



# Performing under Pressure; on the Biology, Psychology and Sociology of stress in high-performance professions

X – RELAX, ON THE IMPORTANCE OF REST

# Rest: one of the most important components of peak performance

- ▶ Learning
  - ▶ We store information when we sleep
- ▶ Physical performance

When was the last time you were delusional?



# On the importance of sleep

- ▶ Nature has not provided us with a means to store sleep. The sleep we do not get is lost.
  - ▶ Immune system
  - ▶ Endocrine system
  - ▶ Cognitive function

Almondes, K. M. de, Marín Agudelo, H. A., & Jiménez-Correa, U. (2021). Impact of Sleep Deprivation on Emotional Regulation and the Immune System of Healthcare Workers as a Risk Factor for COVID 19: Practical Recommendations From a Task Force of the Latin American Association of Sleep Psychology. *Frontiers in Psychology, 12*(May), 1–10. <https://doi.org/10.3389/fpsyg.2021.564227>

Garbarino, S., Lanteri, P., Bragazzi, N. L., Magnavita, N., & Scoditti, E. (2021). Role of sleep deprivation in immune-related disease risk and outcomes. *Communications Biology, 4*(1). <https://doi.org/10.1038/s42003-021-02825-4>

Lateef, O. M., & Akintubosun, M. O. (2020). Sleep and reproductive health. *Journal of Circadian Rhythms, 18*(1), 1–11. <https://doi.org/10.5334/jcr.190>

Su, L., Zhang, S. zheng, Zhu, J., Wu, J., & Jiao, Y. zheng. (2021). Effect of partial and total sleep deprivation on serum testosterone in healthy males: a systematic review and meta-analysis. *Sleep Medicine, 88*, 267–273. <https://doi.org/10.1016/j.sleep.2021.10.031>

Csipo, T., Lipecz, A., Owens, C., Mukli, P., Perry, J. W., Tarantini, S., ... Yabluchanskiy, A. (2021). Sleep deprivation impairs cognitive performance, alters task-associated cerebral blood flow and decreases cortical neurovascular coupling-related hemodynamic responses. *Scientific Reports, 11*(1), 1–13. <https://doi.org/10.1038/s41598-021-00188-8>

# Stages of sleep: and their importance

- ▶ Deep sleep
  - ▶ Delta waves / slow waves
  - ▶ Memory consolidation
  
- ▶ Rapid Eye Movement sleep
  - ▶ Dream state
  - ▶ Memory contextualization

# Why sleep is so important

- ▶ Acute extreme sleep deprivation can
  - ▶ Be fatal
  - ▶ Lead to exacerbation of mental issues
  - ▶ Will lead to psychotic symptoms while sleep deprived
- ▶ Chronic sleep deprivation
  - ▶ Testosterone (a few nights of 4-5 hours – drop to levels of someone 10 years older)
  - ▶ Blood sugar dysregulation
  - ▶ Immune system failure
  - ▶ Effect on gene-expression
  - ▶ 1 night of 4 hours – a 70 % drop in natural killer cells
  - ▶ Alzheimer's

# Temperature and sleep

- ▶ During sleep core body temperature drops about 1 degree
- ▶ You need to get colder to get to sleep
  - ▶ Warm bath
  - ▶ Feet out
- ▶ You need to get warm to wake up



# Light and sleep

- ▶ Early morning light starts the production of adenosine
  - ▶ Caffeine
- ▶ Late afternoon / early evening light and dark stimulate melatonin
  - ▶ Blue light filters
  - ▶ Using your mobile devices before sleep

Article, O. (2001). *Circadian Time of Morning Light Administration and Therapeutic Response in Winter Depression*. 58.

Choi, K., Shin, C., Kim, T., Chung, H. J., & Suk, H. (2019). *Awakening effects of blue-enriched morning light exposure on university students' physiological and subjective responses*. (November 2018), 1–8. <https://doi.org/10.1038/s41598-018-36791-5>

Lawrenson, J. G., Hull, C. C., & Downie, L. E. (2017). *The effect of blue-light blocking spectacle lenses on visual performance, macular health and the sleep-wake cycle: a systematic review of the literature*. 37, 644–654. <https://doi.org/10.1111/opo.12406>

Tosini, G., Ferguson, I., & Tsubota, K. (2016). *Effects of blue light on the circadian system and eye physiology*. (August 2015), 61–72.



# Sleep and nutrition

- ▶ Disruption of hunger hormones
  - ▶ Leptin
  - ▶ Ghrelin
- ▶ Increased appetite
  - ▶ Especially for savory and high carbohydrate foods

Rasaei, B., Karim, N. A., Talib, R. A., Mohd Noor, I., & Karandish, M. (2019). The Effect of Simultaneous Consumption of Coffee Caffeine and Sleep Deprivation on Plasma Ghrelin and Leptin Levels. *Int J Nutr Sci*, 4(2), 88–96. <https://doi.org/10.30476/IJNS.2019.82136.1017>. Introduction

Kazemizadeh, V., & Behpour, N. (2021). *The Effect of 30-Hours Sleep Deprivation on the Response of Leptin and Ghrelin Levels to an Exhaustive Activity Among Active Male Students*. 28(4), 569–580.

Lin, J., Jiang, Y., Wang, G., Meng, M., Zhu, Q., Mei, H., ... Jiang, F. (2020). Associations of short sleep duration with appetite-regulating hormones and adipokines: A systematic review and meta-analysis. *Obesity Reviews*, 21(11), 1–15. <https://doi.org/10.1111/obr.13051>

# Stimulating and buffering sleepiness

- ▶ Caffeine
- ▶ Alcohol & sedatives
- ▶ Melatonin supplementation

# Sleep and motivation

- ▶ Dopamine disruption
- ▶ Attention

# Sleep and peak performance

- ▶ Lowered effect of  $\mu$ -opioid receptor
- ▶ Disrupted dopamine / serotonin
- ▶ Increased stress sensitivity

Zant, J. C., Leenaars, C. H. C., Kostin, A., Van Someren, E. J. W., & Porkka-Heiskanen, T. (2011). Increases in extracellular serotonin and dopamine metabolite levels in the basal forebrain during sleep deprivation. *Brain Research*, 1399, 40–48. <https://doi.org/10.1016/j.brainres.2011.05.008>

Longordo, F., Kopp, C., & Lüthi, A. (2009). Consequences of sleep deprivation on neurotransmitter receptor expression and function. *European Journal of Neuroscience*, 29(9), 1810–1819. <https://doi.org/10.1111/j.1460-9568.2009.06719.x>

Benedetti, F., Barbini, B., Campori, E., Colombo, C., & Smeraldi, E. (1996). Dopamine agonist amineptine prevents the antidepressant effect of sleep deprivation. *Psychiatry Research*, 65(3), 179–184. [https://doi.org/10.1016/S0165-1781\(96\)03000-4](https://doi.org/10.1016/S0165-1781(96)03000-4)

Staffe, A. T., Bech, M. W., Clemmensen, S. L. K., Nielsen, H. T., Larsen, D. B., & Petersen, K. K. (2019). Total sleep deprivation increases pain sensitivity, impairs conditioned pain modulation and facilitates temporal summation of pain in healthy participants. *PLoS ONE*, 14(12), 1–14. <https://doi.org/10.1371/journal.pone.0225849>

Kundermann, B., Krieg, J. C., Schreiber, W., & Lautenbacher, S. (2004). The effect of sleep deprivation on pain. *Pain Research and Management*, 9(1), 25–32. <https://doi.org/10.1155/2004/949187>