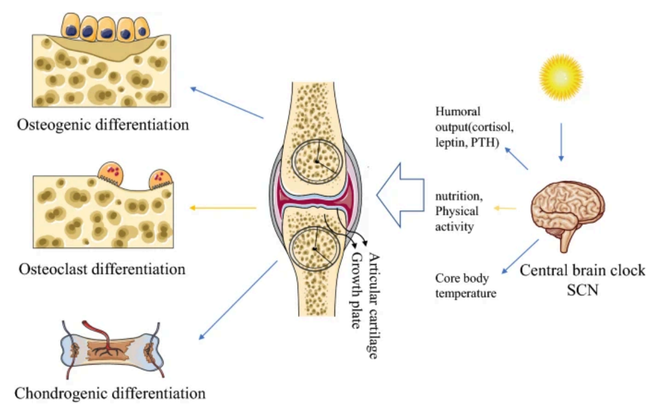
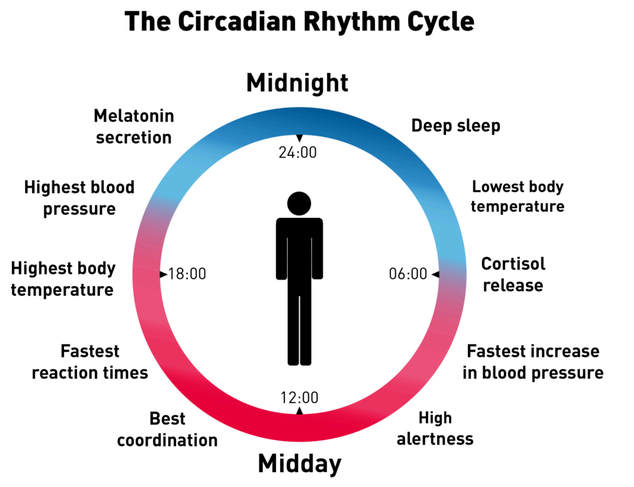
Sleep/Circadian Optimization

Calibrating Your Circadian Rhythm for Optimal Height Growth

The Role of the Circadian RhythmThe circadian rhythm is the body's natural, internal process that regulates the sleep-wake cycle and repeats roughly every 24 hours. It is controlled by the "biological clock" in the brain, specifically in the suprachiasmatic nucleus (SCN) located in the hypothalamus. External cues such as light, darkness, and temperature play a major role in influencing this rhythm. When properly calibrated, the circadian rhythm promotes deeper, more restorative sleep, which is essential for height growth. Studies show that exposure to the orange or red hues of the sun during sunrise and sunset helps signal the body to align with the natural rhythm of the day, optimizing hormone regulation and repair processes during sleep.





Source: Press release. NobelPrize.org. Nobel Media AB 2021. Fri. 8 Jan 2021.<https://www.nobelprize.org/prizes/medicine/2017/press-release/>

Circadian Rhythm and the Endocrine System
The circadian rhythm has a profound impact on the endocrine system. It regulates the secretion of **cortisol** and **melatonin**, which in turn influences every other hormone in the body.

- **Daytime**: Increased **Sympathetic Nervous System (SNS)** activity supports alertness, higher energy levels, and physical activity. However, SNS activation also promotes **bone resorption** (breaking down bone tissue).
- **Nighttime**: During the evening and sleep, the **Parasympathetic Nervous System (PNS)** becomes dominant, promoting **osteogenesis** (bone formation) and overall recovery.

Research confirms this dual role:
"Activation of the sympathetic nervous system acts to stimulate bone resorption as well as negatively affect bone formation. Conversely, the parasympathetic nervous system activity inhibits bone resorption, which results in bone mass accrual." (Source: https://pubmed.ncbi.nlm.nih.gov/35143910/)

Liver Function and Height Growth
A well-regulated circadian rhythm is critical for liver function, especially the activity of **cytochrome P450 enzymes** responsible for detoxification. Disruption of the rhythm can impair these enzymes, which has cascading effects on height growth.

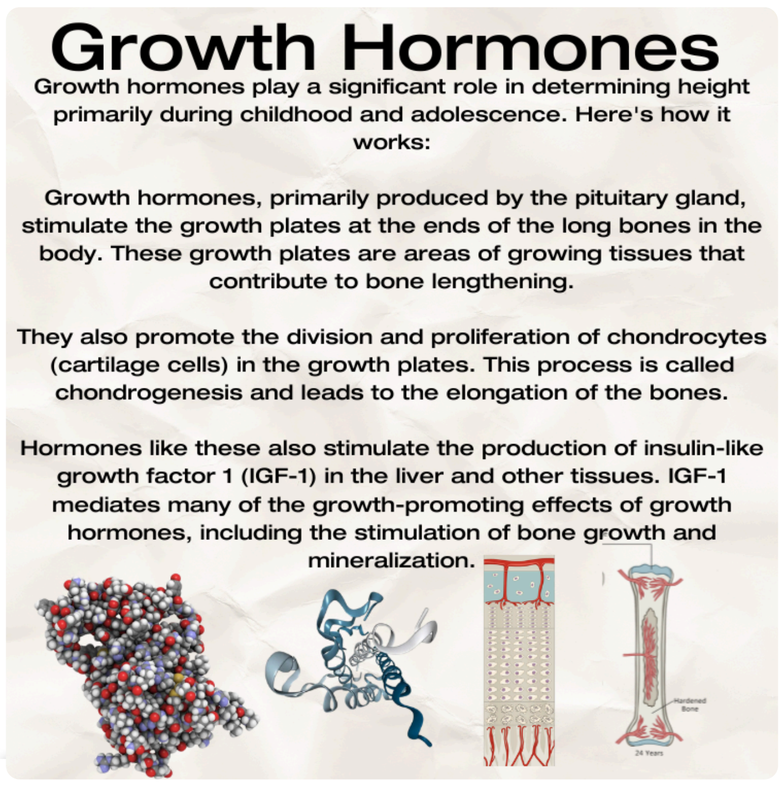
Key roles of the liver in growth include:

- **Detoxifying estrogen** to prevent premature growth plate closure.
- **Converting T4 into T3**, the active thyroid hormone essential for metabolism and bone growth.
- **Synthesizing IGF-1**, a crucial growth factor produced in response to human growth hormone (HGH).

How to Protect and Optimize Your Circadian Rhythm

- **Watch the Sunrise and Sunset**: Exposure to these natural light cues helps signal the body to align with the day-night cycle.
- **Limit Blue Light Exposure at Night**: Use blue light blockers or filters to minimize the disruptive effects of artificial lighting.
- **Get Ample Sunlight During the Day**: Sunlight exposure boosts serotonin production, a precursor to melatonin, and reinforces the circadian rhythm.
- **Sleep in a Cool Room**: A cooler environment supports deeper sleep and better recovery.

By aligning your lifestyle with your natural circadian rhythm, you can significantly improve the hormonal and restorative processes necessary for height growth.Sleep is also extremely important for the production of various growth hormones, and the timing of sleep also matters.



Please stress the importance of sleep, some factors which are not widely known but are fundamental to sleep. Sleep research is a very new field in general.

TLDR: sleep is a largely physiological process highly dependent on core body temperature resulting from light/ dark exposure to the eyes. If you're worrying about Vitamin D3, melatonin, or relaxation techniques without taking care of your light/ dark exposure, you're missing the forest for the trees.

4 Main Processes Driving Sleep
– Circadian Rhythm/ Body Clock
– Homeostatic Sleep Pressure
– Ultradian Rhythm
– Psychological Factors

Circadian Rhythm/ Body Clock
– Roughly 24h cycle that regulates all body processes
– Greatest tendency to sleep occurs during a) your circadian night, and b) your circadian siesta (when people nap in the afternoon)
– Sleep is induced when the hypothalamus reduces core body temperature in response to light and darkness
– Most powerful signal to manipulate the circadian rhythm is **Light and Darkness as detected by the eyes**
– Other signals that can shift the body clock are temperature, food, exercise, melatonin, body posture, and socializing
– This process explains why you sleep/ have bowel movements at mostly the same time everyday
– Also explains jetlag which is a sudden drastic shift in light/ dark exposure

Image: daily variation in core body temperature. Note the drops in temperature during the circadian night beginning at ~11pm, as well as the afternoon dip in temperature during the circadian siesta at ~11am

Homeostatic Sleep Pressure
– Tendency for sleep increases linearly with time awake, akin to pressure accumulating
– Sleep pressure dissipates when you sleep
– Coffee keeps you awake by reducing buildup of sleep pressure
– This process is why you feel tired if you stay up the entire night (excessive sleep pressure has built up), and why you generally don't feel tired when you wake up from a long sleep (you've dissipated most of your sleep pressure)

Ultradian Cycle
– 80 min to 2h mini cycles within your circadian rhythm
– Increased tendency for sleep occurs in the 20-30 mins between each ultradian cycle
– Explains why afternoon naps without alarms are usually in multiples of 80mins-2h (without alarms I either nap 80 min or 2h 40min, no in between)
– Also explains why if you feel sleepy at night and resist the urge to sleep for 20-30 mins, you won't feel tired until the next ultradian cycle

Psychological Factors
– Psychological state is dependent on your circadian rhythm. You feel more active during your circadian day and more relaxed during your circadian night
– Can be influenced acute stimuli or autonomous decisions (i.e. viewing rage-inducing evisceration threads at night)
– You need to take advantage of all 4 of these processes to sleep well

HOW TO SLEEP BETTER (in descending order of importance)

1. Consistency in timing of light exposure, and sleep/ wake times
2. Bright days + dark nights
3. Sleep during your circadian night
4. Dim lights & avoid blue light starting 2-3h before bedtime
5. Avoid excessively long afternoon naps close to bedtime
6. Avoid procrastination when you feel sleepy at night
7. Avoid the dopaminergic wake maintenance zone
8. Keep your room comfortably cool
9. Warm shower ~2h before bed
10. Avoid eating near bedtime or during your circadian night
11. Exercise during the day & not too near your bedtime
12. Avoid coffee, marjuana, and alcohol
13. Take instant-release melatonin before DLMO
14. Relaxation/ Psychological Aids

1. Consistency in timing of retinal light exposure, and sleep/ wake times
– Most recommendations for consistency ignore consistency in light/ dark exposure
– Sleep/ wake times is not consciously determined by your choice , but follow your light/ dark exposure as in jetlag
– Expose your eyes to light at the same time in the morning and dim the lights at the same time at night everyday
– Evolutionary purpose of the circadian rhythm is behavioral consistency with 24h periodicity
– Aberrant timing of light exposure is the cause of jetlag & reduced sleep quality

2. Very bright days and very dark evenings and nights
– Modern humans are exposed to very little daytime bright light and more nighttime bright light, the opposite of the natural tendency
– Camping with no artificial lights and only outdoor sunlight completely reset and entrained the circadian rhythm
– Bright days and dark nights increase circadian amplitude (strength), boosting daytime wakefulness and nighttime sleepiness
– It is generally much brighter outdoors than indoors, even on gloomy days (unless you live at extreme latitudes)
– Light Intensity: should be sufficiently bright without causing discomfort, although there is

a saturation point beyond which there is no difference in impact
– Light Duration: the longer the duration, the greater the circadian impact. A slightly less bright long exposure can be better than a very bright short exposure
– Light Angle: Daytime light should optimally reach your eyes from all directions, particularly your peripheral vision, as opposed to a single focused light source, as ipRGCs respond best to light in your peripheral vision (located mainly in the parafovea of the macula and nasal retinal region)
– Light Color: Blue light has the greatest circadian impact, 400 lux of blue light is equivalent 10,000 lux of white light. Sunlight is rich in blue light
– Darken your room totally during sleep. Even dim lights in your eyes at night disrupt the circadian rhythm. See also here
– The brighter the daytime light exposure, the lesser the disruptive impacts of nighttime light on sleep.

3. Sleep during Circadian Night
– Sleep duration and quality (particularly REM sleep)is reduced when sleeping outside the circadian night as you are only relying on homeostatic sleep pressure
– Best way to determine your circadian night is to track your core body temperature, which dips during the circadian night
– Alternatively, the circadian night begins ~12h after the circadian siesta. If you start feeling an urge to nap at 1pm in the afternoon, the circadian night begins at ~1am

4. Dim the lights & avoid blue light starting 2-3h before your sleep time
– Blue light has the most impact on your circadian rhythm, so avoidance of evening blue/ bright lights prevents circadian disruption
– Dim electronic devices to min brightness & use flux app to make the screen colors warmer
– Photic history: brighter daytime light exposure reduces disruptive impacts of nighttime light and vice versa

5. Avoid excessively long afternoon naps close to bedtime
– Dissipates sleep pressure
– How long & how close depends on individual, some accumulate sleep pressure faster than others
– Rule of thumb: determine your circadian night as in point (3), your afternoon nap should not be too long and should end at least 9h before bedtime

6. Avoid procrastination when you feel sleepy at night
– The 20-30 mins between ultradian cycles carries increased tendency for sleep
– So if you feel tired at night, go to sleep and don't procrastinate; the sleepiness may disappear until the next ultradian cycle

7. Avoid the dopaminergic wake maintenance zone
– Every evening before body temperature drops and melatonin secretion begins, a dopamine surge prevents sleep
– Occurs 1-3h before usual bedtime, so avoid sleeping 1-3h earlier from one day to the next unless you have shifted your circadian rhythm with light/ dark therapy

8. Keep your room comfortably cool
– Ideally 60-70F (16-22 Celsius)
– Aids in core body temperature reduction needed to induce and maintain sleep

9. Warm shower 2-3h before bed
– Common misconception: cold showers actually raise your body temperature as they cause vasoconstriction, preventing heat loss
– Warm showers cause vasodilation and help heat loss, helping reduce core body temperature if done 2-3h before bed

10. Avoid eating near bedtime or during your circadian night
– Digesting food raises body temperature , which disrupts the natural dip in core body temperature needed to induce sleep
– The digestive system also releases 400x more melatonin than the pineal gland and is dependent on food intake timing
– However, your brain needs energy to last throughout the night, so don't starve yourself before bed either

11. Exercise during the day & not too near your bedtime
– You are strongest when your core body temperature is highest during the circadian day
– Studies show exercise aids sleep as long as its done more than ~90min before bedtime to give your body time to cool down

12. Avoid coffee, marjuana, and alcohol
– Coffee's impact is very individual, some are very affected while others aren't
– Optimally, don't take caffeine at all. If you have to, drink it in the morning well before bedtime
– Caffeine has a half life of ~5h in humans, so if you drink it at 8am, there's still 12.5% of that amount remaining at 11pm which may disrupt sleep
– Marjuana and alcohol disrupt sleep quality, hormone release, and cause circadian misalignment. Also massive looksmins in general

13. Relaxation/ Psychological Aids
– Don't read rage-inducing texts before bed
– Ultimately, sleep is a highly physiological process dependent on light inputs and core body temperature
– If your circadian rhythm is properly entrained and your sleep pressure is correct, you will feel tired at the correct time no matter your cognitive state