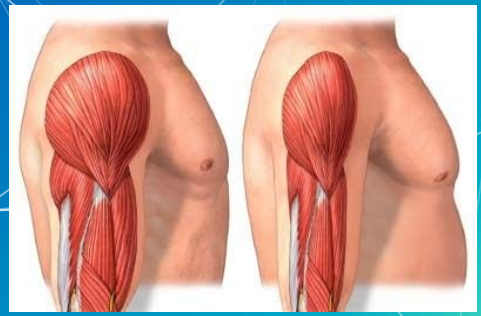
HOW SLEEP INFLUENCES THE BODY

Group 3 - Christina, Ahmad, Lucas, Roham, Sukhanwar

INTRODUCTION

- **Sleep** is the most important factor that humans need
- Highly conserved behaviour across animal evolution
- Characterized by:
  - Altered **consciousness**
  - Inhibited **sensory activity**
  - Reduced **muscle activity**
  - Decreased overall reactivity to **stimuli**
  - Inhibition of **voluntary muscles** during deep sleep (John Hopkins Medicine, n.d.)

(Strauss, 2019)



(Sarcopenia, 2014)

SIGNIFICANCE OF SLEEP

- Most of the body's systems are in an **anabolic state** which helps to restore the immune, nervous, endocrine, muscular, and skeletal systems.
- Maintain a **healthy mood**, **memory**, and **cognitive functions**.

(Credit, 2018)

(Unsplash, 2020)

CIRCADIAN RHYTHM - BODY'S CLOCK

- The **internal circadian rhythm** promotes daily sleep at night
- This is our "**internal clock**" that recognizes the difference between day and night

(APR, 2019)

HOW MANY HOURS OF SLEEP IS IDEAL?

- Varies from individual to individual
- Sleep is considered to be adequate when there is no daytime sleepiness or dysfunction (John Hopkins Medicine, n.d.).

Hours of sleep required for each age group[65]

Age and condition	Sleep needs
Newborns (0–3 months)	14 to 17 hours
Infants (4–11 months)	12 to 15 hours
Toddlers (1–2 years)	11 to 14 hours
Preschoolers (3–4 years)	10 to 13 hours
School-age children (5–12 years)	9 to 11 hours
Teenagers (13–17 years)	8 to 10 hours
Adults (18–64 years)	7 to 9 hours
Older Adults (65 years and over)	7 to 8 hours

(Hirshkowitz et al., 2015)

FACTORS THAT DISTURB SLEEP

Blue light

Stress

FACTORS THAT DISTURB SLEEP

Exercise

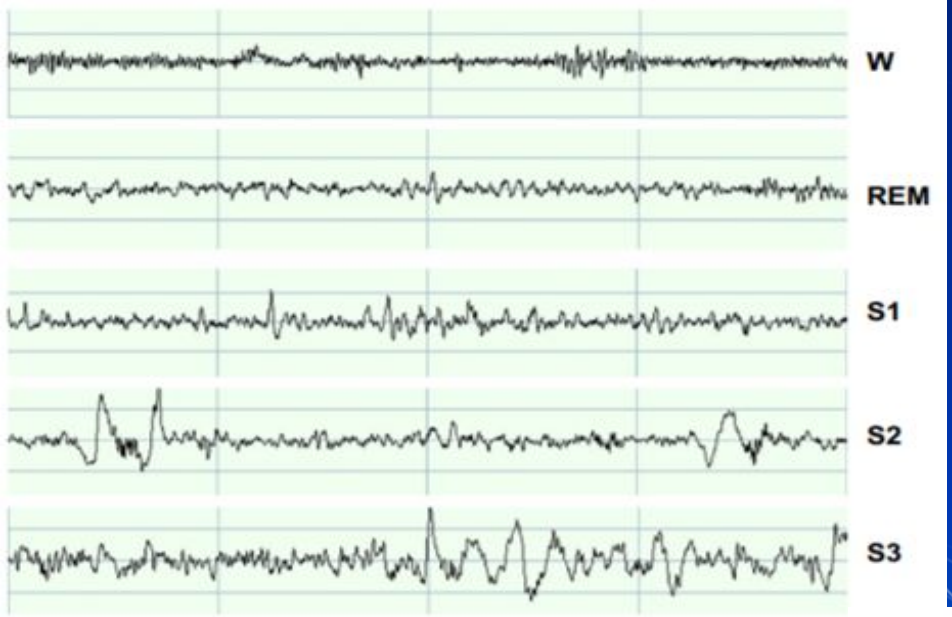
No Effect

Caffeine, Alcohol, Nicotine

Caffeine's Effect Varies

Late Night Snacking

Depends

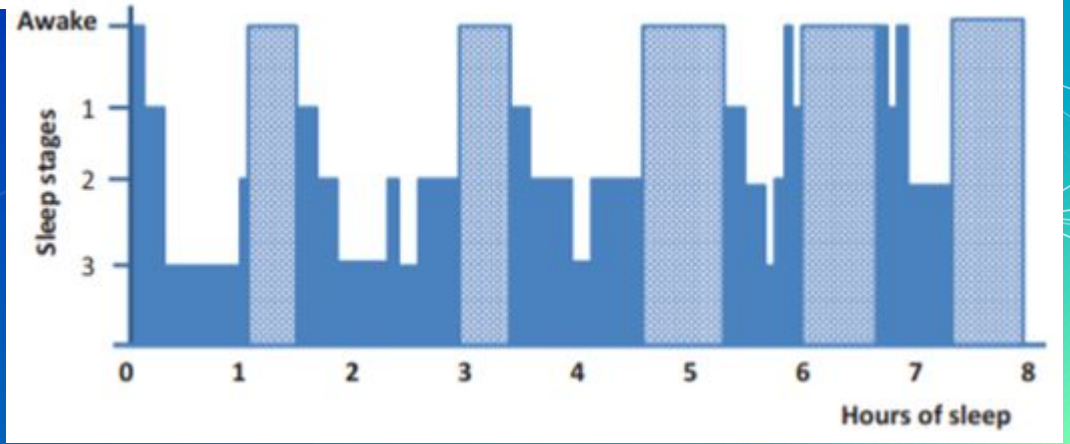


(Porkka-Heiskanen et al., 2013)

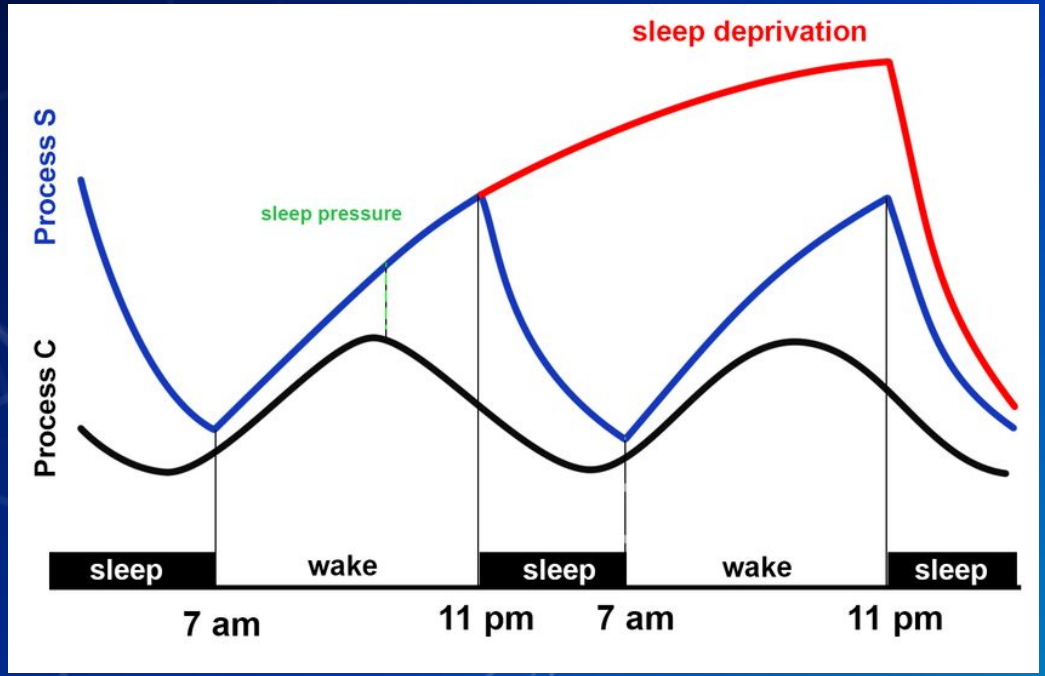
Hypnogram showing changes in sleep stages over a night's sleep

EEG of the different sleep stages

(Porkka-Heiskanen et al., 2013)



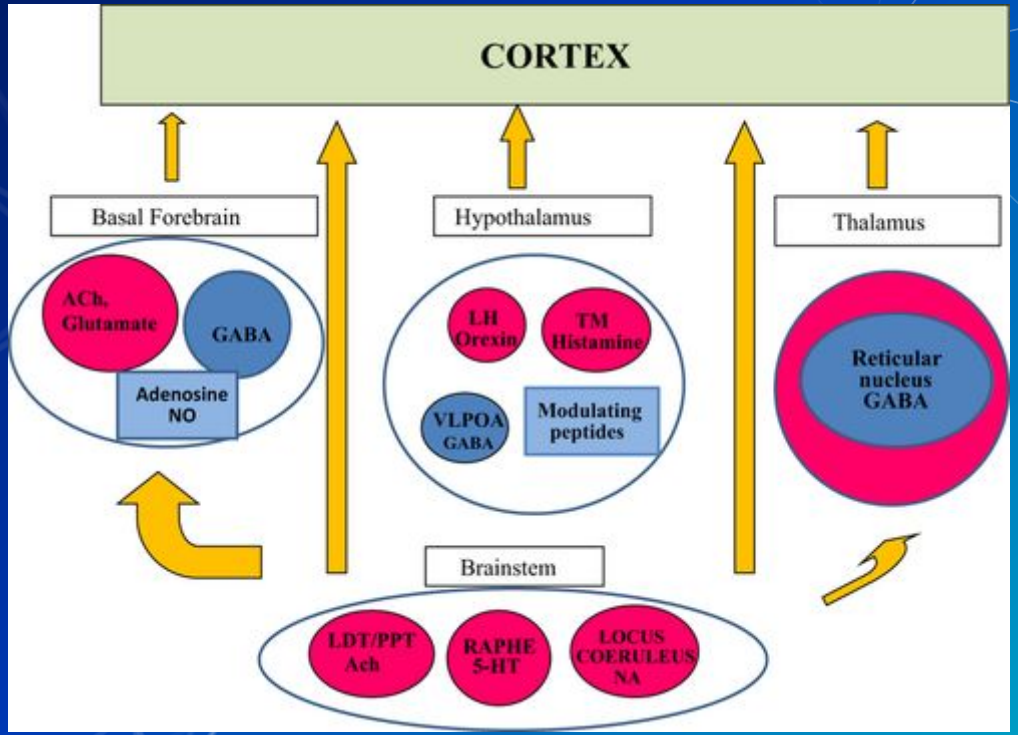
The Two Process Model of Sleep Regulation



- **Process S**: Homeostatic process
- **Process C**: Circadian pacemaker
- **Process S and C** interact together

(Patanaik, 2015)

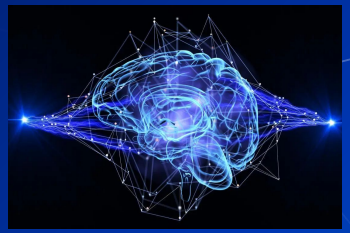
The Parts of the Brain Involved in Sleep Regulation



(Porkka-Heiskanen et al., 2013)

CONSEQUENCES OF SLEEP DEPRIVATION

NERVOUS SYSTEM



(Salpadia, n.d.)

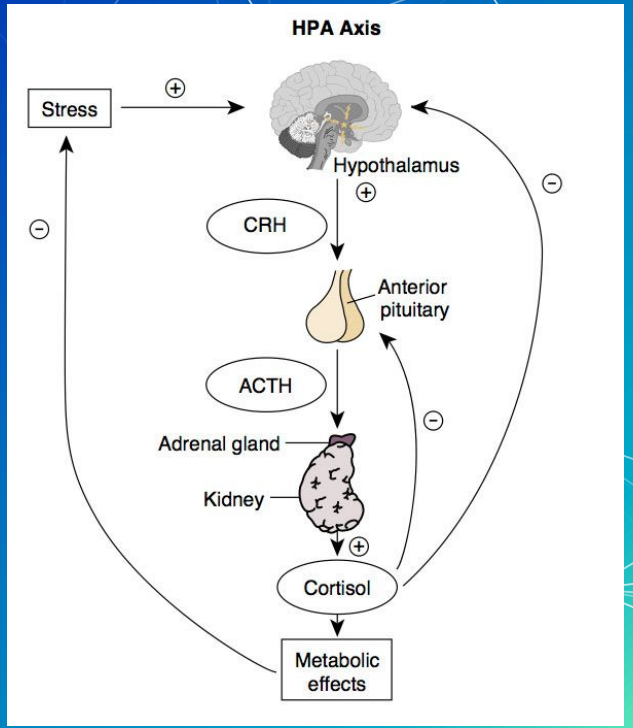
- Sleep increases an individual's ability to **focus** their **attention** maximally.
- Sleep has a profound effect on **memory consolidation** (i.e. process used to convert our STM → LTM)
  - Partially why it is recommended for students to get adequate sleep before writing a test.

(Medical News Today, 2018)

ENDOCRINE SYSTEM

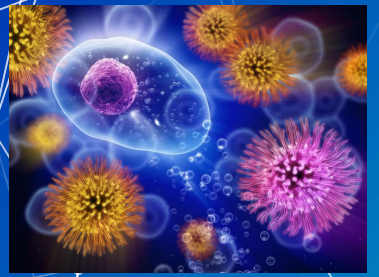
- A good quality of sleep is critical for the endocrine system, specifically the **hypothalamic-pituitary adrenal (HPA)** axis.
  - Fight/Flight response

- Lack of sleep disturbs the HPA axis and heightens an **individual's sensitivity to stress.**



(Mong et al., 2010)

IMMUNE SYSTEM



(Medical News Today, 2019)

- Adequate restorative sleep is required to maintain good immunity.
- **Immune parameters** like leukocyte number, function, and proliferation are altered.
- Sleep deprivation is linked to increased daytime release of **inflammatory mediators** such as interleukins, cytokines, and tumor necrosis factor.
- There is a strong positive correlation with a lack of sleep and **inflammatory diseases.**

(New York Times, 2017))

DIGESTIVE SYSTEM

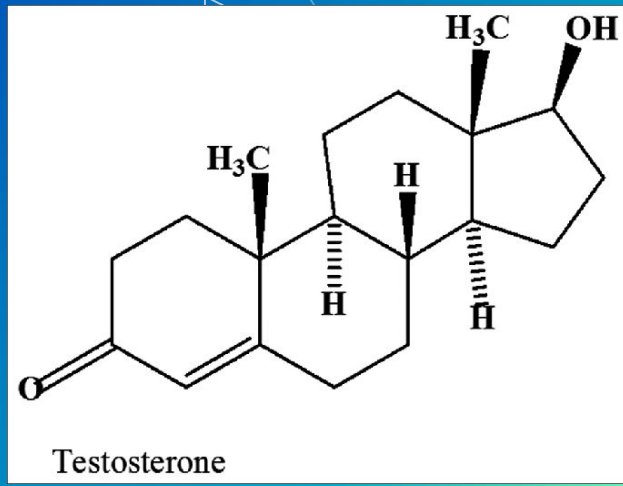
- Circadian rhythm maintains the body's physiological processes on a daily, consistent basis
- Disruption ➡ Severe metabolic changes, increased risk of obesity and diabetes
- Less sleep leads to ↑ Ghrelin ↓ Leptin

(National Post, 2019)

REPRODUCTIVE SYSTEM

- ↓ Levels of FSH ↑ LH amplitude
- ↑ Pro-inflammatory cytokines resulting in Postpartum depression, Preterm delivery
- Significant decreases in Testosterone levels and Sperm Viability

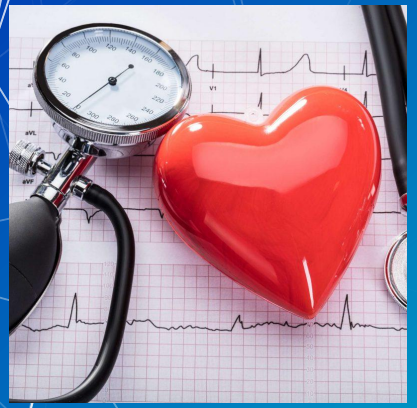
(Rosen and Epstein, 2020)



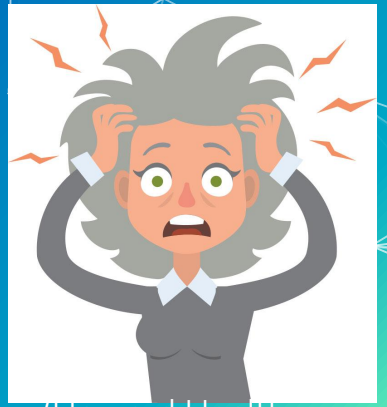
(Almaiman, 2018)

CARDIOVASCULAR SYSTEM

- < 5 hours of sleep can lead to **hypertension**
- Sleep deprivation is linked with increased insulin resistance, sympathetic activation, and cortisol levels
- Increased insulin resistance can promote the risk of **cardiovascular disease**
    - Other contributors: CRP and Leptin levels



(CSCE, n.d.)



(Harvard Health Publishing, 2018)

How To Improve Sleep

Consistent Sleep Schedule

Ideal Sleep Environment

How To Improve Sleep

Supplements

Relaxing Activities

References

AlDabal, L., & BaHammam, A. S. (2011). Metabolic, Endocrine, and Immune Consequences of Sleep Deprivation. *The Open Respiratory Medicine Journal*, *5*, 31–43. https://doi.org/10.2174/1874306401105010031

Alvarenga, T. A., Hirotsu, C., Mazaro-Costa, R., Tufik, S., & Andersen, M. L. (2015). Impairment of male reproductive function after sleep deprivation. *Fertility and sterility*, *103*(5), 1355-1362.

Besedovsky, L., Lange, T., & Born, J. (2012). Sleep and immune function. *Pflugers Archiv*, *463*(1), 121–137. https://doi.org/10.1007/s00424-011-1044-0

Bopparaju, S., & Surani, S. (2010). Sleep and diabetes. *International journal of endocrinology*, *2010*.

Borbély, A. A., Daan, S., Wirz-Justice, A., & Deboer, T. (2016). The two-process model of sleep regulation: a reappraisal. *Journal of sleep research*, *25*(2), 131-143.

Chang, J. J., Pien, G. W., Duntley, S. P., & Macones, G. A. (2010). Sleep deprivation during pregnancy and maternal and fetal outcomes: is there a relationship?. *Sleep medicine reviews*, *14*(2), 107-114.

Choi, J. H., Lee, S. H., Bae, J. H., Shim, J. S., Park, H. S., Kim, Y. S., & Shin, C. (2016). Effect of sleep deprivation on the male reproductive system in rats. *Journal of Korean medical science*, *31*(10), 1624-1630.

Cohorte, L. (n.d.). Que Faire S'il Y A Des Problèmes De Concentration? Retrieved from https://www.sapaldia.net/sante/que-faire-sil-y-a-des-problemes-de-concentration/

Cousins, J. N., Wong, K. F., Raghunath, B. L., Look, C., & Chee, M. W. L. (2018). The long-term memory benefits of a daytime nap compared with cramming. *Sleep*, *42*(1). doi: 10.1093/sleep/zsy207

Drake, C., Roehrs, T., Shambroom, J., & Roth, T. (2013). Caffeine Effects on Sleep Taken 0, 3, or 6 Hours before Going to Bed. *Journal of Clinical Sleep Medicine*, *09*(11), 1195–1200. doi: 10.5664/jcsm.3170

Fowler, M. J., Sullivan, M. J., & Ekstrand, B. R. (1973). Sleep and Memory. *Science*, *179*(4070), 302–304. https://doi.org/10.1126/science.179.4070.302

References

Fraigne, J. J., Torontali, Z. A., Snow, M. B., & Peever, J. H. (2015). REM sleep at its core–circuits, neurotransmitters, and pathophysiology. *Frontiers in neurology*, *6*, 123.

Graves, L., Pack, A., & Abel, T. (2001). Sleep and memory: A molecular perspective. *Trends in Neurosciences*, *24*(4), 237–243. https://doi.org/10.1016/S0166-2236(00)01744-6

Harvard Health Publishing. (n.d.). Blue light has a dark side. Retrieved from https://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side

How to get a great nap. (2018, November 20). Retrieved from https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/napping/art-20048319

John Hopkins Medicine. (n.d.). The Science of Sleep: Understanding What Happens When You Sleep. Retrieved from https://www.hopkinsmedicine.org/health/wellness-and-prevention/the-science-of-sleep-understanding-what-happens-when-you-sleep

Johnson, J. (2018). Stress and sleep: What's the link? Retrieved from https://www.medicalnewstoday.com/articles/322994

Kang, J.-H., & Chen, S.-C. (2009). Effects of an irregular bedtime schedule on sleep quality, daytime sleepiness, and fatigue among university students in Taiwan. *BMC Public Health, 9*(1). doi: 10.1186/1471-2458-9-248

Karakas, M., & Koenig, W. (2009). CRP in cardiovascular disease. *Herz*, *34*(8), 607-613.

Lauriello, S. (2019, July 9). This Is the Best Temperature for Sleeping, According to Experts. Retrieved from https://www.health.com/condition/sleep/best-temperature-for-sleeping

Manzar, M. D., Zannat, W., & Hussain, M. E. (2015). Sleep and physiological systems: a functional perspective. *Biological rhythm research*, *46*(2), 195-206.

Mawer, R. (2018, November 2). 17 Proven Tips to Sleep Better at Night. Retrieved from https://www.healthline.com/nutrition/17-tips-to-sleep-better

Mong, J. A., Suchecki, D., Semba, K., & Parry, B. L. (2010). Sleep and the endocrine brain. *International journal of endocrinology*, *2010*.

Myllymäki, T., Kyröläinen, H., Savolainen, K., Hokka, L., Jakonen, R., Juuti, T., ... Rusko, H. (2011). Effects of vigorous late-night exercise on sleep quality and cardiac autonomic activity. *Journal of Sleep Research, 20*(1pt2), 146–153. doi: 10.1111/j.1365-2869.2010.00874.x

Paddock, C. (2018). How a key protein boosts memory, learning in the adult brain. Retrieved from https://www.medicalnewstoday.com/articles/323623

References

Peters, B. (2019). Timing of Last Meal May Contribute to Nighttime Heartburn or Insomnia. Retrieved from https://www.verywellhealth.com/eating-before-bed-3014981

Porkka-Heiskanen, T., Zitting, K. M., & Wigren, H. K. (2013). Sleep, its regulation and possible mechanisms of sleep disturbances. *Acta physiologica*, *208*(4), 311-328.

Rhoads, D. B., Levitsky, L. L., & Tavakkoli, A. (2016). Rhythms in the Digestive System. In *Circadian Clocks: Role in Health and Disease* (pp. 267-293). Springer, New York, NY.

Sam, A. H., & Dhillo, W. S. (2010). Endocrine links between fat and reproduction. *The Obstetrician & Gynaecologist*, *12*(4), 231–236. https://doi.org/10.1576/toag.12.4.231.27614

Saper, C. B., Cano, G., & Scammell, T. E. (2005). Homeostatic, circadian, and emotional regulation of sleep. *Journal of Comparative Neurology*, *493*(1), 92-98.

Sleep, Learning, and Memory | Healthy Sleep. (n.d.). Retrieved February 13, 2020, from http://healthysleep.med.harvard.edu/healthy/matters/benefits-of-sleep/learning-memory

Sleep Foundation. (n.d.). Napping Benefits & Tips. Retrieved from https://www.sleepfoundation.org/articles/napping

Spadola, C. E., Guo, N., Johnson, D. A., Sofer, T., Bertisch, S. M., Jackson, C. L., ... Redline, S. (2019). Evening intake of alcohol, caffeine, and nicotine: night-to-night associations with sleep duration and continuity among African Americans in the Jackson Heart Sleep Study. *Sleep*, *42*(11). doi: 10.1093/sleep/zsz136

Stickgold, R. (2005). Sleep-dependent memory consolidation. *Nature*, *437*(7063), 1272–1278. https://doi.org/10.1038/nature04286

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS medicine*, *1*(3).

The Impact of Sleep Deprivation on Hormones and Metabolism. (n.d.). Medscape. Retrieved February 24, 2020, from http://www.medscape.org/viewarticle/502825

Travison, T. G., Morley, J. E., Araujo, A. B., O'Donnell, A. B., & McKinlay, J. B. (2006). The relationship between libido and testosterone levels in aging men. *The Journal of Clinical Endocrinology & Metabolism*, *91*(7), 2509-2513.

Trayhurn, P. (2005). Endocrine and signalling role of adipose tissue: New perspectives on fat. *Acta Physiologica Scandinavica*, *184*(4), 285–293. https://doi.org/10.1111/j.1365-201X.2005.01468.x

IMAGE SOURCES

https://www.firstbeat.com/en/blog/why-good-sleep-hygiene-really-matters-in-elite-sport/

https://www.sleepability.be/2019/08/02/20-positive-sleep-affirmations-to-help-you-fall-asleep/

https://fanaticcook.com/2014/10/08/up-to-a-third-of-adults-over-50-have-some-degree-of-muscle-loss-sarcopenia-more-protein-doesnt-seem-to-help/

https://www.medtronic-diabetes.ch/de/meditation-fur-mehr-seelenfrieden

Cooley, J. (2020). *Lavender.* Retrieved from https://universityhealthnews.com/daily/sleep/lavender-for-sleep/

Boruki, R. (2013). *Meditation for Sleep, Insomnia, Stress*https://www.youtube.com/watch?v=qF_ENvZahZU

Late night excercise. (n.d.). Retrieved from https://www.mdlaserandcosmetics.com/exercise-late-night/

Jonelis, M. (2019). *Caffeine, alcohol, nicotine*. Retrieved from https://medium.com/@michelle.jonelis/understanding-the-effects-of-caffeine-nicotine-alcohol-and-cannabis-on-sleep-fc56a0507aeb

Why Good Sleep Hygiene Really Matters in Elite Sports—Firstbeat. (n.d.). Retrieved February 26, 2020, from https://www.firstbeat.com/en/blog/why-good-sleep-hygiene-really-matters-in-elite-sport/

Wilkey, J. (2015). *Late night snacking*. Retrieved from https://www.eurekalert.org/pub_releases/2015-05/byu-lsi050515.php

https://www.health.harvard.edu/newsletter_article/does-stress-management-become-more-difficult-as-you-age

http://www.cscestrie.on.ca/en/manage-and-prevent-hypertension/

Yupimaros. (n.d.). *Sleeping clock*. Retreived from https://www.123rf.com/photo_93984387_stock-vector-cartoon-sleep-clock-alarm-character-vector-illustration.html

Sleep Environment. (n.d.). Retrieved from https://pipelineperformancegroup.com/the-ideal-sleep-environment/

Weintraub, K. (2017, December 29). Does a ‘Strong’ Immune System Ward Off Colds and Flu? *The New York Times*. https://www.nytimes.com/2017/12/29/well/live/does-a-strong-immune-system-ward-off-colds-and-flu.html

THANK YOU FOR LISTENING!

MC Questions

What controls the circadian rhythm?

a) Ventromedial Medulla
b) Suprachiasmatic Nuclei ##
c) Subcoeruleus Nucleus
d) Leptin
e) GABA

What is a characteristic of REM sleep?

a) Slow-wave activity
b) High amplitude on EEG
c) It is the first state of sleep
d) No muscular activity ##
e) All of the above

QUESTIONS?