2-20-2019

The Nights of Our Lives: Why We Sleep & Dream

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The Nights of Our Lives: Why We Sleep & Dream

Circle of Friends

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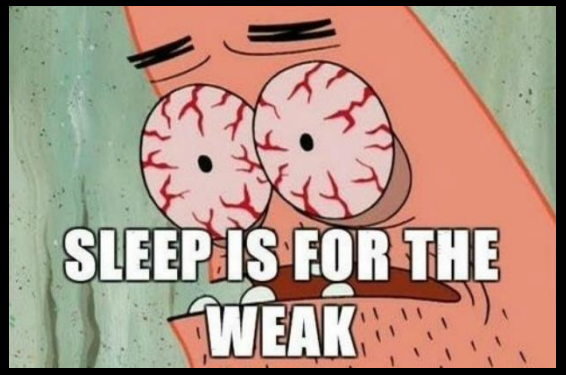
Instagram: SocietyforNeuroSports

1. Did you get enough sleep this past week?

2. Do you wake up without an alarm clock, feeling refreshed, not needing caffeine?

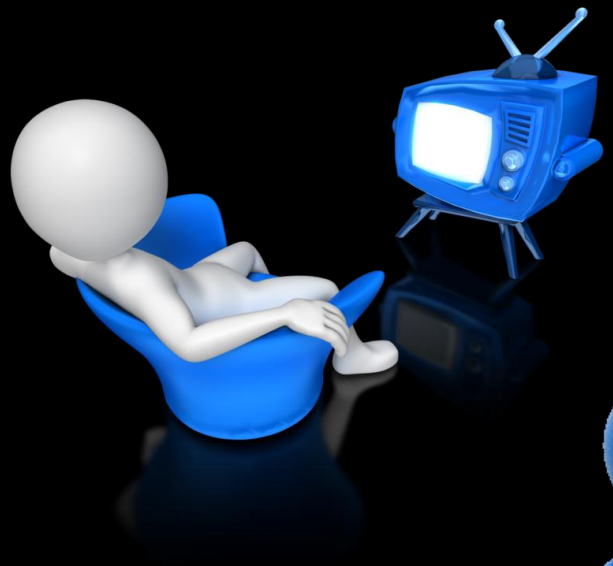
Two-thirds of adults do not get enough sleep

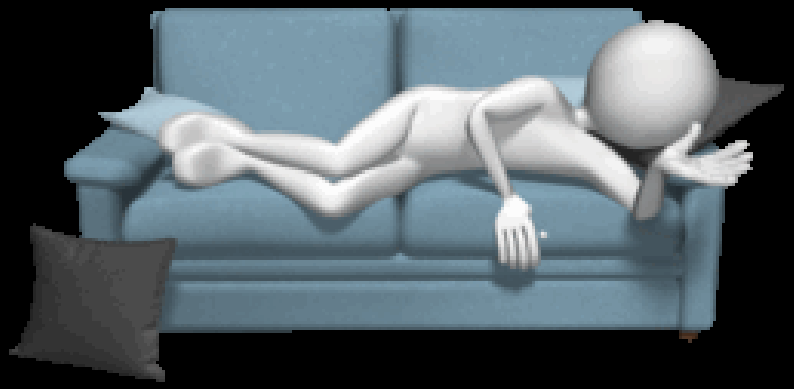


<u>Sleep is not a luxury</u>

Sleeping well is one of the absolute best things you can do for your health.

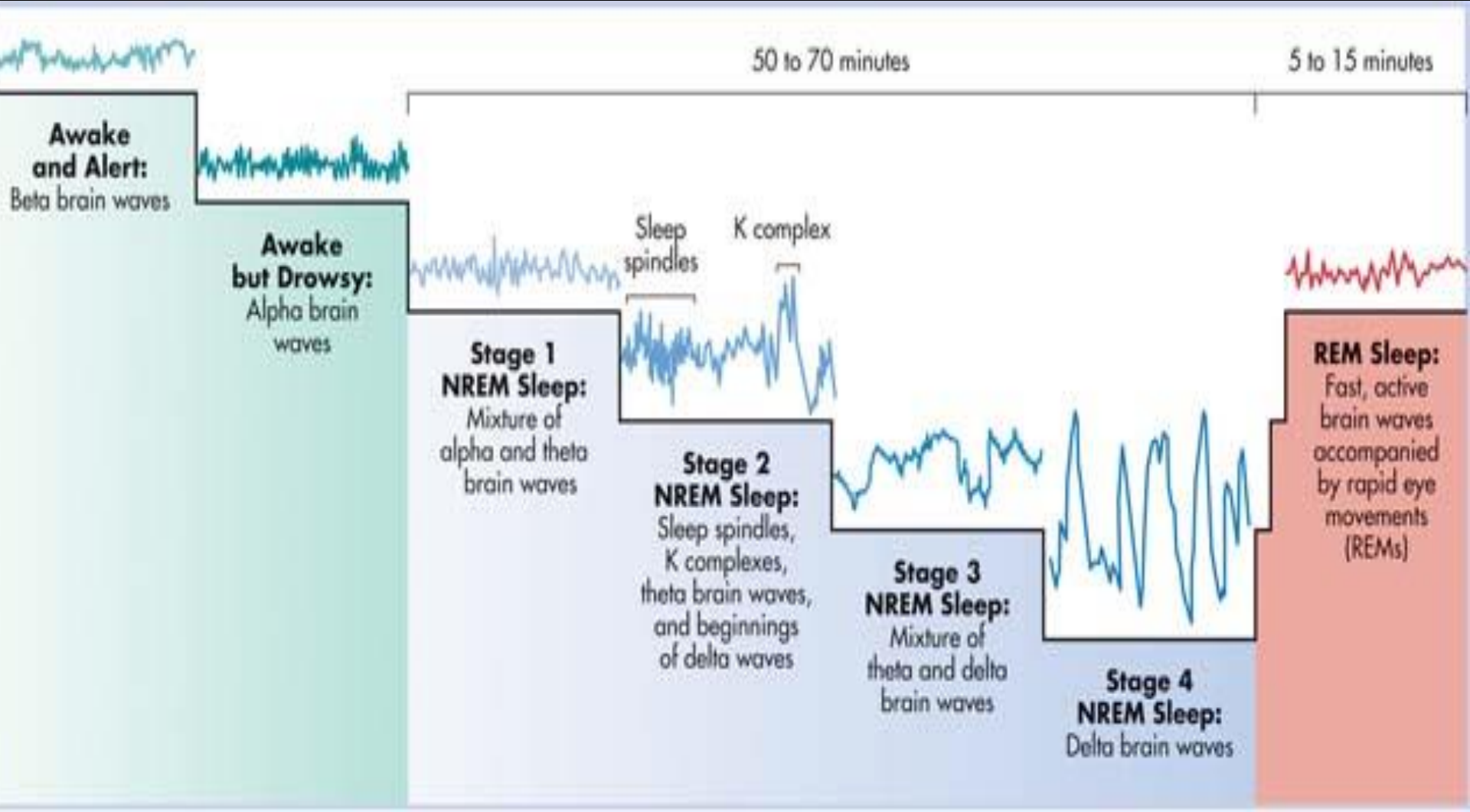
Sleep Deprivation vs. Sleep Restriction



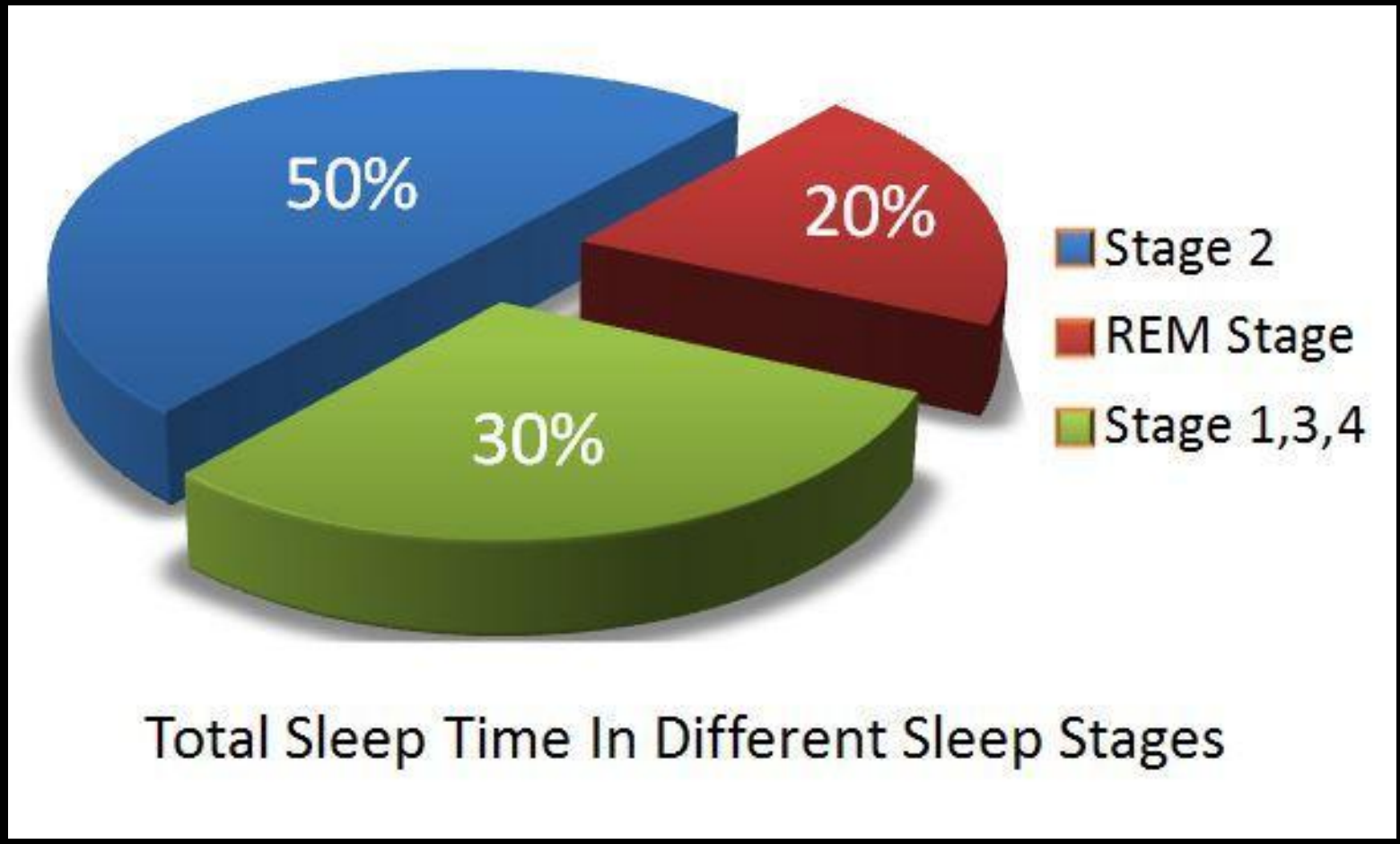


Who wants to sleep better?

Sleep Stages and Sleep Architecture



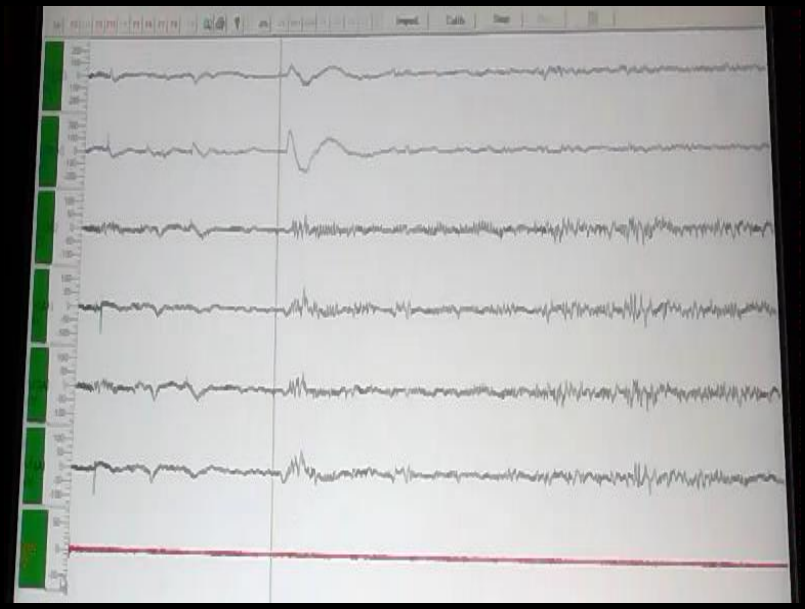
Sleep Stages and Sleep Architecture



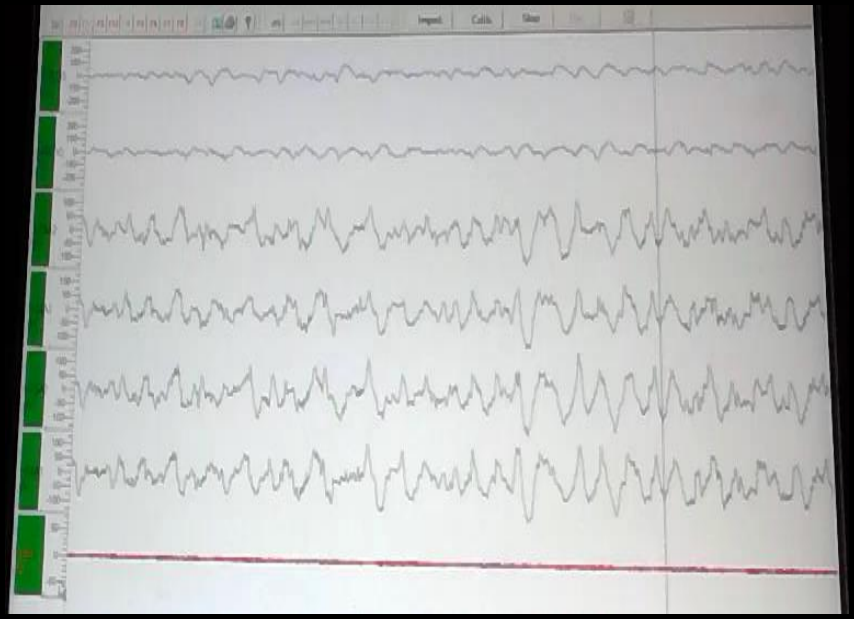
PSG wake and sleep recordings during a napping session in the NSU Sleep Lab.

NSU grad student Kayla Thompson

Dr. Ana Fins



WAKE

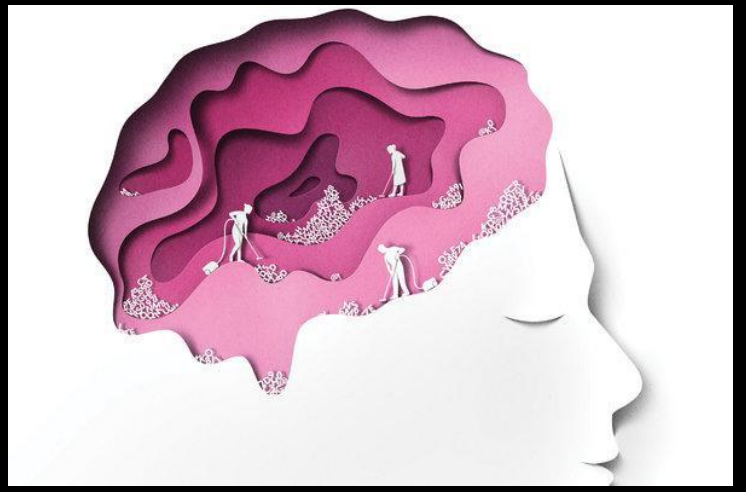


SLEEP

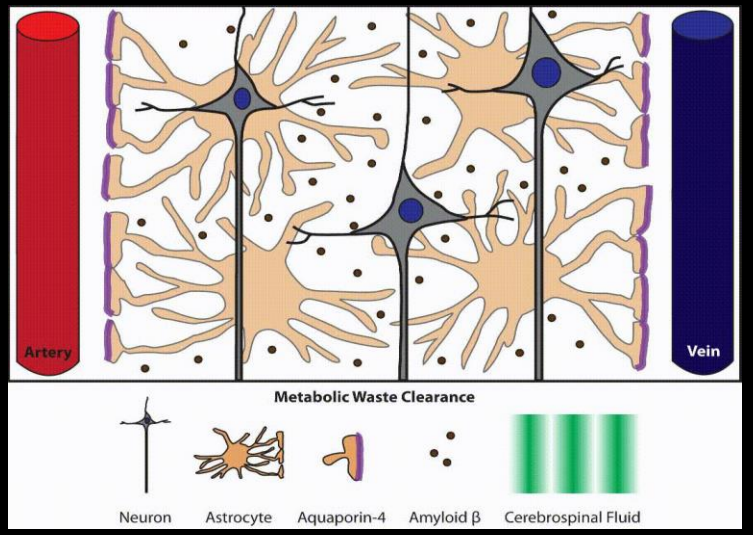
Question 1 -Why do we Sleep?

Sleep Cleans the Brain: The Glymphatic System

The lymphatic drainage pathway removes extracellular proteins, excess fluid, and metabolic waste products.

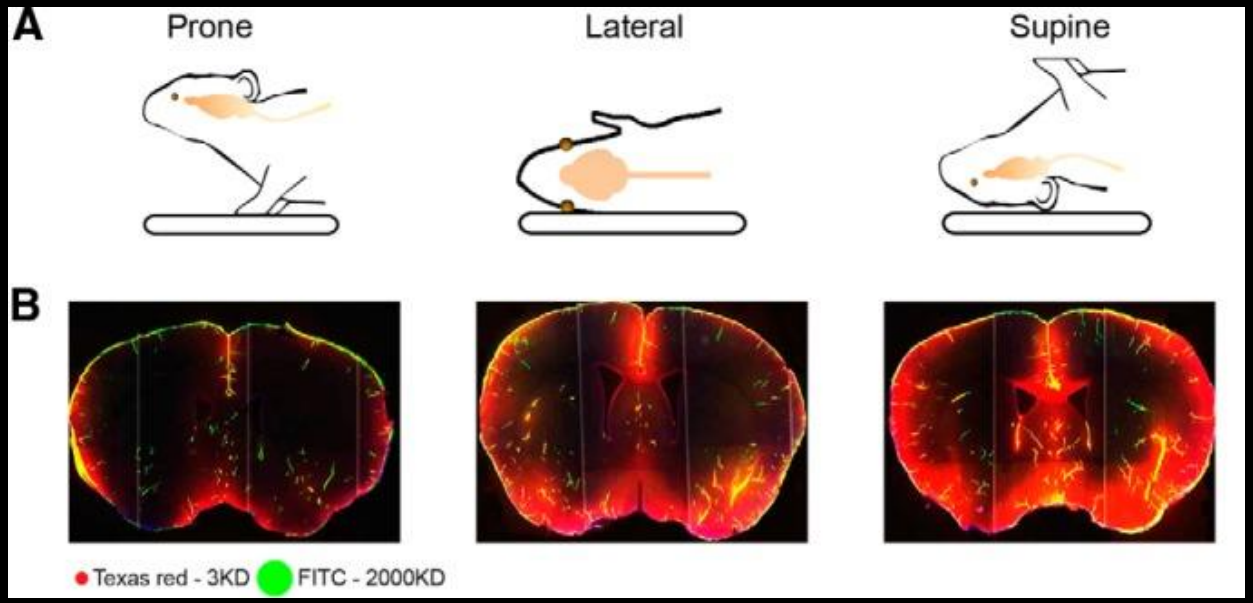


The clearance of these waste products- like Amyloid-β (Aβ)- increases during slow wave sleep.

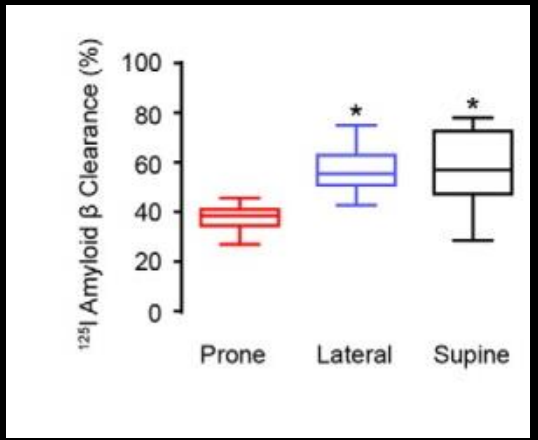


Xie,…Nedergaard, M. (2013). Science,

The Glymphatic System and Sleeping Position



A tracer (red) was mixed with CSF and injected into the area surrounding the brain.
CSF influx in brain was significantly reduced in prone brain compared with lateral and supine brain



Aβ clearance was significantly more efficient in the supine than in the lateral and prone positions

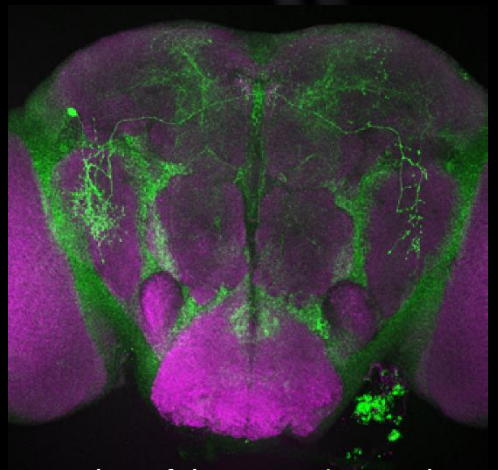
Lee et al., (2015). Journal of Neuroscience.

Sleep Helps the Immune System: Sickness, Stress, and Somnogens

Adenosine builds up during the day to promote sleepiness at night.

Interleukin-1 beta (IL-1β) and tumor necrosis factor alpha (TNFα) promote NREM sleep under stress and inflammatory conditions.

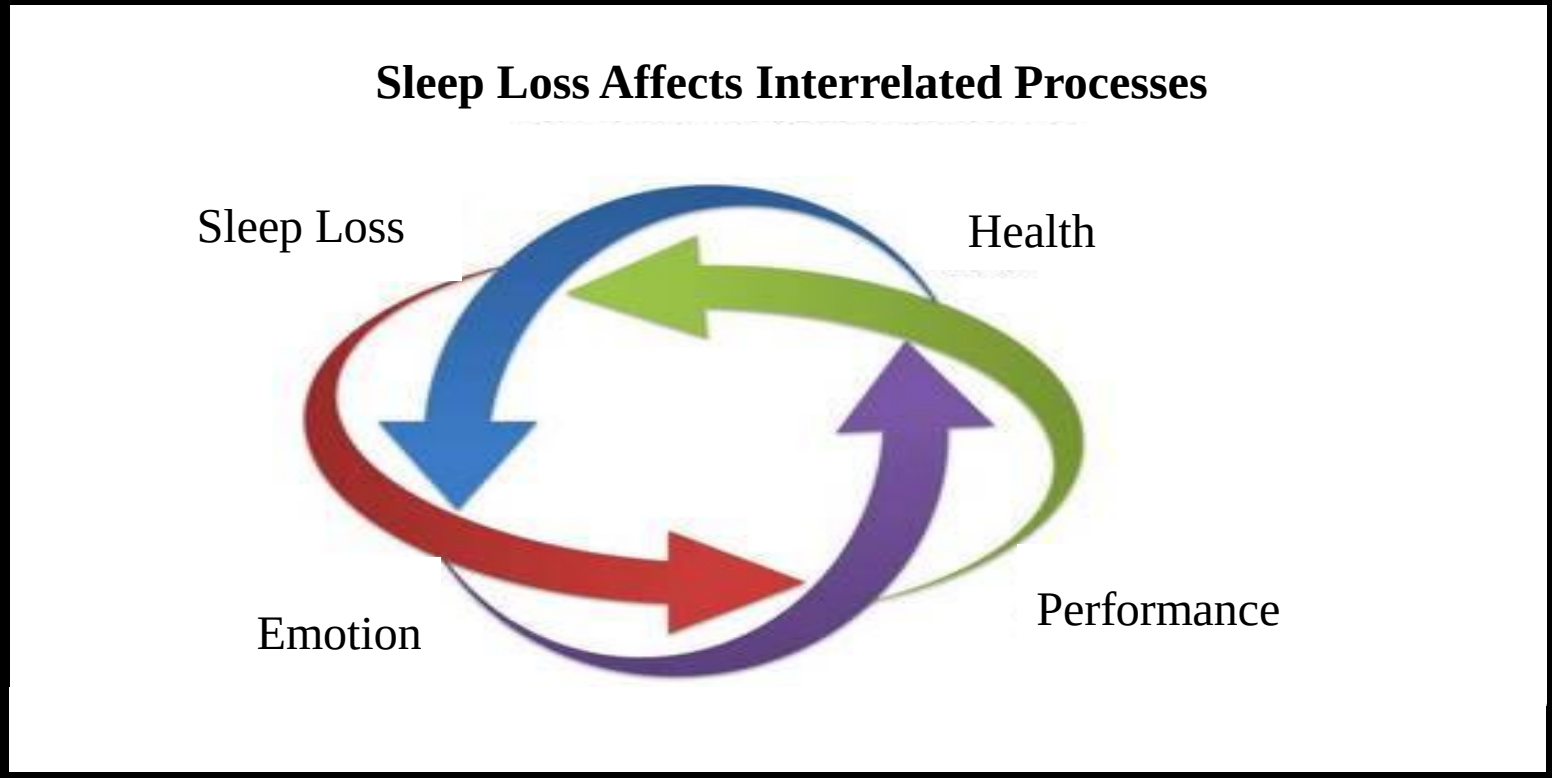
...and hot off the press (Feb 2019)!
The peptide *nemuri* has been discovered in fruit flies to combat bacteria AND increase sleepiness.



Expression of the nemuri gene (green) in neurons in the brain of a fruit fly.

Toda et al., (Feb. 2019). *Science*, *363*(6426), 509-515.

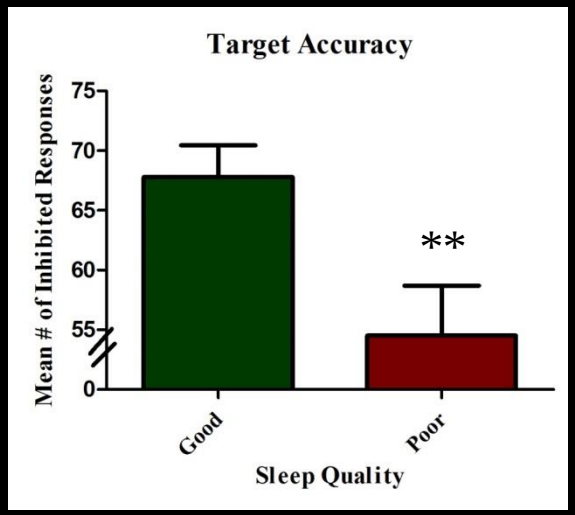
Findings from my Lab



We use a combination of physiological and clinical assessments to test the effects of sleep loss across multiple health and behavioral domains.

Poor sleep quality is associated with an increased negativity bias and decreased sustained attention

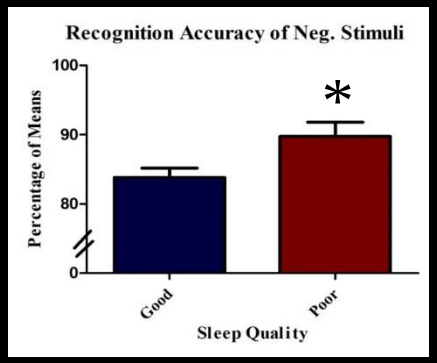
Non-Emotion Attention Task

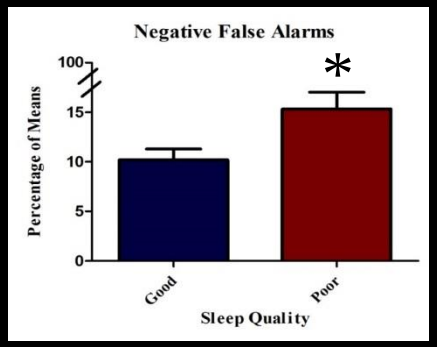


Poor quality is associated with a reduction in target accuracy

* = p < 0.05 **p < 0.01

Emotion Task: Memory for Emotionally Negative Pictures





Poor sleep quality is associated with greater sensitivity to negative stimuli

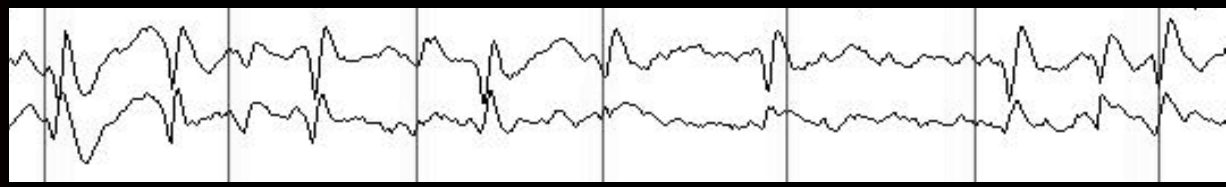
Jonathan Banks, Ph.D.

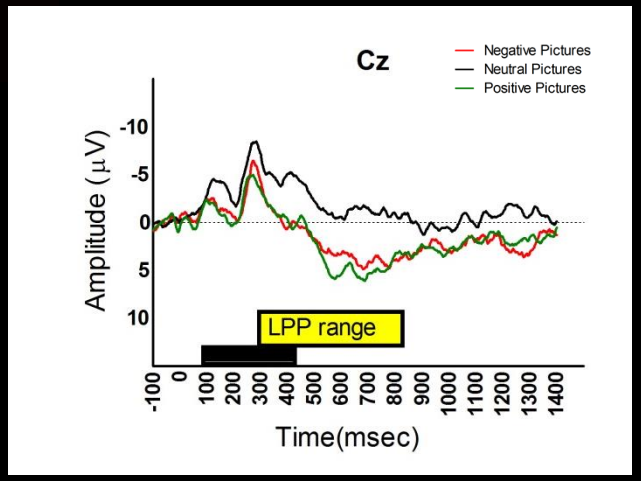
Ana Fins, Ph.D.

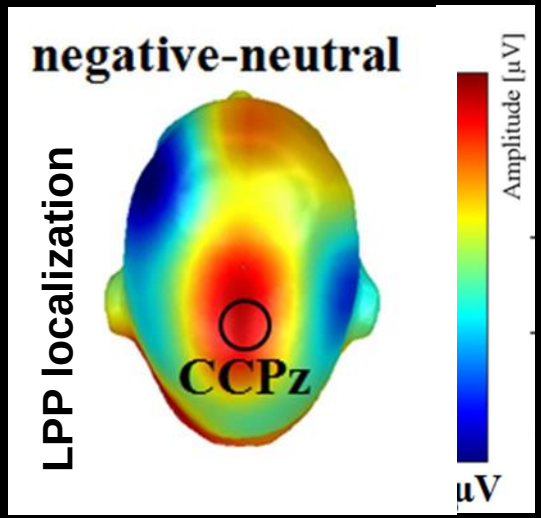
Christina Gobin

Gobin, Banks, Fins, Tartar, Journal of Sleep Research, 2015

Getting into the Brain

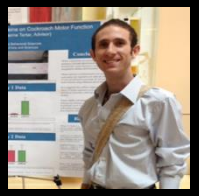






Sleep Deprivation and Sleepiness Leads to Emotional Instability

Ramey Alfarra

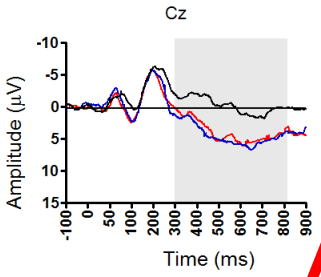


Isaac Chayo

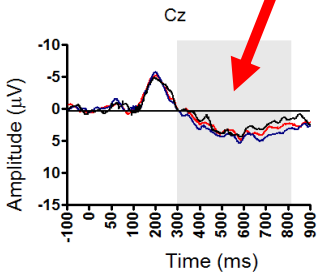
Ana Fins, Ph.D

Sleep Deprivation

Baseline



After SD

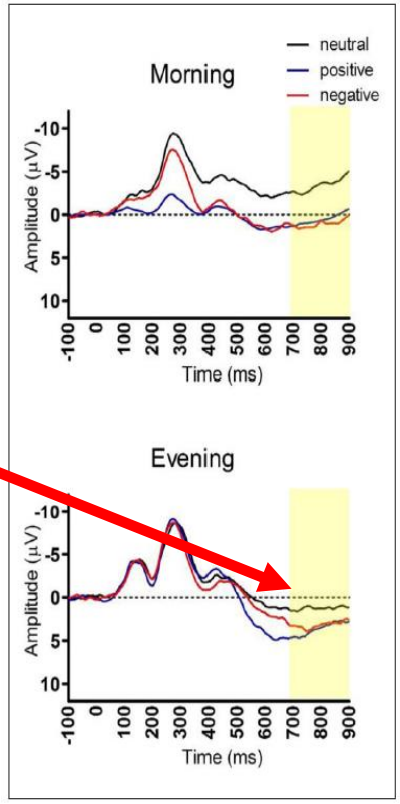


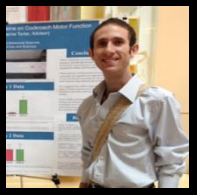
Neutral Pictures
Negative Pictures
Positive Pictures

After SD: Not able to differentiate emotional from non-emotional pictures

In the Evening: Less able to differentiate emotional from non-emotional pictures.

Morning vs. Evening





Isaac Chayo

Samantha Sandor

Mercedes Fernandez, Ph

Alfarra, Fins, Chayo, Tartar (2015) *Biological Psychology*;
Chayo, Fernandez, Sandorr, Tartar (2018) *Journal of Circadian Rhythms*

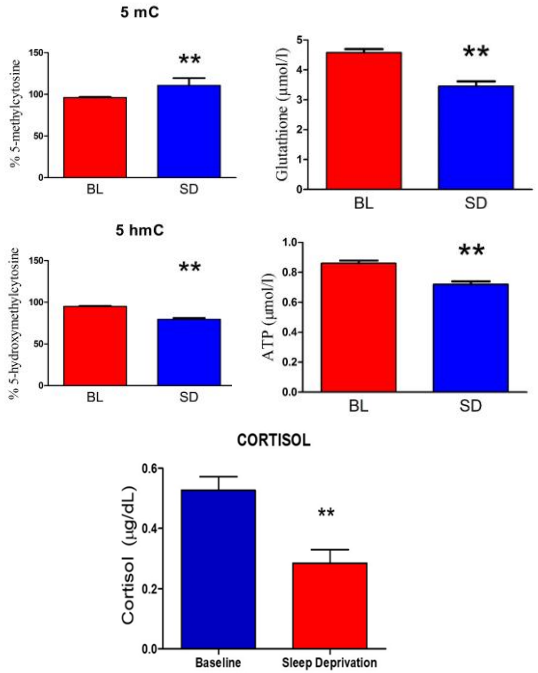
Sleep Deprivation is No Bueno for Biomarkers of Health

Aurelien Tartar, Ph.D.

Malav Trivedi, Ph.D.

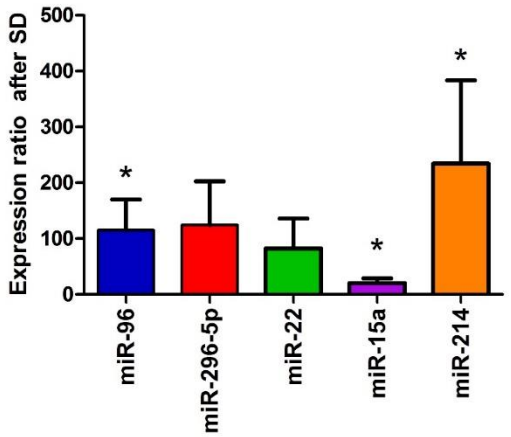
Travis Craddock, Ph.D.

SD changes gene methylation, reduces GSH, and reduces ATP



Trivedi, Holger, Bui, Craddock, Tartar, PloS ONE (2017)

SD increases miRNAs associated with Cancer Risk



Tartar, Tatin, Gonedes, Assefa, Tartar, In Prep

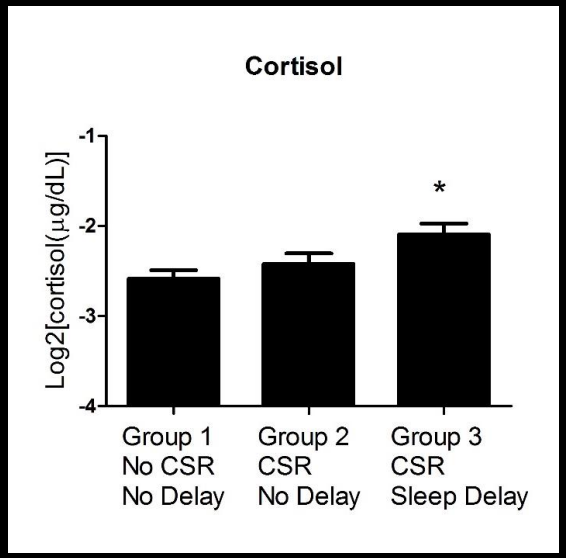
Xavier Tatin

Andrew Gonedes

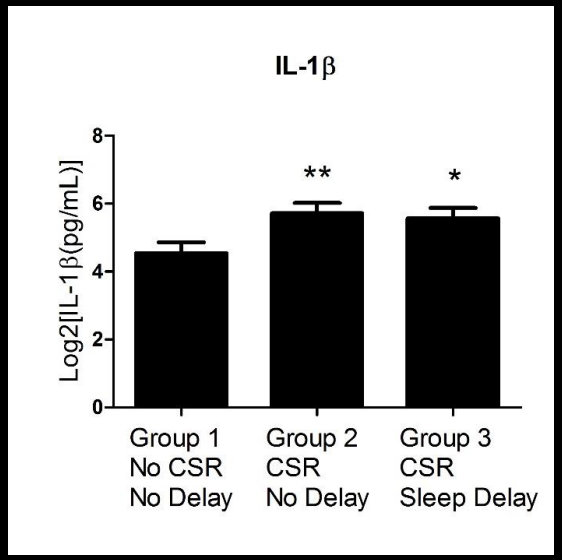
Ezana Assefa

Sleep Restriction…Still No Bueno

Chronic Sleep Restriction increases cortisol in those who go to bed late



Chronic Sleep Restriction increased inflammation



Combined this Indicates GC resistance

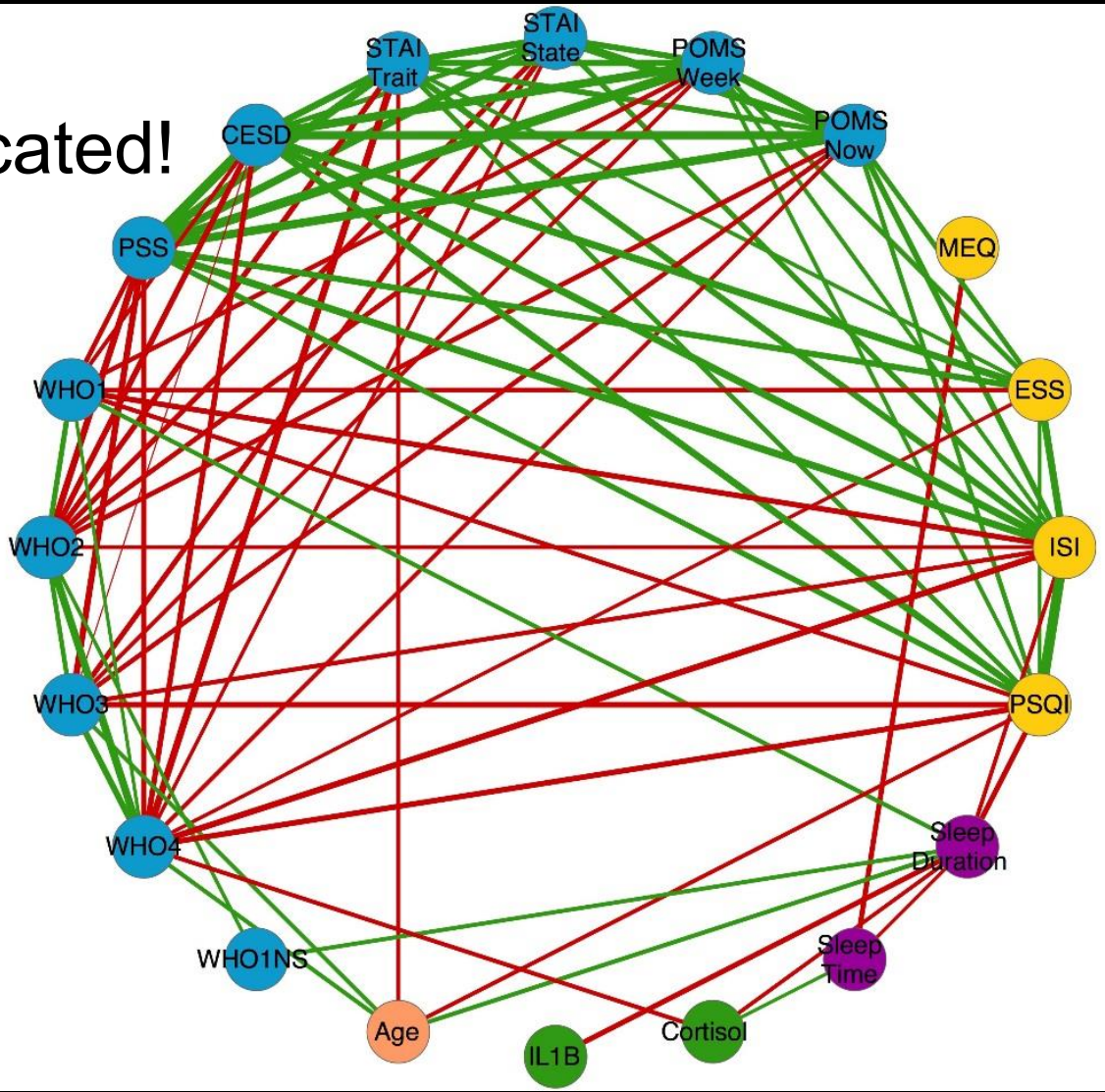
Ana Fins, Ph.D

Travis Craddock, Ph.D.

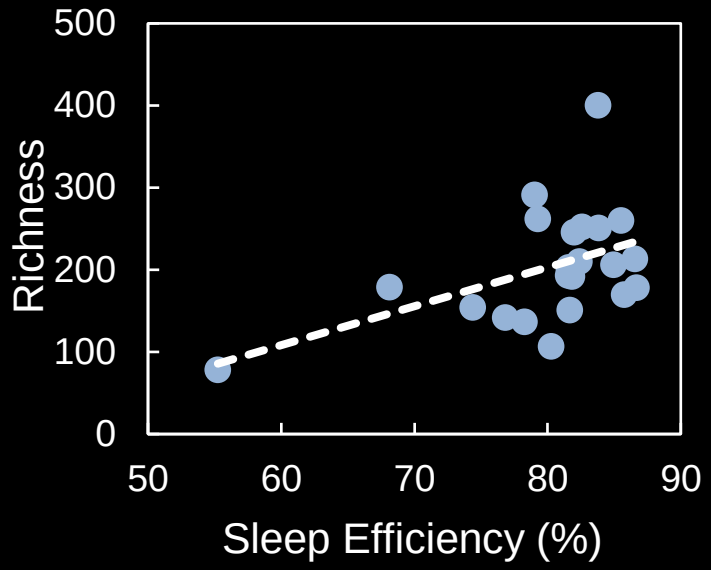
Tartar, J. L., Fins, A. I., Lopez, A., Sierra, L. A., Silverman, S. A., Thomas, S. V., & Craddock, T. J. (2015). Sleep health

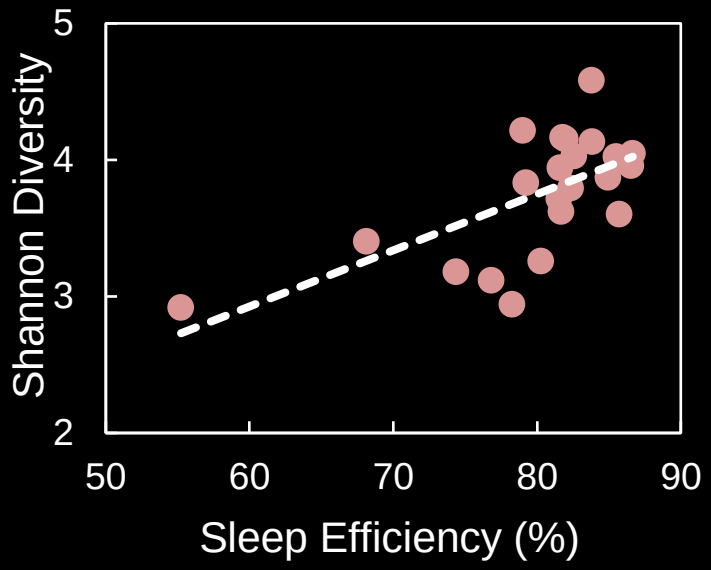
Sleep Restriction…Still No Bueno

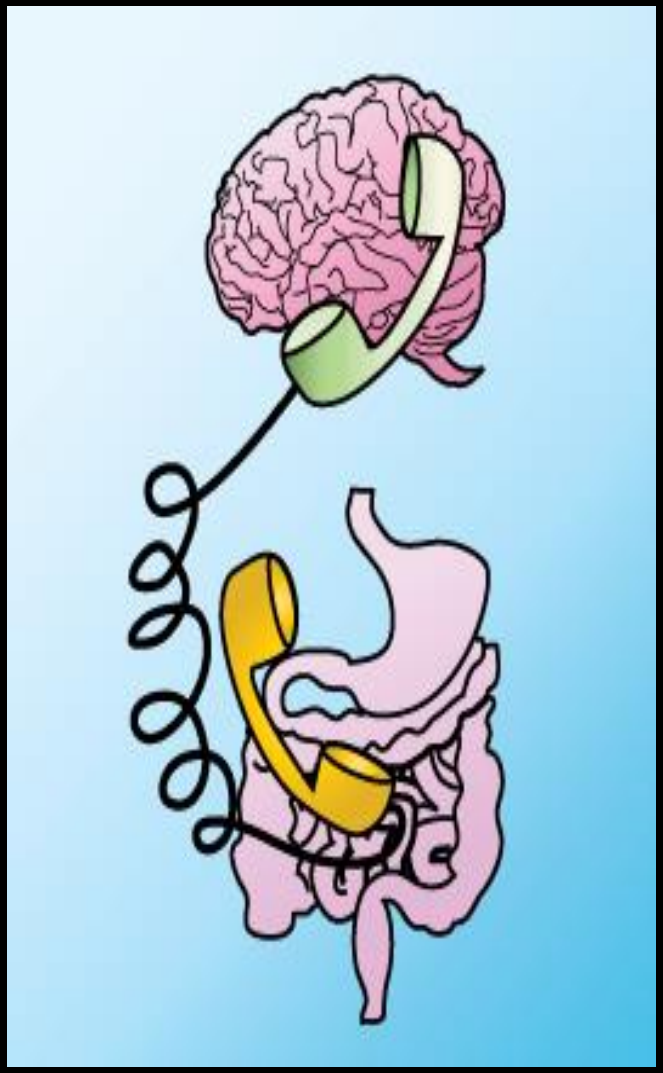
But…
it's complicated!

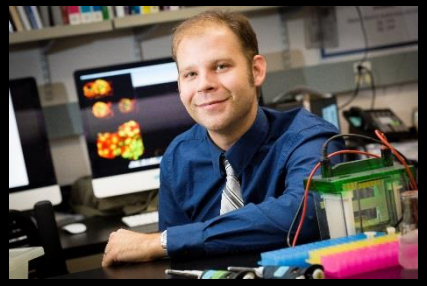


Sleep: A Gut Feeling
Gut Microbiome Health Associates with Sleep Efficiency





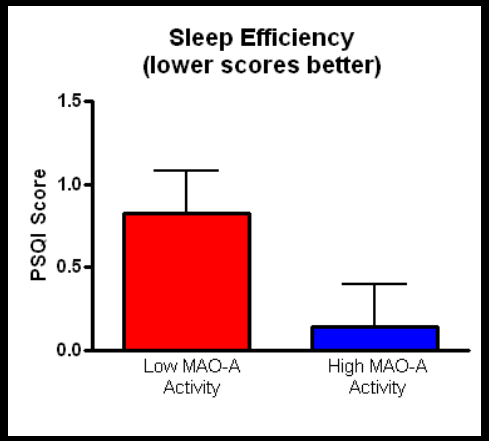




The Great
Rob Smith, Ph.D.

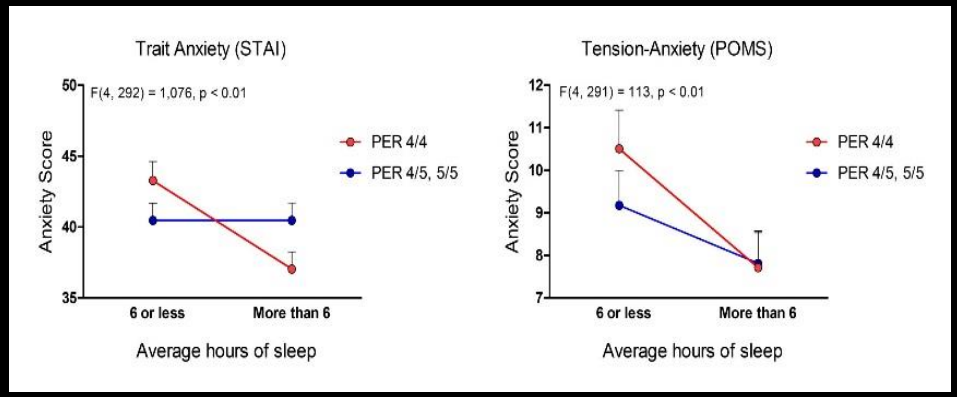
Joe Lopez, Ph.D.

Sleep Loss and Individual Differences

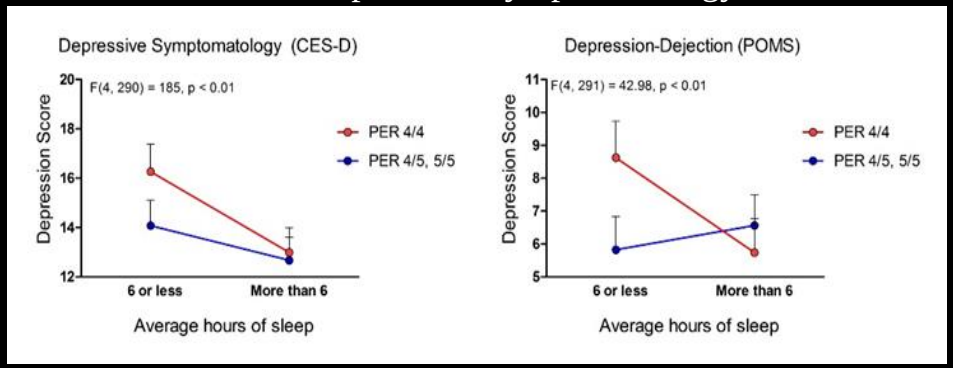


- Dopamine is associated with wakefulness
- People with higher dopamine (low MAO-A activity) have poorer sleep quality

Anxiety



Depressive Symptomatology



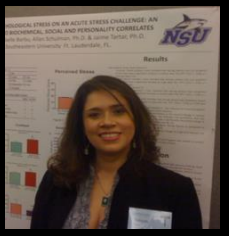
Night Owl genotypes who have sleep restriction show increased anxiety and depression symptoms.


Aurelien Tartar, Ph.D.


Ana Fins, Ph.D

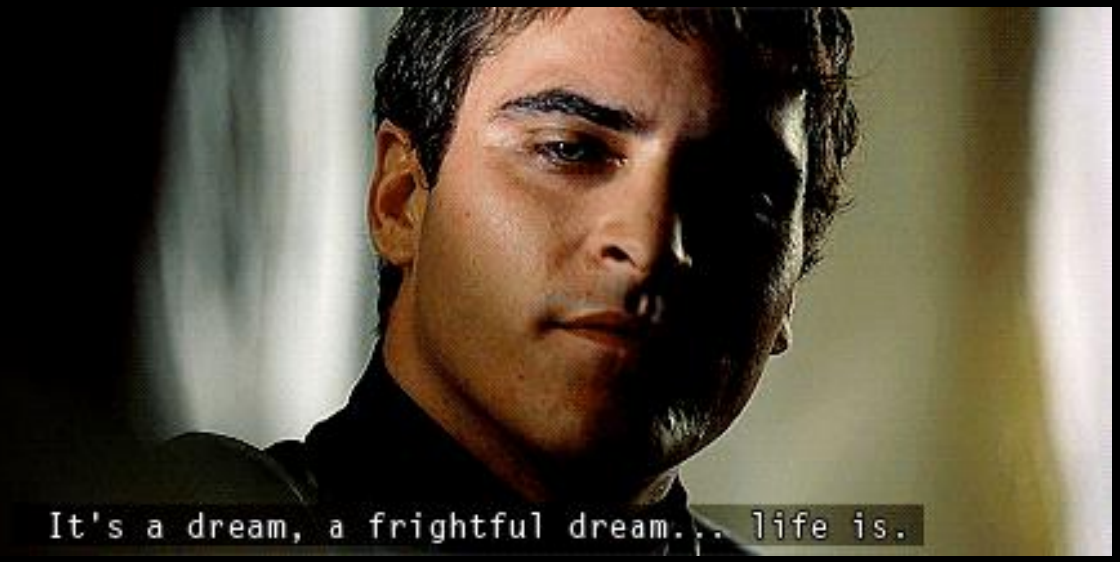

Travis Craddock, Ph.D.


Christina Gobin, M/.S.


Tatiana Vienna, Ph.D.

Viena, T. D., Gobin, C. M., Fins, A. I., Craddock, T. J., Tartar, A., & Tartar, J. L. (2016). Journal of circadian rhythms.

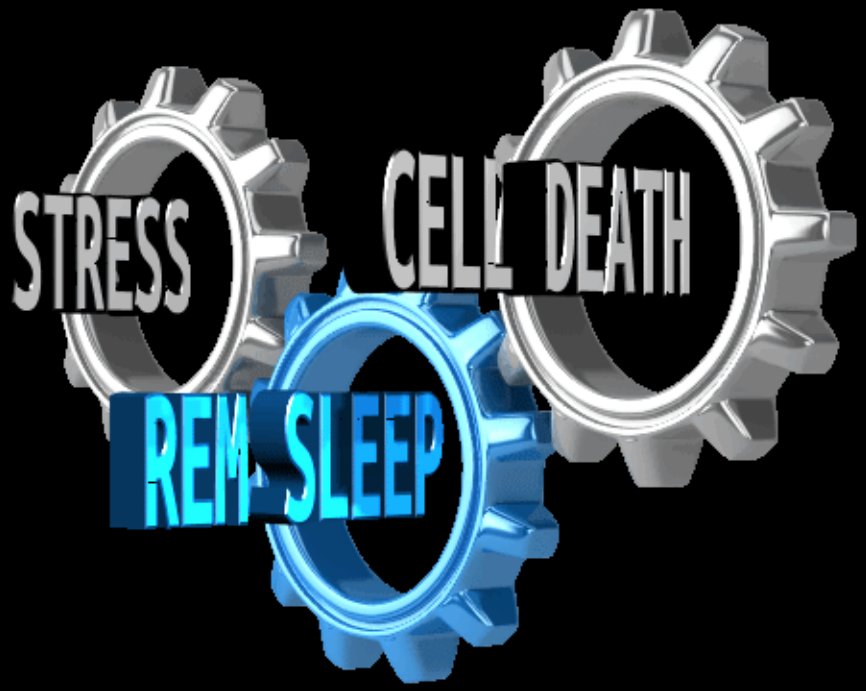
Question 2 -Why do we Dream?



Stress, REM Sleep, and Cell Death

Daily mild stress results in an increase in depressive symptomatology ***and*** an increase in REM sleep.

These changes were associated with increased gene expression in a signaling pathway related to cell death.



Opens up new possibilities in understanding how stress leads to mood disorders and how changes in sleep may contribute to this.

Nollet et al., (Feb 14 2019) PNAS. 201816456.

REM Sleep and Muscle Memory!

Sleep benefits memory consolidation

- SWS is beneficial for declarative memories,
- REM sleep appears important for consolidation of non-declarative, procedural and emotional memories.

Kayla's thesis is currently testing the idea that procedural memory is strengthened by REM sleep!

Learn

Sleep while wearing an EEG band

Test

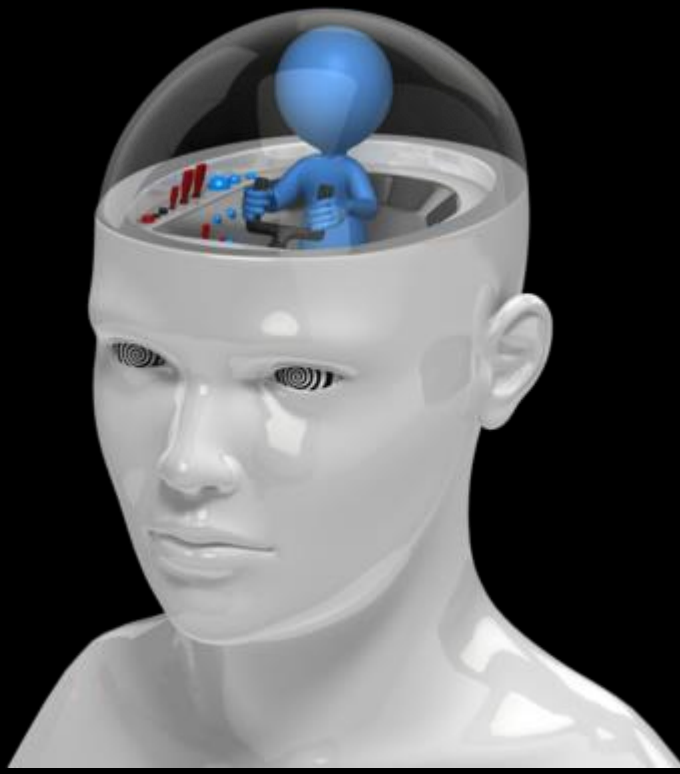
What Can You Do?

1. Stick to a sleep schedule.
2. Pay attention to what you eat and drink.
3. Create a restful environment.
4. Limit daytime naps.
5. Manage worries.
6. Include physical activity in your daily routine.

Sleep Efficacy is Critical

Sleep efficacy -the belief that one can get a good night's sleep- was associated with

1. perceived competence- or an individual's sense that he or she could do the things they wanted to do
2. locus of control- or sense that they were in control of their own lives



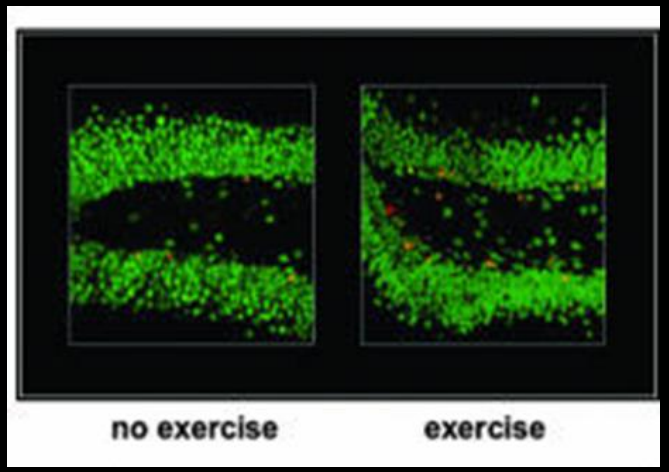
Zhang et al., (Jan 2019). *The Journals of Gerontology*

Exercise is your brain's BFF and it helps you sleep better!

Exercise is your brain's BFF and can help you sleep better.

Oh…and this other stuff, too!

- Combats psychological consequences to stress – especially memory.
- Decreases the rate at which telomeres shorten – by seven biological years!.
- Increases the number of mitochondria and ribosomes in cells
- Increases cognitive function and brain plasticity
- Reduces the risk of the primary development of several cancers
- Increased neurogenesis and expression of brain derived neurotrophic factor (BDNF)
- People in their 80s having immune profiles similar to people in their 20s !



Thanks!