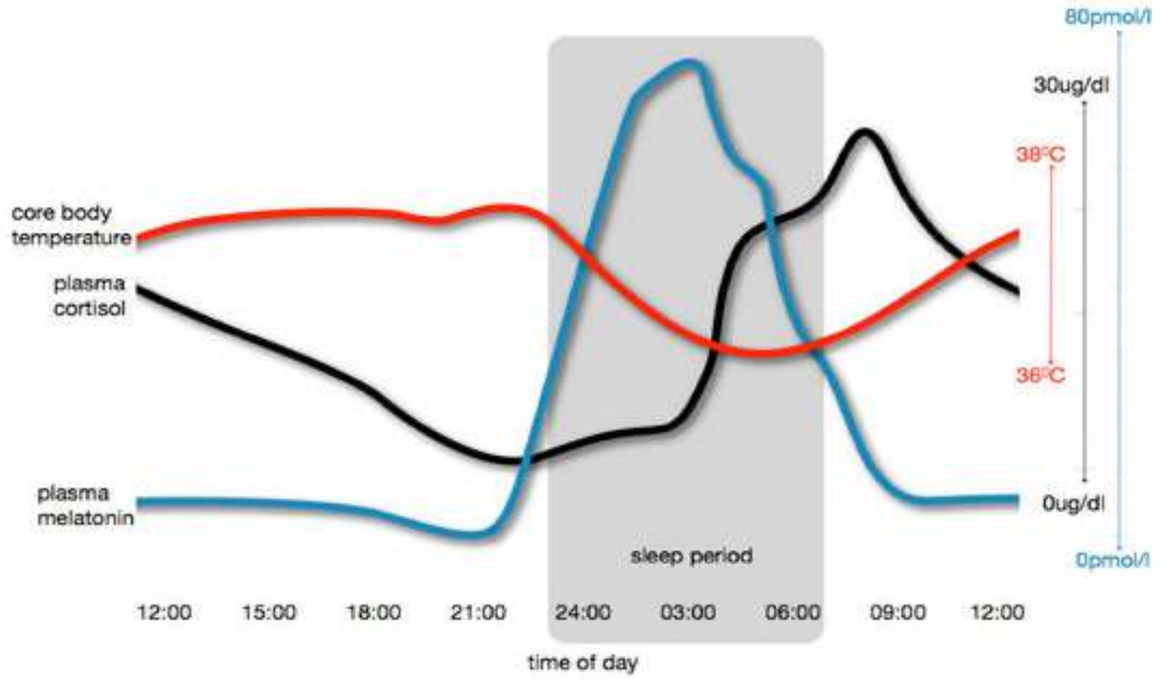
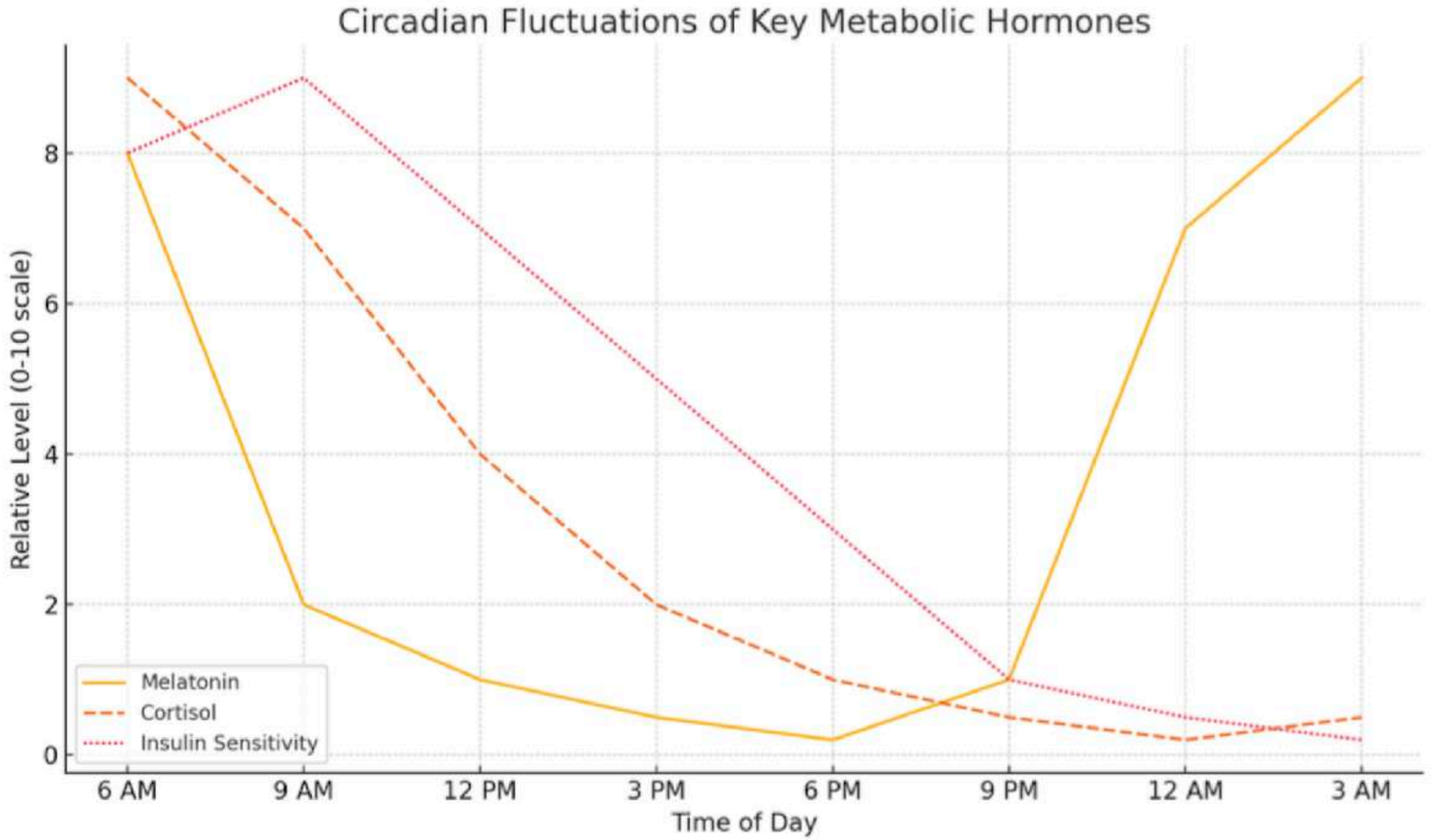
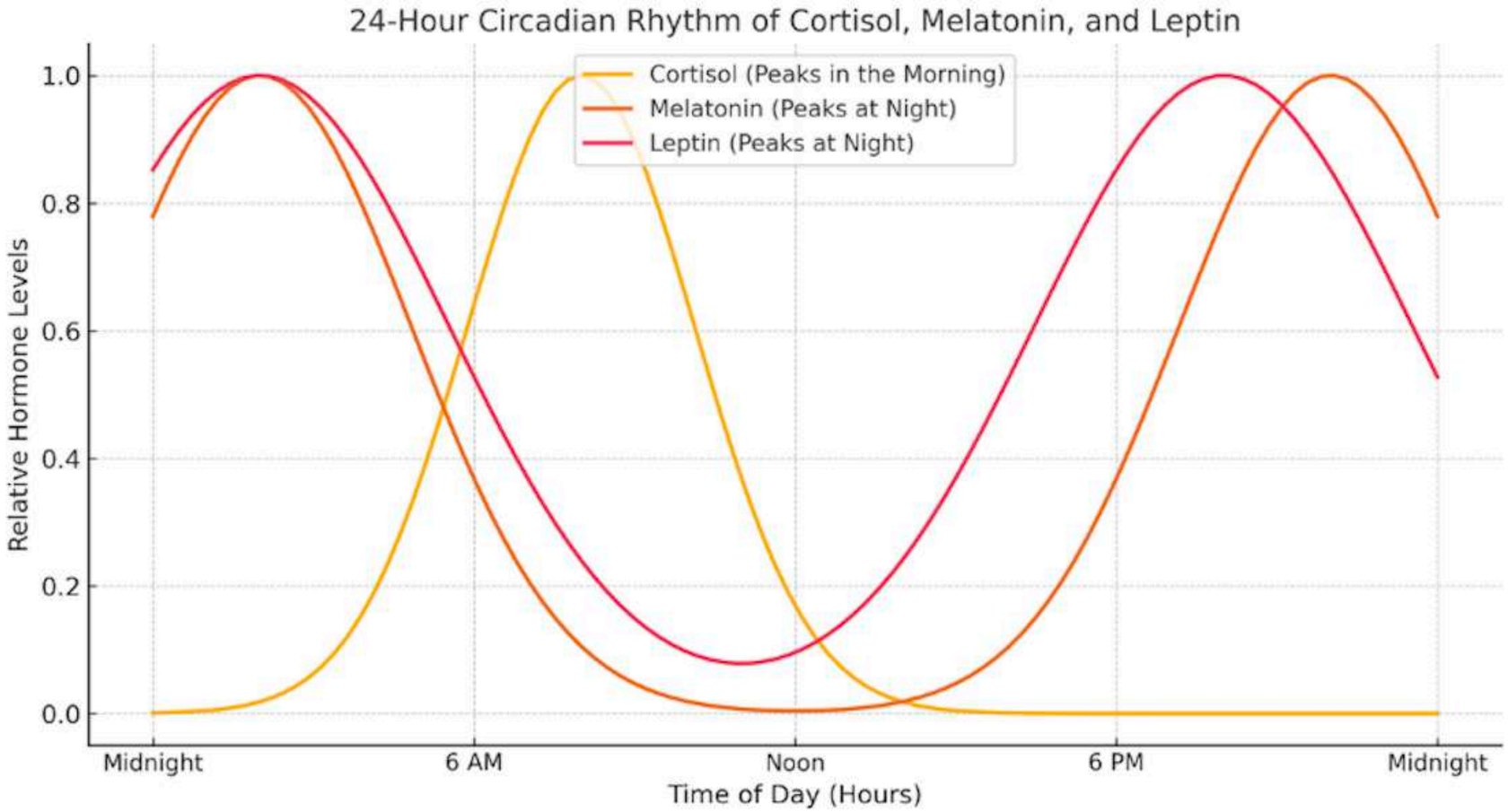


Figure 3: The normal synchronous relationships between sleep and daytime activity and varying levels of cortisol, melatonin and body temperature

Light and Metabolism



Light and Metabolism



Light and Metabolism[12]

When it comes to weight:

- Metabolism is a major physiological process under circadian control - thus, disruption of circadian rhythms such as exposure to light at night might be expected to affect metabolism[13]
- Indeed, studies of night-shift workers and other epidemiological studies, as well as laboratory studies of non-human animals have established strong relationships between exposure to light during the night and dysregulated glucose, increased prevalence of metabolic syndrome, and obesity.[14]

Dark matters: effects of light at night on metabolism

Randy J. Nelson[1,*] and **Souhad Chbeir**[2]

[1]Department of Behavioral Medicine and Psychiatry, West Virginia University, Morgantown, WV 26505, USA

[2]Department of Neuroscience, The Ohio State University, Columbus, OH 43210, USA

Abstract

Life on earth has evolved during the past several billion years under relatively bright days and dark night conditions. The wide-spread adoption of electric lights during the past century exposed animals, both human and non-human, to significant light at night for the first time in their evolutionary history. Endogenous circadian clocks depend on light to entrain to the external daily environment and seasonal rhythms depend on clear nightly melatonin signals to assess time of year. Thus, light at night can derange temporal adaptations. Indeed, disruption of naturally evolved light-dark cycles results in several physiological and behavioural changes with potentially serious implications for physiology, behaviour and mood. In this review, data from night-shift workers on their elevated risk for metabolic disorders, as well as data from animal studies will be discussed. Night-shift workers are predisposed to obesity and dysregulated metabolism that may result from disrupted circadian rhythms. Although studies in human subjects are correlative, animal studies have revealed several mechanisms through which light at night may exert its effects on metabolism by disrupting circadian rhythms that are associated with inflammation, both in the brain and in the periphery. Disruption of the typical timing of food intake is a key effect of light at night and subsequent metabolic dysregulation. Strategies to avoid the effects of light at night on body mass dysregulation should be pursued.

Light and Metabolism

Leptin:

- Hormone released by your fat cells.
- Sends signals to your brain about how much energy you have stored.
- Plays a key role in regulating thyroid activity by telling your brain how fast or slow to run your metabolism.

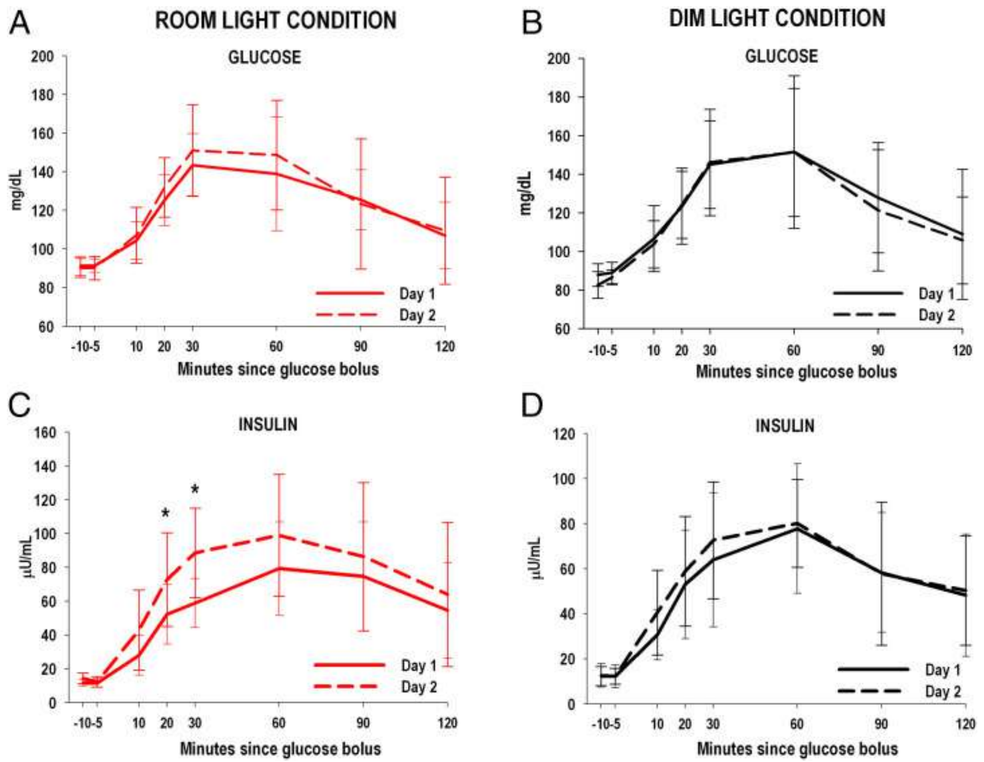
Leptin resistance can cause metabolic issues:

- It can be caused by chronic inflammation (e.g. mycotoxins), excess body fat, poor light exposure, and disrupted circadian rhythms.
- Resistance leads to a breakdown in metabolic communication and often low T3 (active thyroid hormone).

Light and Cardiometabolic Function[15]

Ambient nighttime light exposure is implicated as a risk factor for adverse health outcomes, including cardiometabolic disease; in healthy adults, one night of moderate (100 lx) light exposure during sleep:

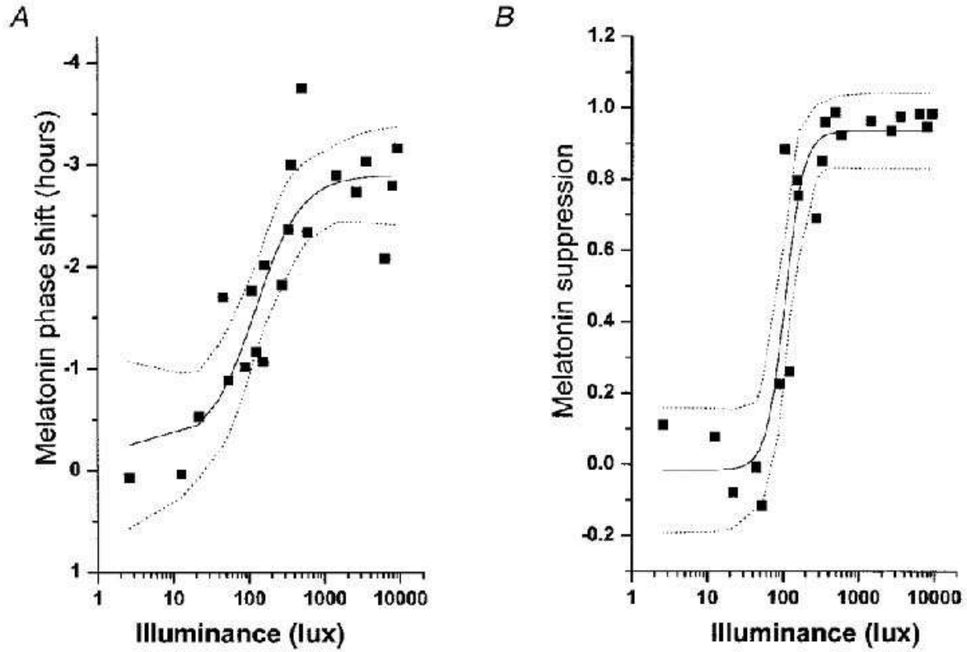
- increases nighttime heart rate
- decreases heart rate variability (higher sympathovagal balance)
- increases next-morning insulin resistance when compared to sleep in a dimly lit (<3 lx) environment



Light and Cardiometabolic Function[16]

Melatonin increases insulin resistance:

- eating in a high-melatonin state worsens glucose tolerance and insulin response
  - avoid eating between sunset and sunrise
  - ensure exposure to morning sunlight on rising to stimulate cortisol and clear melatonin and, in turn, optimise insulin sensitivity

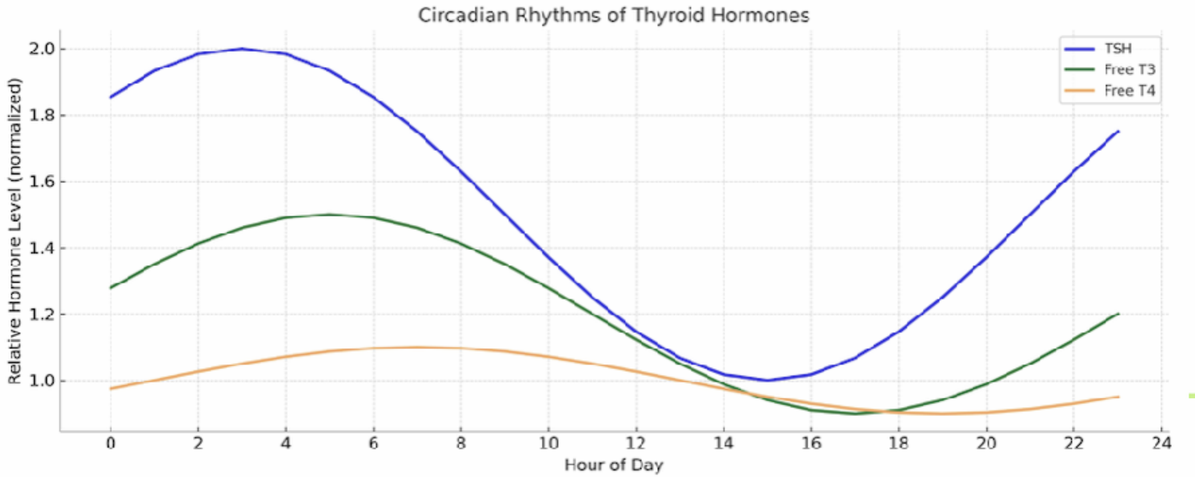


Light and Thyroid

- Thyroid function varies on a circadian, infradian (for women, indirectly) and circannual basis.

TSH Levels:

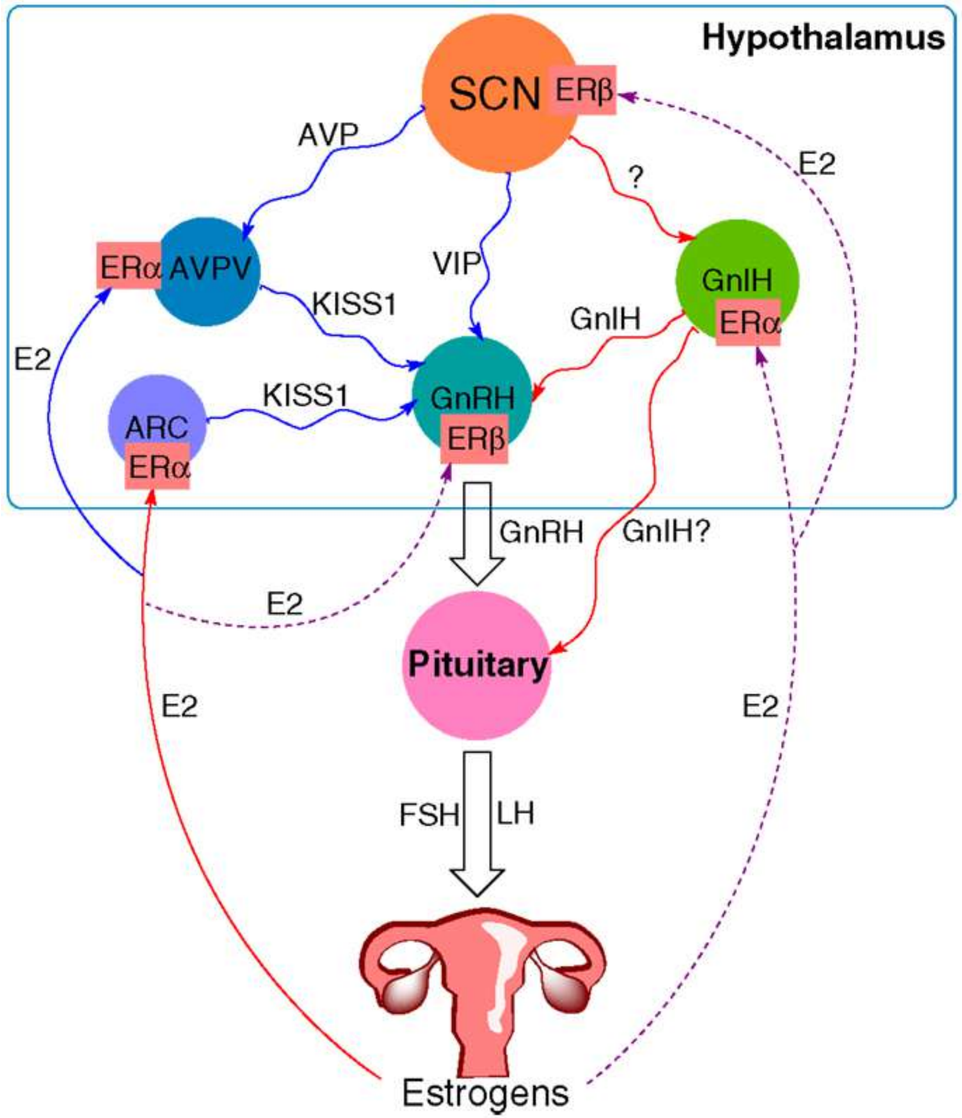
- Higher in Winter: Increased TSH levels are observed during colder months.
- Lower in Summer: TSH levels tend to decrease during warmer months.
- Free T3 and T4 are less consistent across studies, but some report higher free T3 in winter.



Light and Hormone Production[17]

The role of circadian rhythmicity in reproduction is becoming more and more evident.

- Defects of the clock or impaired steroidogenesis influence reproduction; defects in functionally related genes, such as Clock and Bmal1, have different outcomes, with former showing decreased reproduction rates, while the latter proving infertile.
- Signals by estradiol and the SCN together are crucial for the start of an LH surge with the resulting ovulation.
- Estradiol and circadian signalling pathways are more intimately connected with evidence for their interplay on the molecular level. The core clock genes were found to interfere with estradiol signaling, while estradiol was shown to alter the rhythms of Per1 and Per2 gene expression in various tissues.
- Cholesterol synthesis itself is rhythmic, and interferes with steroidogenesis in the ovary via the downregulation of LHR



Light and Hormone Clearance

Light is the master regulator of your hormonal rhythm- because your circadian clocks control oestrogen metabolism at every level:

- Liver enzymes (CYP450) that detoxify oestrogen are circadian-regulated; In one study, 24-hour rhythmic gene expression regulated up to 83% of the genome, including oestrogen receptors and detox enzymes [18]
- Another study found that blue light at night impairs oestradiol signalling and worsens hormonal imbalance[19]

Furthermore:

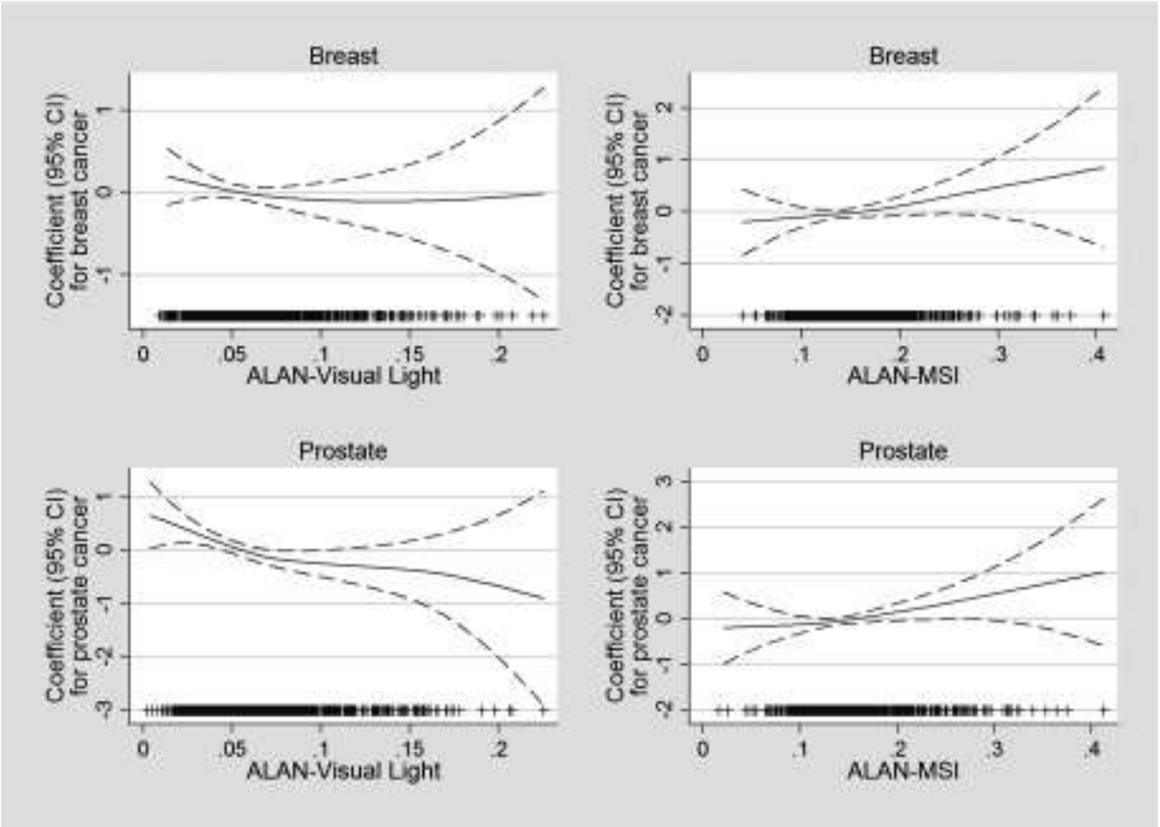
- Gut motility (which clears oestrogen in phase 3) follows light/dark cues
- Melatonin - a natural aromatase inhibitor - is suppressed by artificial light at night
- The hypothalamic-pituitary-gonadal axis (which governs oestrogen production) is entrained by sunrise and sunset light

Light and Breast Cancer[20]

Exposure to ALAN in the blue light spectrum was associated with breast cancer and prostate cancer.

Compared with those who reported sleeping in total darkness, men who slept in "quite illuminated" bedrooms had a higher risk of prostate cancer .

Both prostate and breast cancer were associated with high estimated exposure to ALAN in the blue-enriched light spectrum.



Light and Breast Cancer[21]

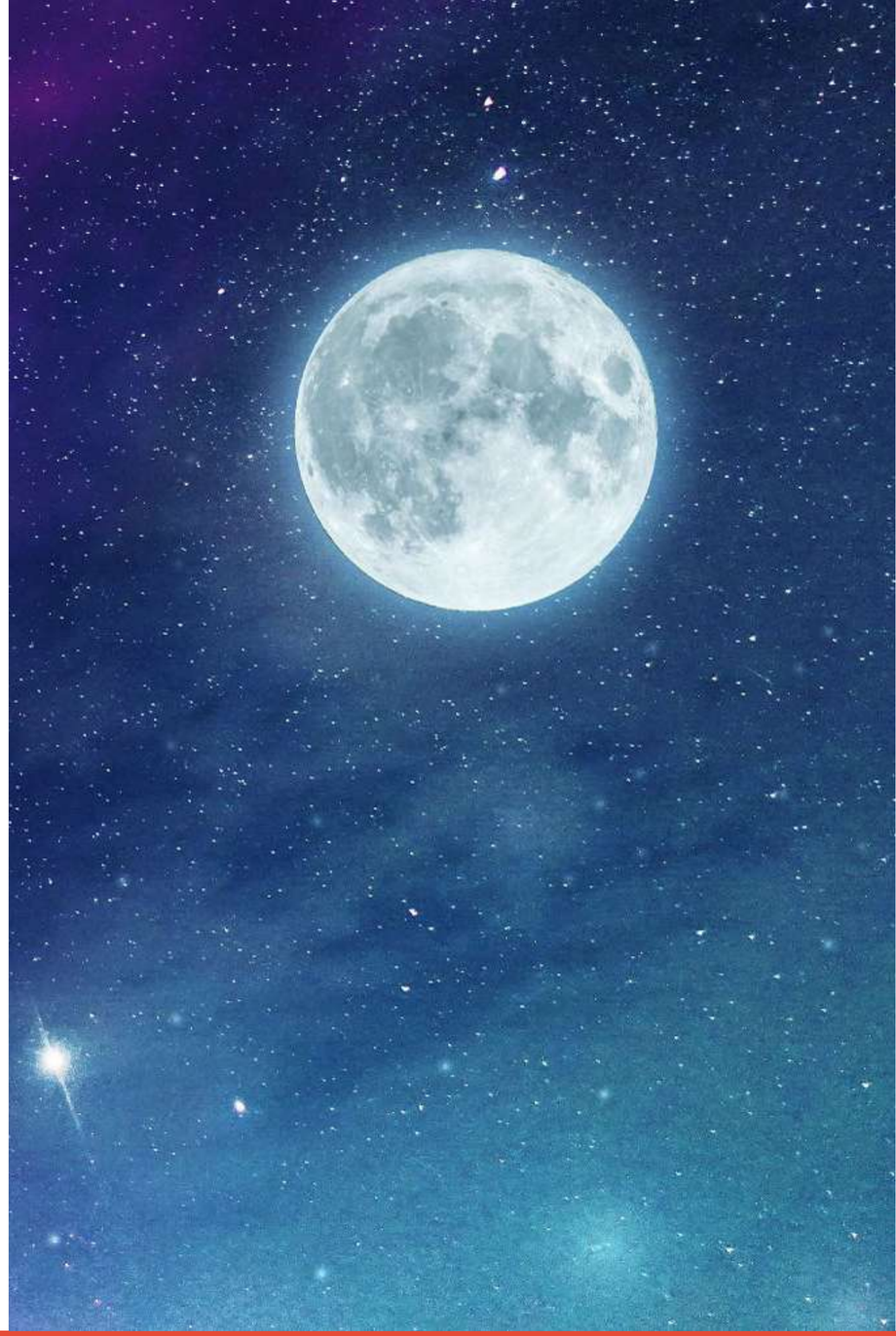
Exposure to NIR-light for 20 minutes per day for six days significantly increased the level of senescence in MCF7 breast cancer cells (13.5%; $P<0.01$), with no observable effects on MCF10A or IMR-90 cell lines.

NIR-induced senescence was associated with significant changes in mitochondria homeostasis, including raised ROS level and mitochondrial membrane potential, with no changes in mitochondrial Ca2+.

These results suggest that NIR-light exposure can significantly arrest the proliferation of breast cancer cells via inducing senescence, while leaving non-cancerous cell lines unaffected.

Light and Fertility[22]

- Melatonin, which is suppressive to gonadal function, seems to have its highest secretion during the new moon.
- A 1986 study of 800+ women showed this was the most common pattern, and that the difference in melatonin levels between menstruation and ovulation was significant with lowest levels coinciding with a menstrual period during a new moon and lowest levels 3-4 days prior to the full moon preceding ovulation.



Light and Fertility

"Looking at the data, we saw that period start dates fall randomly throughout the month, regardless of the lunar phase."

—Dr. Marija Vlajic Wheeler

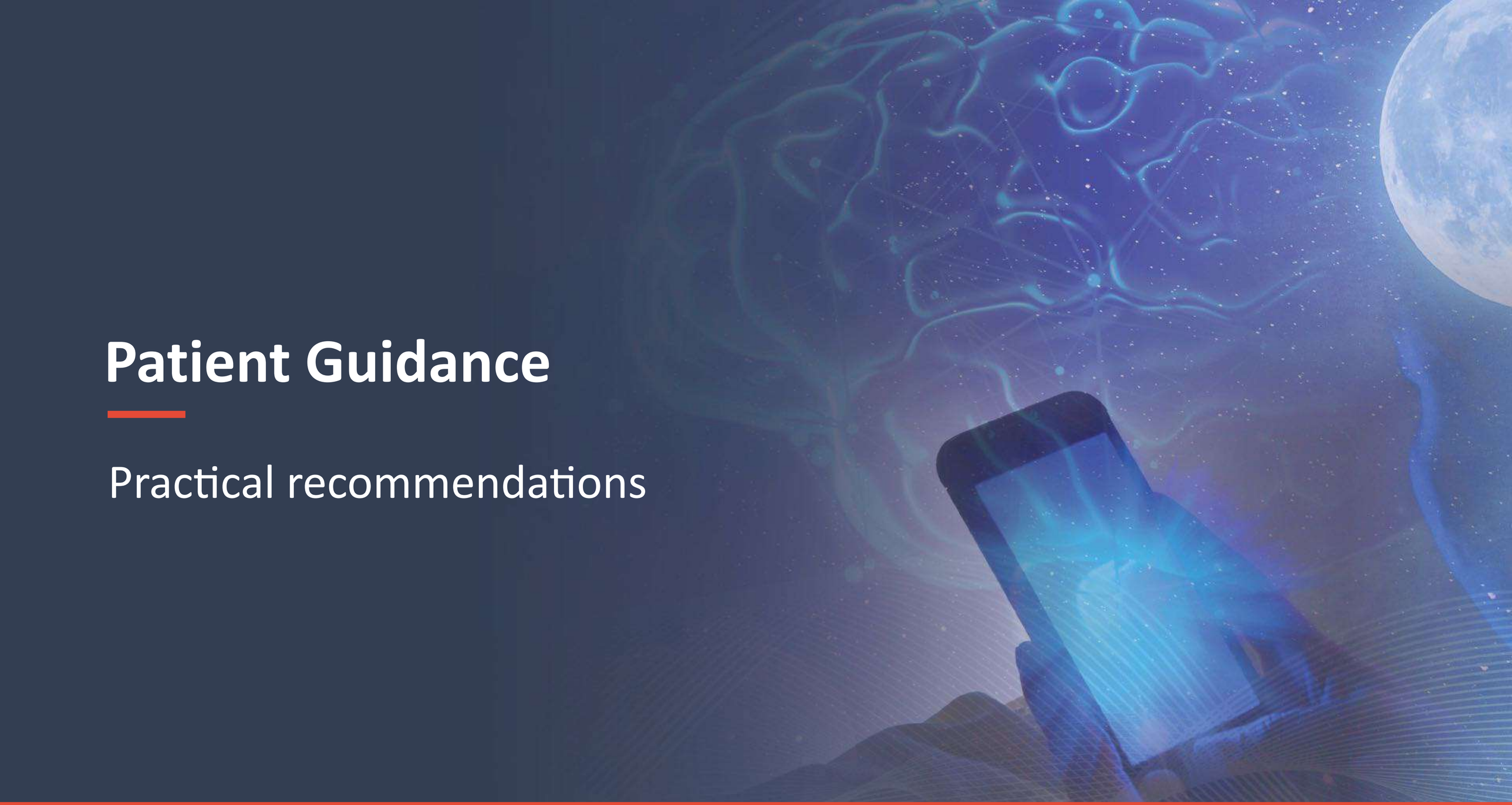
{analysis of 7.5 million cycles via Clue app}

Light and Puberty

- Rat models have investigated the effects of blue light exposure on reproductive hormone levels and the time of puberty onset[23,24,25]
  - Female rats were divided into three groups of six and exposed to either a normal light cycle, six hours or 12 hours of blue light. The first signs of puberty occurred significantly earlier in both groups exposed to blue light, and the longer the duration of exposure, the earlier the onset of puberty.
  - Rats exposed to blue light also had reduced melatonin levels and elevated levels of oestradiol and luteinising hormone, as well as physical changes in their ovarian tissue, all consistent with puberty onset. At the 12 hours exposure, rats also showed some signs of cell damage and inflammation in their ovaries.
- Children are twice as sensitive to blue light exposure resulting in melatonin suppression compared with adults[26]

Patient Guidance

Practical recommendations



Optimal Circadian Rhythm

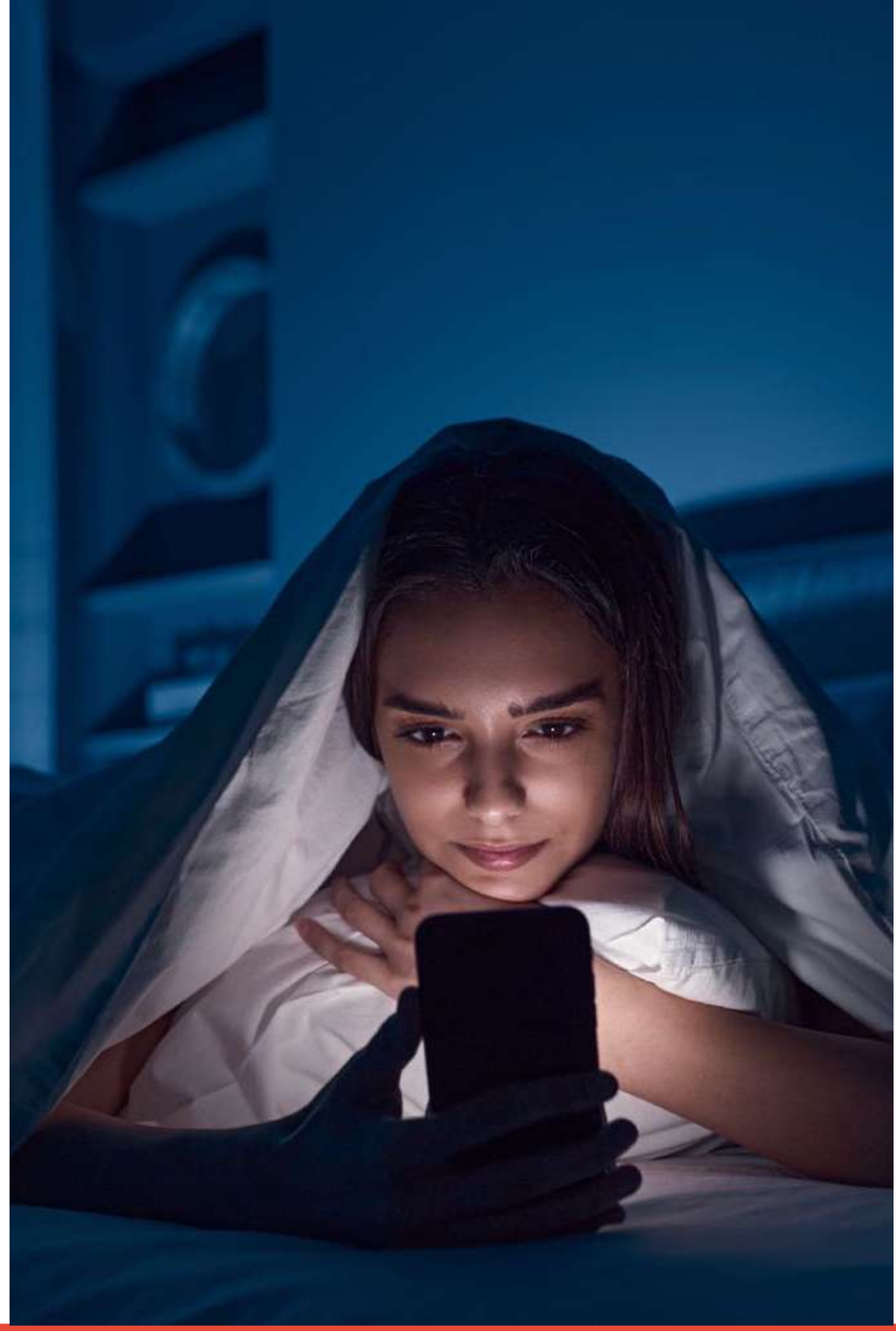
- Watch the sun come up in the morning, and the sun go down in the evening, as often as you can.
- Between sunset and sunrise avoid artificial light as much as possible.
- In the evening, avoid high carbohydrate meals and desserts as sugar suppresses melatonin production (via cortisol).
- Consider minerals, herbal medicine and/or melatonin to reset your sleep/wake cycle.

Light Management

Light management is all about eliminating blue light or reducing its effects on you as much as possible and utilising natural sunlight to prompt optimal hormone and neurotransmitter synthesis - and ultimately restoring the balance of light and dark.

What this means is:

- Reducing or eliminating exposure to blue light between sunset and sunrise as much as possible, and
- Ensuring optimal exposure to healthy levels of natural sunlight.



Blue Light Solutions – Lighting

In an ideal world we'd only be exposed to candlelight or the flames of a fire after dark, however this is impractical for most of us - so the next best thing is swapping out our light bulbs for ones that do not emit blue or green light.

Blue Light Solutions – Lighting

- Avoiding artificial light (and therefore unnatural levels of blue, green and violet light) can look any number of ways depending on what works for your lifestyle.
- Use ‘red’ light at night for indoor lighting by replacing the CFL and LED lights with incandescent light such as the OLED battery operated candlelight from IKEA. (incandescent bulbs are the closest you can get to ‘natural light’)
- Red nightlight for bathroom or torch.
- Avoid LED lights.
- Block out blinds to keep external artificial light out of bedrooms and living areas.

Blue Light Solutions – Lighting

	GOOD	BETTER	BEST
Digital devices ie. phone, iPad, laptop, desktop computer	When using your digital devices wear blue blockers – between sunset and sunrise wear the red ones (and cover your skin as much as possible)	When using your digital devices between sunset and sunrise put it in 'red/night mode'	Don't use your digital devices between sunset and sunrise
TV	When watching TV wear blue blockers – between sunset and sunrise wear the red ones (and cover your skin as much as possible)	Avoid watching TV between sunset and sunrise	Don't watch TV at all
Lights at home	When using lights wear blue blockers from sunset onwards and cover your skin	Change your LEDs to BioLight and/or change your pendant and lamp bulbs to the yellow (living areas) and red (bedrooms)	Don't use lights at all and use the light of flames (burn beeswax candles and/or have a fire)
Sleeping conditions	Don't leave lights on inside the home at night and draw curtains and blinds to reduce light coming from the outside	Use a sleep mask to block light from the eyes, and keep skin covered to limit light activation on the skin	Completely blacked out room (use blockout blinds and eliminate all sources of light)

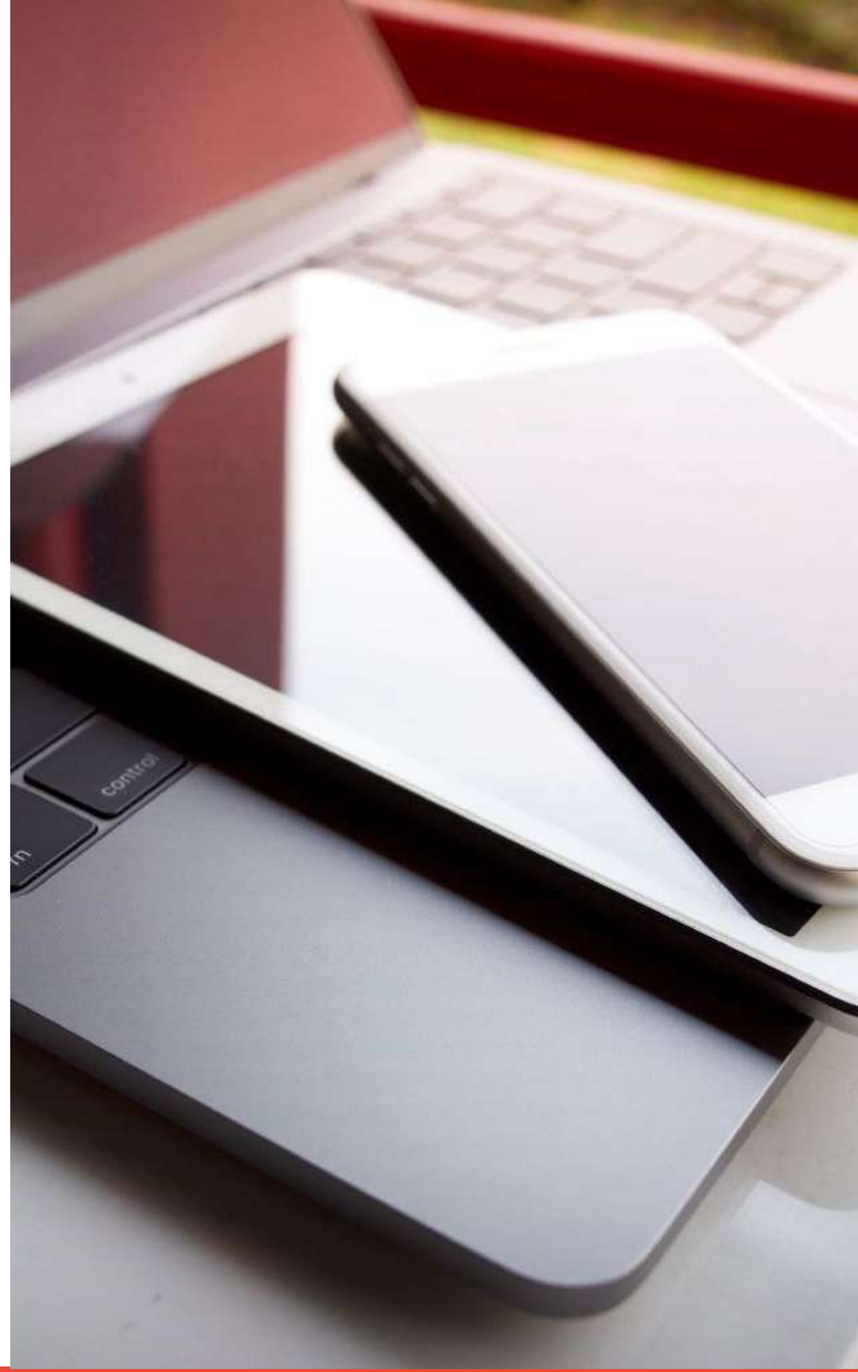
Blue Light Solutions – Lighting

- Lux must be below 10, and below 2 in bedrooms.
- Still need lux under 10 3 hour before bedtime.
- Lights should be below shoulder level, closer to the ground if possible.

Blue Light Solutions – Tech

Blue light from electronic devices can have harmful effects on health, especially when used outside of daylight hours. In addition to covering your skin, avoiding artificial light and/or wearing blue light blocking glasses, there are some strategies to address the blue light emissions from your devices in the event you are using them after dark.

- Avoid using a smartphone, television and digital devices after sunset and for at least one hour before bed.
- It’s important that children do not use digital devices after sunset i.e. watch TV, play on an iPad or phone.
- If you need to use a digital device or smart phone at night, install a blue light filter App.
- Use blue-light blocking glasses which are amber/orange spectacles.
- Cover your skin at night, as it is the largest organ in the body that absorbs light.



Blue Light Solutions – Tech

When it comes to using digital devices there are a number of apps, filters or strategies you can employ to reduce the amount of blue light coming off them:

- For computers and laptops you can use:
  - Iris (seems to be the best) works on a Mac or Windows: https://iristech.co/
  - F.lux for Mac: https://justgetflux.com/
  - Skyscreen for Windows: https://www.skytopia.com/software/sunsetscreen/

Blue Light Solutions – Tech

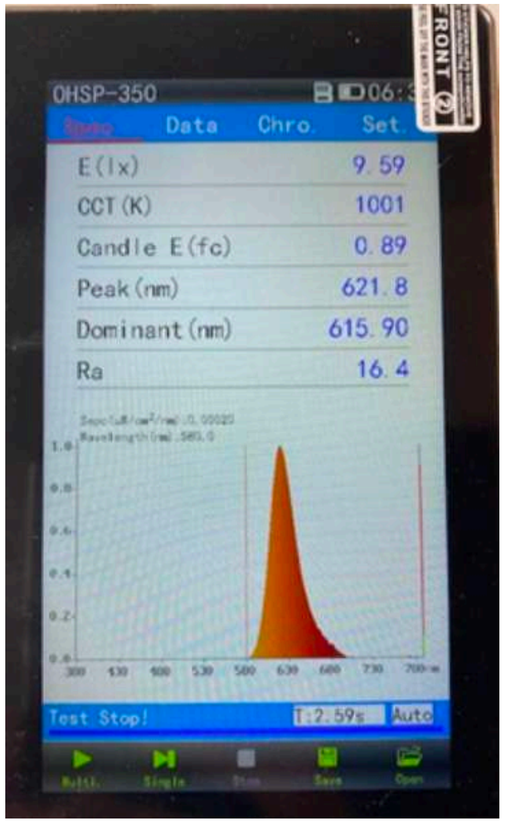
When it comes to using digital devices there are a number of apps, filters or strategies you can employ to reduce the amount of blue light coming off them:

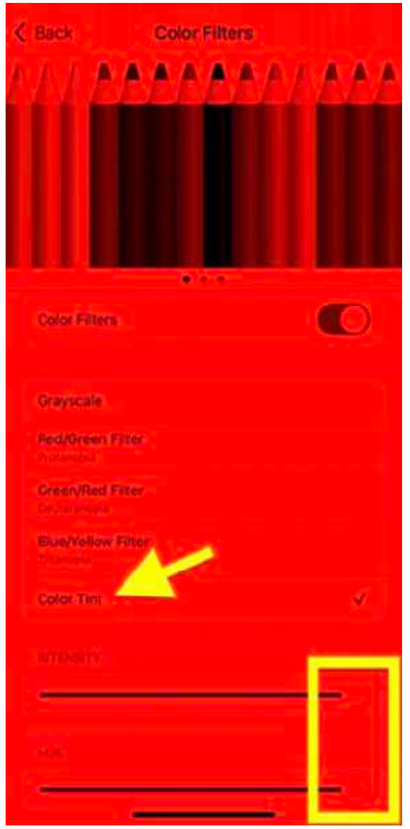
- For mobile phones you can use:
  - Twilight
  - Night mode
  - Iris
  - Dimly
  - Night owl

Blue Light Solutions – Tech

If you have an iPhone X or newer:

- **Step 1:** Find the "Colour Filters" section by going to Settings > General > Accessibility > Display Accommodations.
- **Step 2:** Select "enable colour filters" and then choose the filter "colour tint" as your default setting. Scroll down and locate the sliders for intensity and hue. To get the most benefits out of a red phone screen, both should be set to the maximum setting.
- **Step 3:** You may often need to toggle between your red filter and your normal screen. For instance, you could suddenly have to turn on your screen recorder for work. Save yourself the hassle of having to adjust your screen settings each time by creating a shortcut to your red iPhone setting.
  - Select Settings > General > Accessibility > Accessibility Shortcut > Colour Filters.
  - Once you're done, all you need to do is press the home button three times to switch between your default settings and your custom red screen.





Blue Light Solutions – Glasses

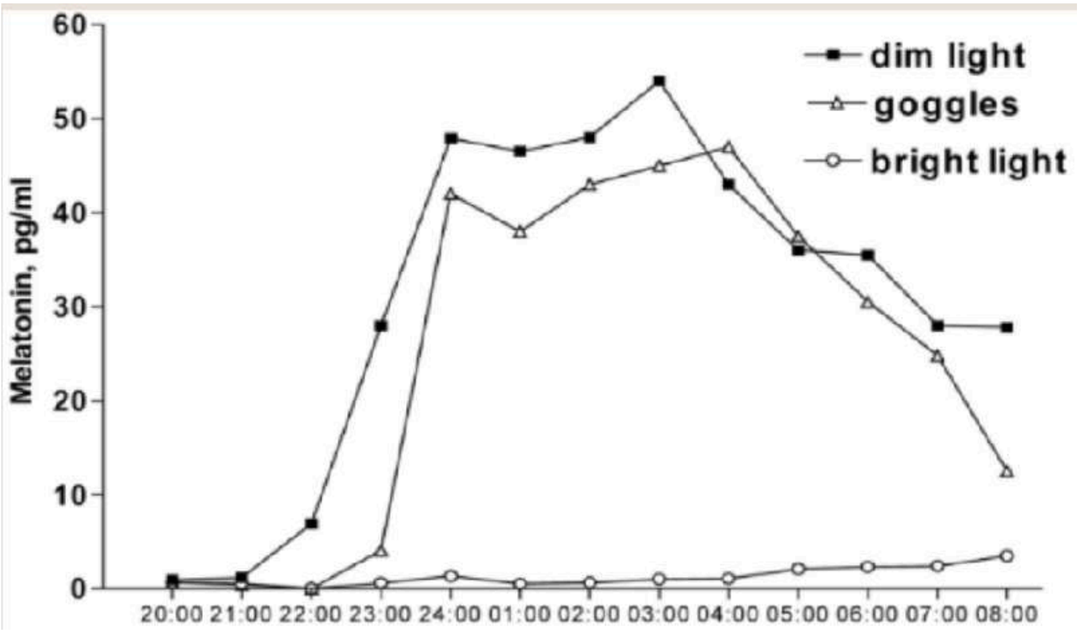
Blue-blocking glasses:

- Do not wear them whilst driving, during the day but especially night.
- Do not wear them during the day when outside at all.
- **Clear blue-blocking daylight lenses** are for whenever you must be indoors under fluorescent or LED lights or (in an office, a hospital, a store, and/or at school) or you're working on a computer, especially if for extended periods of time (more than 20-30 minutes) - many aren’t efficient, but good alit ones can block approx 50%of blue light.
- **Yellow blue-blocking lenses** are for during the day inside buildings, particularly good for sensitive people (migraines) — and blocks 95% of blue light
- **Red blue-blocking sunset lenses** are for any time you are exposed to man-made light sources after sunset, until sleep (excluding flames - light from candles or fire - and purely red and/or orange light sources) - these block 100% of the artificial blue and green light.
- **When purchasing look for spectrum report or electrospecrometer report.**
- Ensure you cover your skin as well.

Blue Light Solutions – Glasses

This graph illustrates the effect of different light conditions on melatonin production over a 12-hour period, from 8:00 PM to 8:00 AM. It compares the melatonin levels in individuals exposed to dim light, bright light, and bright light while wearing goggles that block specific wavelengths.

- Melatonin levels are highest in dim light conditions, peaking around 3:00 AM.
- Exposure to bright light drastically suppresses melatonin production, keeping levels consistently low throughout the night.
- Wearing goggles that block low-wavelength light in bright conditions allows melatonin levels to remain high, similar to the dim light profile.
- The study suggests that blocking specific light wavelengths can prevent the suppression of melatonin, even in bright environments.



Leonid Kayumov, Robert F. Casper, Raed J. Hawa, Boris Perelman, Sharon A. Chung, Steven Sokalsky, Colin M. Shapiro, Blocking Low-Wavelength Light Prevents Nocturnal Melatonin Suppression with No Adverse Effect on Performance during Simulated Shift Work, The Journal of Clinical Endocrinology & Metabolism, Volume 90, Issue 5, 1 May 2005, Pages 2755–2761, https://doi.org/10.1210/jc.2004-2062 - https://academic.oup.com/jcem/article-abstract/90/5/2755/2836826?redirectedFrom=fulltext&login=false

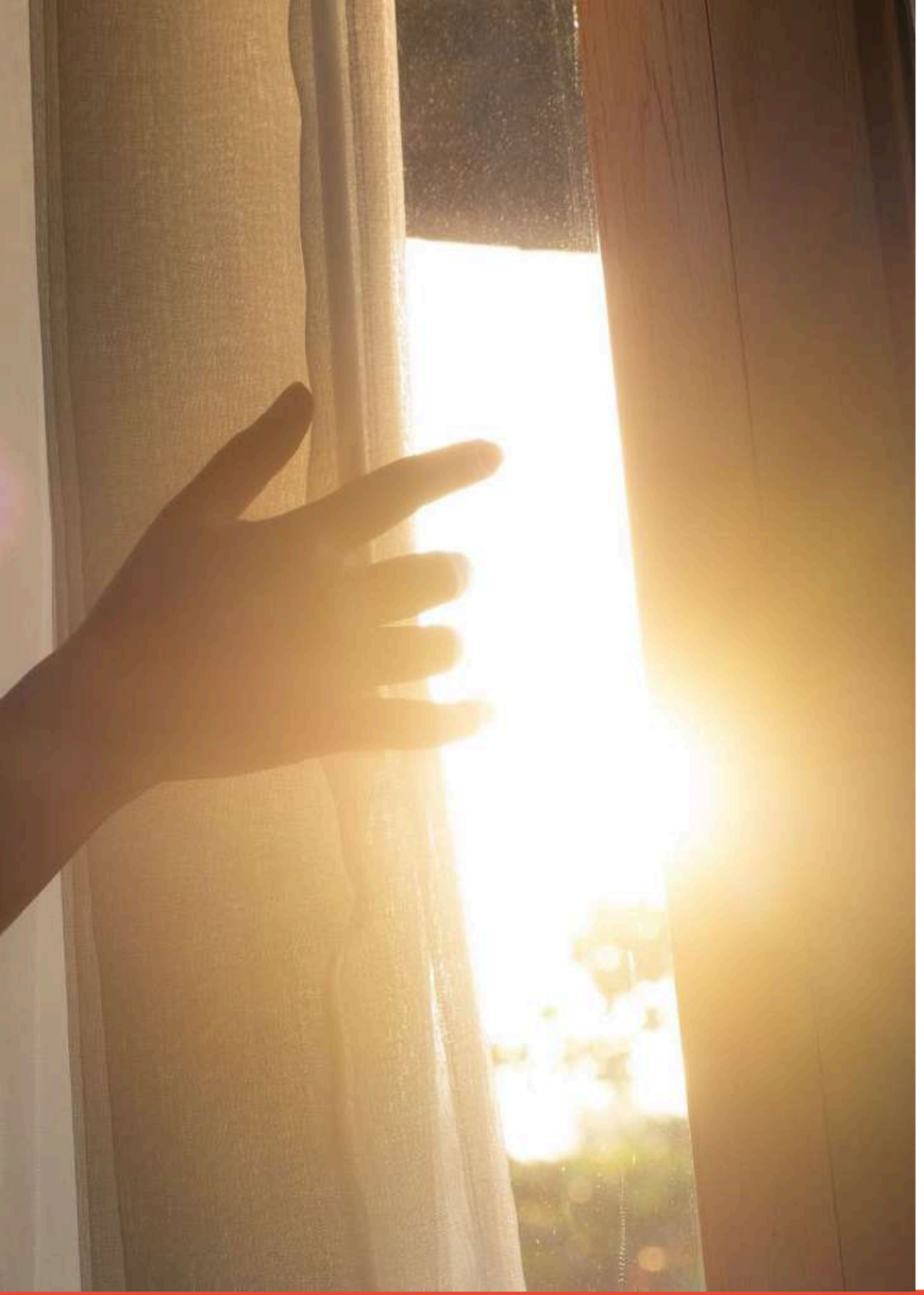
Blue Light Solutions – Sunglasses

- Commercial sunglasses block light signals to the melanopsin cells in the retina (and therefore between the brain and skin) increasing likelihood of burning.
- Biohacker sunglasses
  - allowing beneficial red light through, filtering blue light, providing unmatched anti-glare and 100% UV blocking technology.
- Our sunglasses also ensure that all colour of visible light passes through the lenses and they do not block ALL blue light which is ideal for use outside during the day.

Blue Light Solutions – Glasses

How to test the glasses you have:

- To test your computer glasses to see if they are blue light glasses, you should do one of two things. Use a lab grade spectrometer. These are not easy to come by, or cheap for that matter. However, they will provide the most accurate reading for showing if your glasses are blue light blocking and will show the exact amount of blue light your glasses block across the blue light spectrum.
- You can also see what colour your lenses are reflecting. An authentic pair of computer glasses will show a blue reflection when tilted towards an artificial light source. If your blue light glasses are reflecting purple or green light, they may only have an anti-reflective filter and not a blue light filter. This indicates your glasses are not blue light blocking.
- A test to avoid is the blue laser pen test. This test is just a marketing strategy as the pen does not even emit blue light rendering it useless.

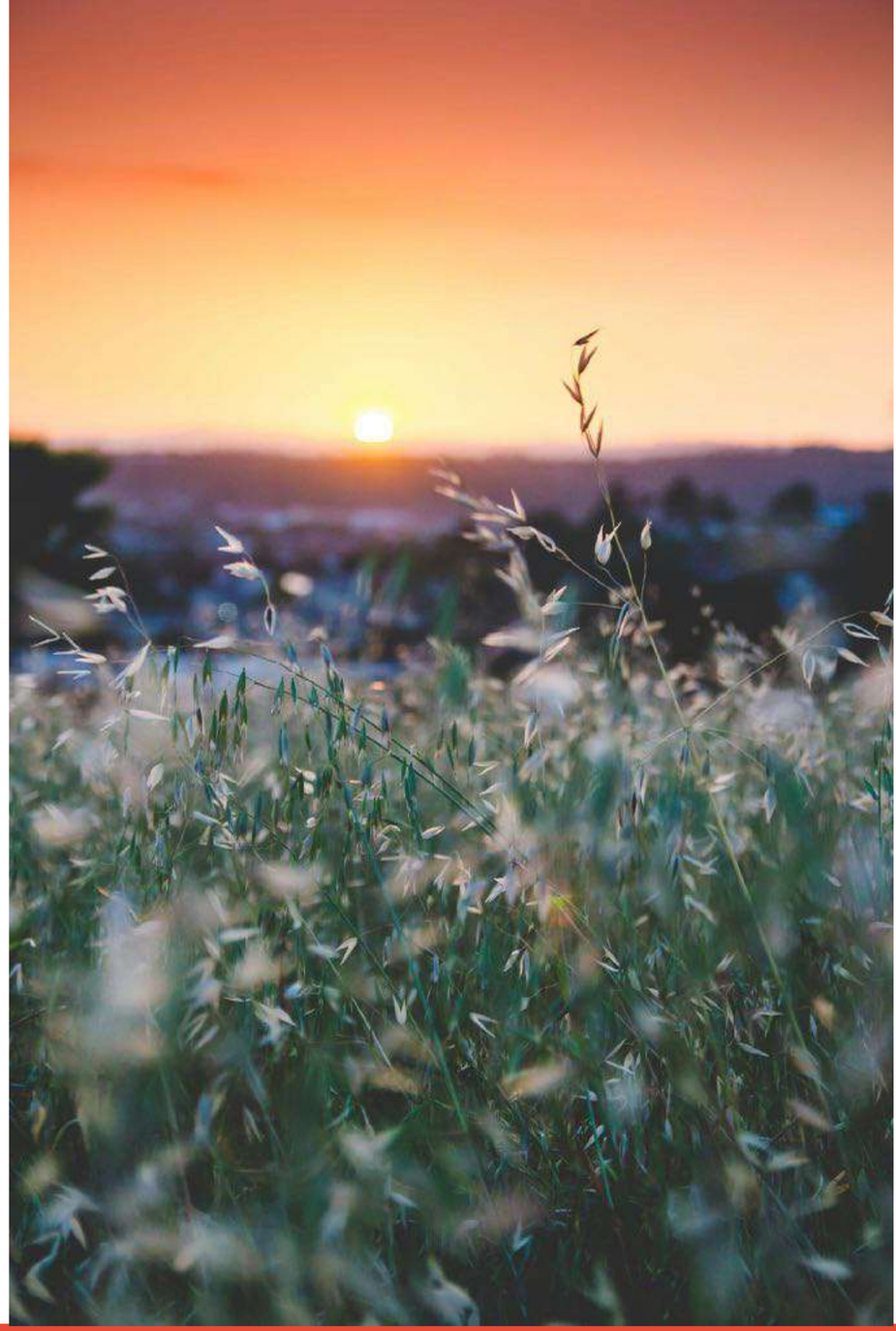


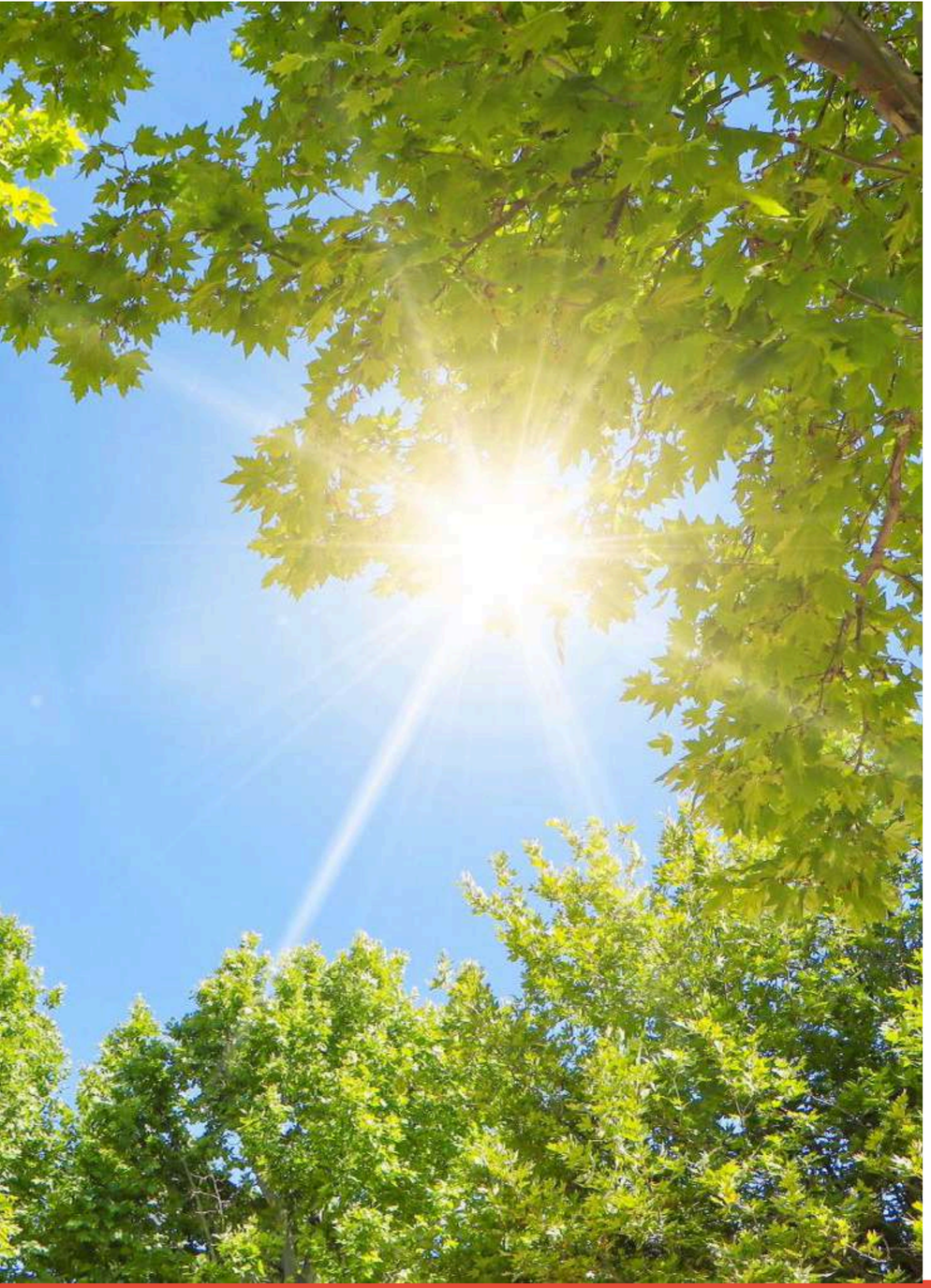
The Light Diet

- Ideally you would expose your bare eyes, and a seasonally appropriate amount of skin to the sun for 5-20 minutes at sunrise and sunset, and 5-10 minutes of midday sun.
- WATCH THE SUNRISE - Go out and watch the sun rising for at least 10-15 minutes, every day, as close to sunrise as possible. More is great. Remove sunglasses, eyeglasses, and contact lenses. Aim to go barefoot on the earth to experience the benefits of grounding/ earthing whenever you are taking in sunlight.
- WATCH THE SUNSET: As with sunrise, aim to watch the sunset or late afternoon sun for at least 10-15 minutes every day. More is great.

The Light Diet

- EAT WITH THE SUN: Eat a medium-sized breakfast, lunch as your heaviest meal between 11am-1pm, and a lighter dinner, ideally before 5pm in winter, and before 7pm in summer.
- SLEEP WITH THE SUN: Aim to begin winding down with sunset and go to sleep within 2-3 hours of sunset, and/or before 10pm at least 5 nights per week.





The Light Diet

- Aim to go outdoors at least once every hour for 5-10 minutes, or every 2 hours for 15-20 minutes. Aim for at least 1 hour (ideally 2 hours) per day of unfiltered daylight exposure on your eyes, without sunglasses, glasses, or contact lenses.
- Practice safe sun exposure** around mid-day (between 10am and 2pm) at least once daily for 2-12 minutes on each side of the body depending on the season you're in. If pale or prone to burning, start exposure slowly starting with 1-2 minutes per day and increasing by 1-2 minutes per day. Do not burn; if you do, take a few days off to heal, and start back up with less exposure.

The Light Diet

Fitzpatrick Scale Explained

Type I	Type II	Type III	Type IV	Type V	Type VI
Light, Pale White	White, Fair	Medium White to Olive	Olive Tone	Light Brown	Dark Brown
Always burns, never tans	Usually burns, tans with difficulty	Sometimes mild burn, gradually tans to olive	Rarely burns, tans with ease to moderate brown	Very rarely burns, tans very easily	Never burns, tans very easily, deeply pigmented

Moonlight

- Moon bathing is an ancient practice and, alongside managing natural and artificial light exposure, can support menstrual cycles.
- Exposing your eyes and skin to moonlight for 10 minutes every night is ideal.

Nutrition and Lifestyle Habits

- Co*nsistent m*orning sunlight exposure.
- Consuming breakfast within 30-60 mins of waking (before UVA rise).
- No snacking after sunset (allows leptin to rise naturally).

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