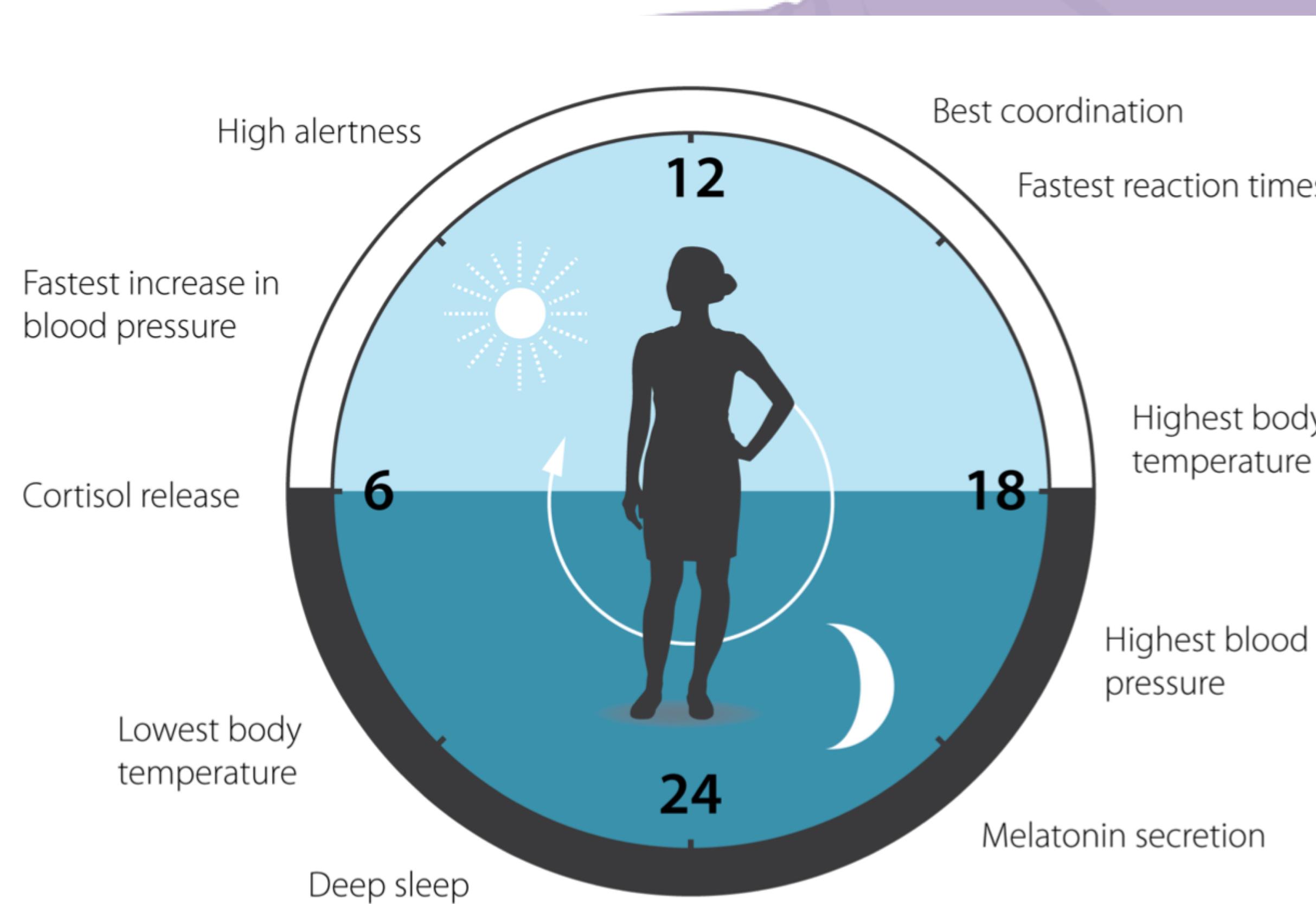


Sleep

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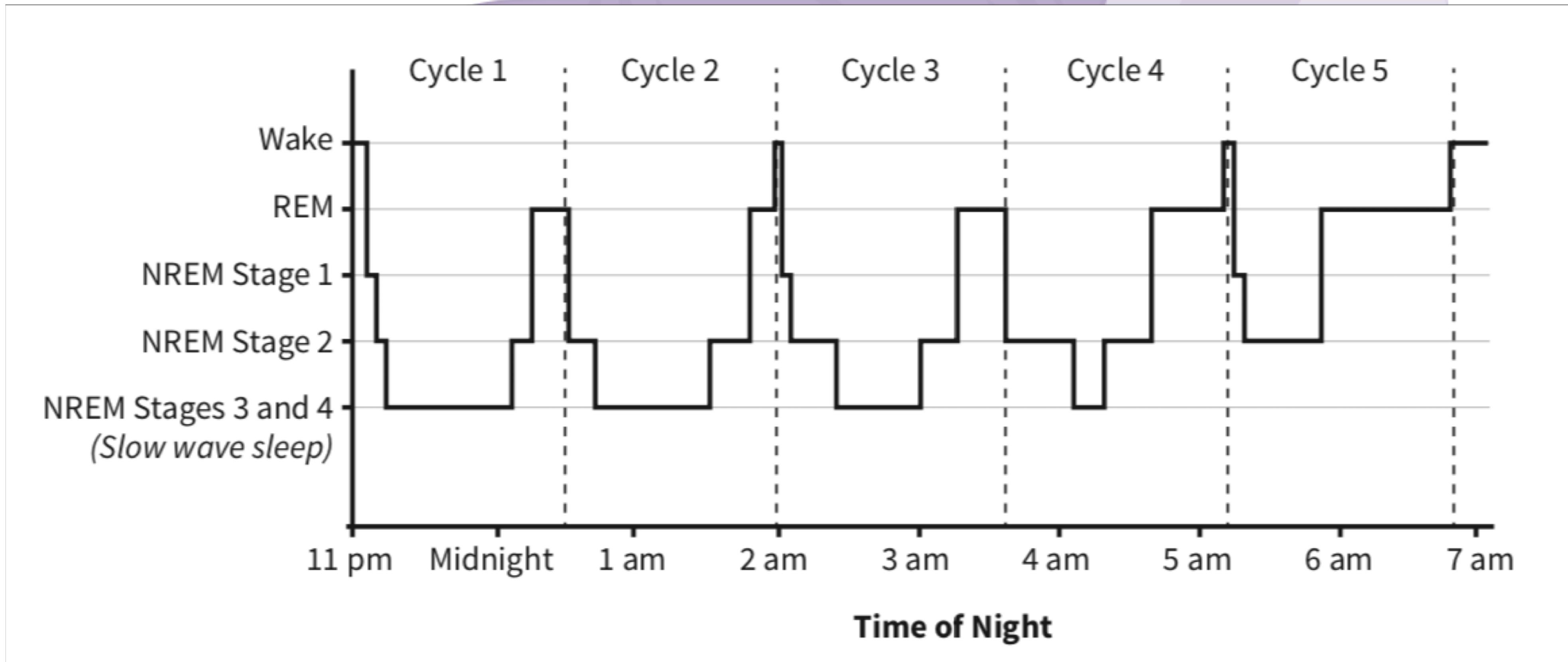
The circadian clock



Prize announcement. NobelPrize.org. Nobel Media AB 2019. Fri. 18 Oct 2019. <<https://www.nobelprize.org/prizes/medicine/2017/prize-announcement/>>

Why We Sleep by Matthew Walker, Simon & Schuster, 2017. Why We Sleep by Matthew Walker, Simon & Schuster, 2017. Steidten, T. et al. (2021) *Frontiers Sports Active Living* 3, 689805. Puta C et al. (2018) *Frontiers Physiology*; 09: 698. Haghayegh S. *Sleep Medicine Reviews* 46, 124–135. Milewski M et al. (2014). *Journal of Pediatric Orthopaedics* 34(2), 129–133. Irwin M (2015) *Annual Review of Psychology* 66. Mah C et al. (2011) *Sleep*, Miyamoto D et al. (2016) *Science* 352(6291), Irwin M (2015) *Annual Review of Psychology* 66, Cauter E et al. (2000) *JAMA* 284(7), Besedovsky L (2011) *European Journal of Physiology* 463(1). <https://open.spotify.com/show/1aIVaabjRjnmiouXozCzF3?si=870e803be1ce42ac>. Viegas, F. et al. The sleep as a predictor of musculoskeletal injuries in adolescent athletes. *Sleep Sci* 15, 305–311 (2022). Simpson, N. S., Gibbs, E. L., & Matheson, G. O. (2017). Optimizing sleep to maximize performance: implications and recommendations for elite athletes. *Scandinavian journal of medicine & science in sports*, 27(3), 266–274.

4 Stages of sleep (wake, light, REM, SWS)



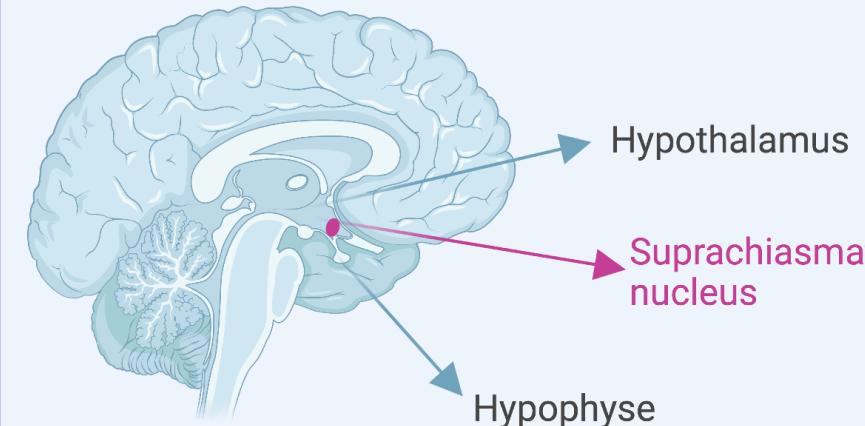
Created by Christian Puta
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Why We Sleep by Matthew Walker, Simon & Schuster, 2017. Why We Sleep by Matthew Walker, Simon & Schuster, 2017. Steidten, T. et al. (2021) *Frontiers Sports Active Living* 3, 689805. Puta C et al. (2018) *Frontiers Physiology*; 09: 698. Haghayegh S. *Sleep Medicine Reviews* 46, 124–135. Milewski M et al. (2014). *Journal of Pediatric Orthopaedics* 34(2), 129–133. Irwin M (2015) *Annual Review of Psychology* 66. Mah C et al. (2011) *Sleep*, Miyamoto D et al. (2016) *Science* 352(6291), Irwin M (2015) *Annual Review of Psychology* 66, Cauter E et al. (2000) *JAMA* 284(7), Besedovsky L (2011) *European Journal of Physiology* 463(1). <https://open.spotify.com/show/1aIVAbjRjnmiouXozCzF3?si=870e803be1ce42ac>. Viegas, F. et al. The sleep as a predictor of musculoskeletal injuries in adolescent athletes. *Sleep Sci* 15, 305–311 (2022). Simpson, N. S., Gibbs, E. L., & Matheson, G. O. (2017). Optimizing sleep to maximize performance: implications and recommendations for elite athletes. *Scandinavian journal of medicine & science in sports*, 27(3), 266–274.

Sleep optimization

Regularity

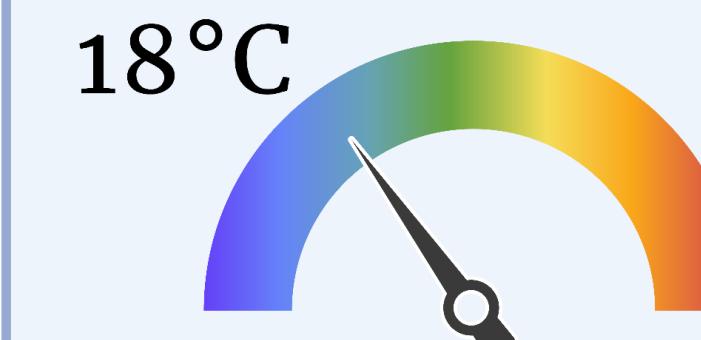
Going to bed & wake up at the same time every day



Your brain has its own master 24-hour clock, the suprachiasmatic nucleus, which expects regularity.

Temperature

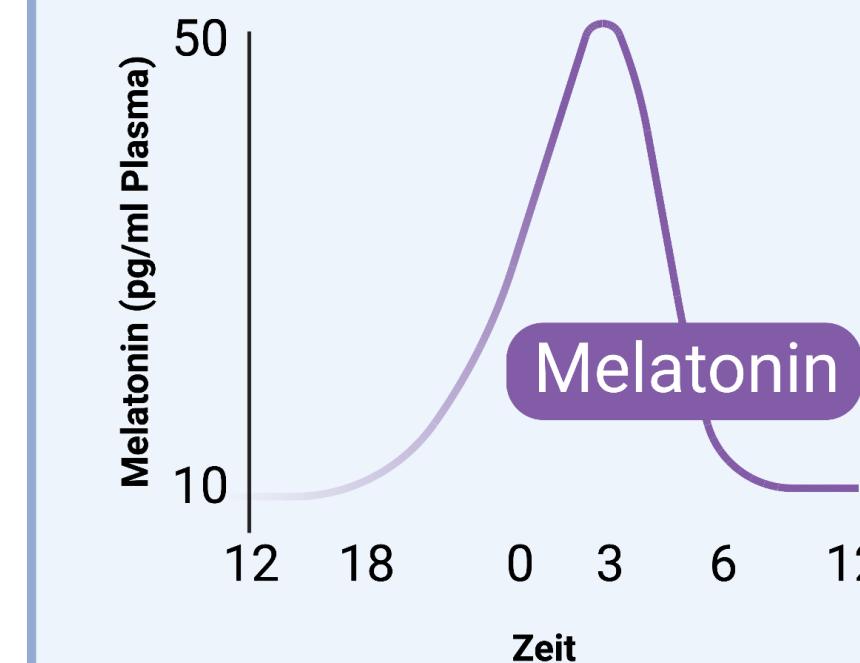
Your brain and body need to drop their temperature for you to fall and stay asleep



Ambient temperature must be cold

Darkness

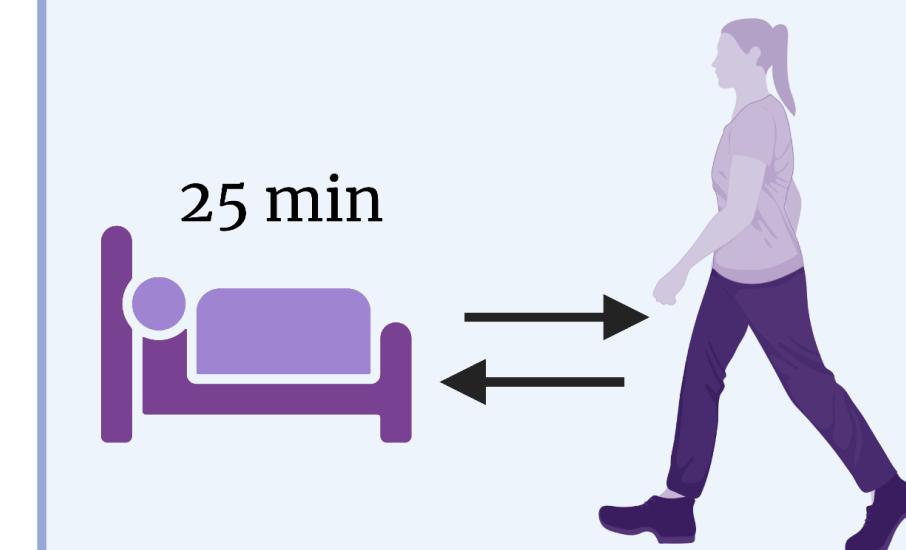
Darkness trigger the release of melatonin



Ambient temperature must be cold

Walk it out

If you can't fall asleep (25 min) get out of bed



Relax in another room, read a book, dimmed light

Sleep optimization

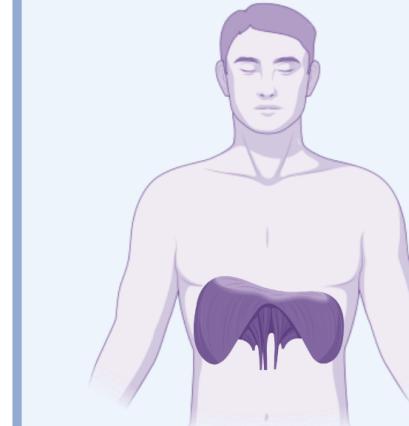
Bad night sleep

DO NOTHING!
Change nothing!

Don't excessive coffee
Don't nap
Don't go to bed earlier

Wind-down routine

Your need to wind down.
Find your wind-down routine.



Breathing: 4-7-8 by 4
Meditation:
<https://www.headspace.com/de>

Naps

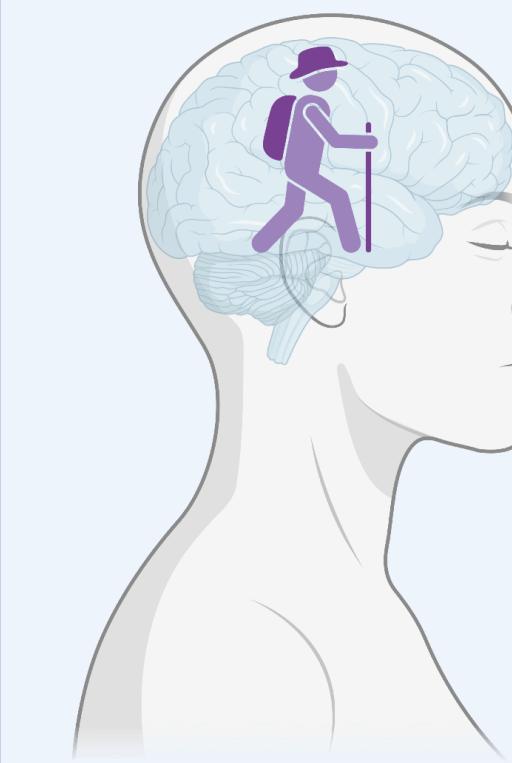
regular: no naps after 1 pm
performance: 20 or 90 min



Naps should be an exception

Don't count sheep

It doesn't work (in fact, it makes matters worse!)



Take your self on a mental walk

Sleep optimization

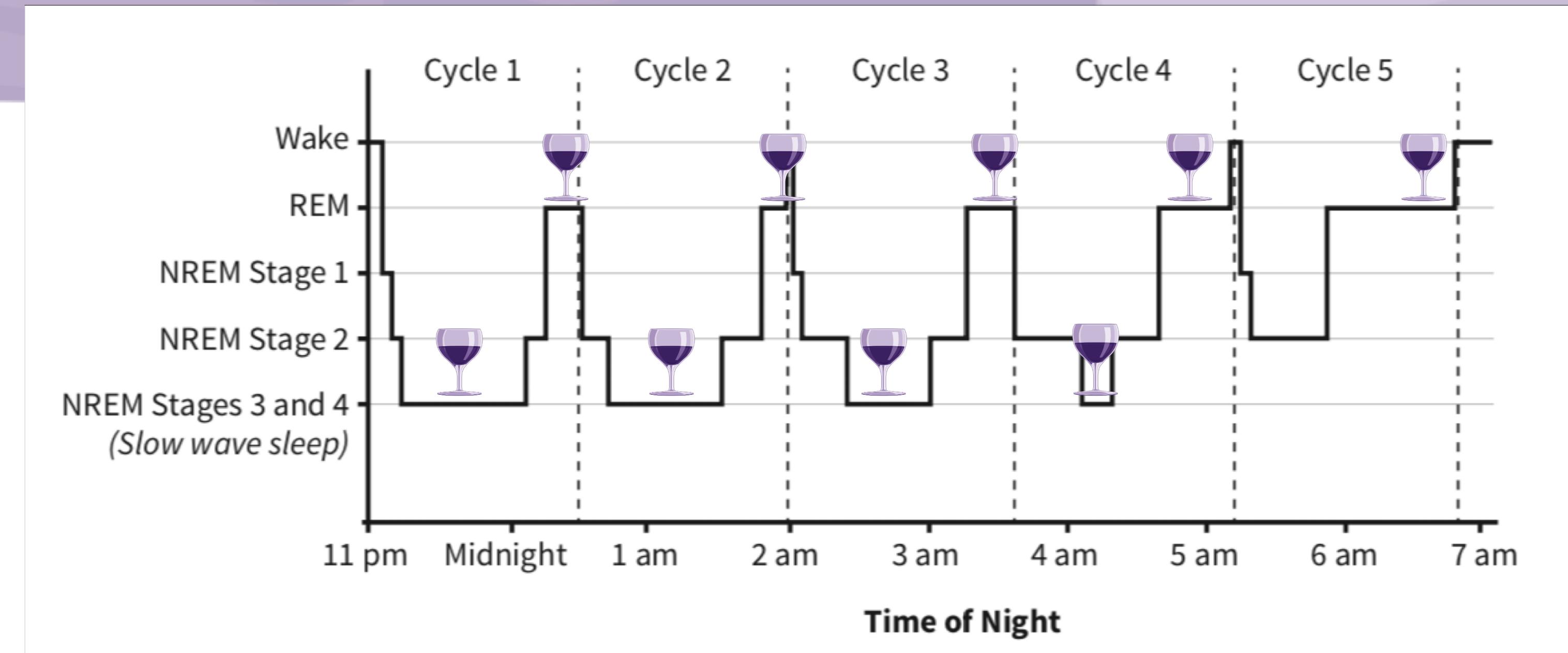
Coffee & alcohol

abstain from coffee (noon) and avoid drinking alcohol (evening).



Coffein half-life 4-6 hrs
last alcohol 2 hrs before bed

Alcohol crushes REM sleep (mentally restorative sleep) and deep sleep (physically restorative sleep)

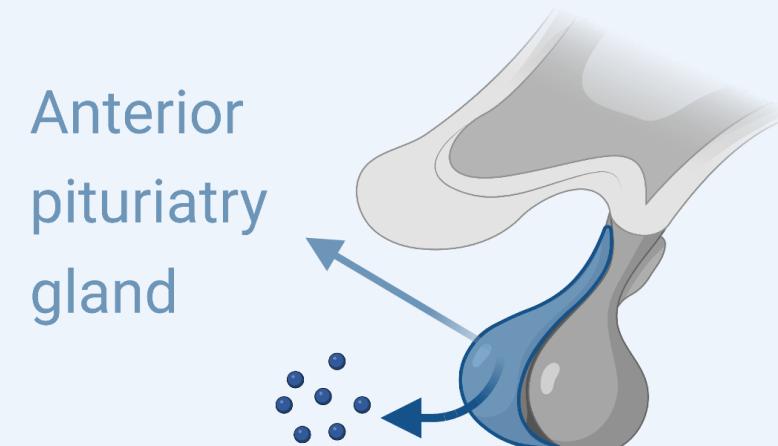


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Deep Sleep

What is deep sleep (slow wave sleep)? Stages 3 and 4 of non- rapid eye movement (non-REM) sleep, brainwaves are the slowest, muscles repair and growth, heart rate and respiratory rate decrease significantly, first period of deep sleep ~40 - 90 min, deep sleep periods become shorter during the night, 3-5 sleep cycles per night (4 stages: wake, light, REM, slow wave sleep), it is hard to wake from deep sleep (feel groggy).

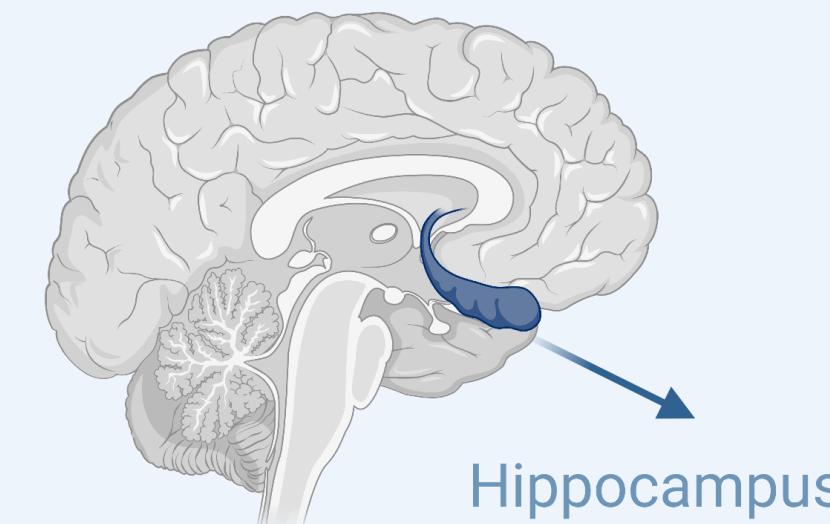
Growth hormone



Anterior pituitary gland

60% to 70% of daily secretion occurs during deep sleep

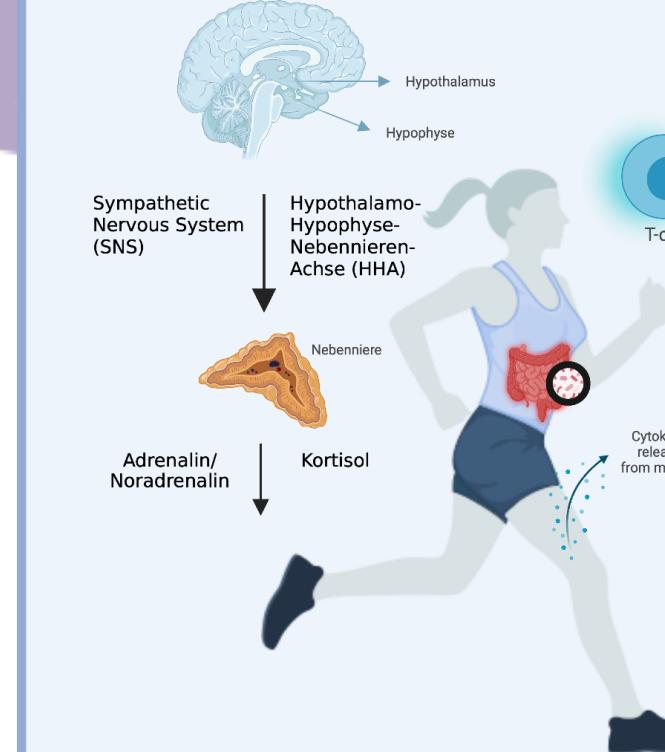
Perceptual memory-skill acquisition



Hippocampus

Deep sleep is necessary for sensory experience to be consolidated in memory

Immune system



Deep sleep is related to reduced inflammation & supports immune system recovery & repair muscle damage

Improves reaction times

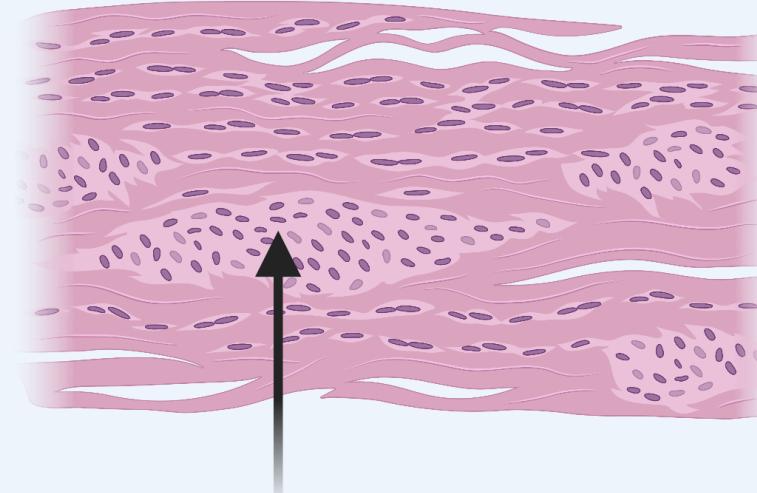


Improves also mood and vigilance

Sleep & Injury

Injury

Athletes should sleep 8 to 10 hrs and use naps (20 min or 90 min) make it cool (20 Grad), darkness, wear socks
- warm feet



e.g. tendon fibrosis

- **Quantity and quality of sleep were associated with musculoskeletal injuries in adolescent athletes**
- **Previous injuries were predicted by WASO and the occurrence of injuries was predicted by TA**
- **Athletes < 8hrs sleep per night 1.7 times more likely had an injury**

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