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NEUROFEEDBACK

SLEEP, COGNITION & MENTAL HEALTH

Free C.E. Webinar - 2 C.E. Credits

Thomas Woodman, DC

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Dr. Tom Woodman, DC, BCN

- DC – Life Chiropractic College West - 2005
- Board Certified Neurofeedback - BCIA - 2012
- Post Graduate Faculty – Life University
- Norwalk Hospital Grand Rounds
- Panel Expert – Acadia Healthcare
- Director – Next Level Neurofeedback
  - In-office and At-home training
  - NextLevelNeurofeedback.com

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In this webinar, we will cover:

1. Sleep – General Overview
2. Functions of Sleep
3. Sleep Quantity – Recommendations based on demographics
4. Sleep disorders – general overview
5. Impacts of inadequate sleep
6. Improving Sleep Hygiene
7. Overview of professional interventions aimed at improving sleep quality
8. Case Studies

We have two hours to talk about Sleep

This can get very boring, and what I want to avoid is having a 2 hour webinar on sleep become a 2 hour nap.

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Cover the more academic aspects first, and then transition to some more interesting and practical aspects concerning sleep so that you can improve the quality of your life.

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General Information On Sleep

A simple goggle search on sleep will bring up something like the following:

- Poor sleep is related to obesity, high blood pressure, lower life expectancy, mood disorders and poor immune function.

How dangerous is sleep deprivation?

Alan Eustace – Former Google Executive.

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How dangerous is sleep deprivation?

- Wanted to set the world record for the longest free fall distance.
- He hooked himself up to a large helium balloon, ascended into the stratosphere to an altitude of 135,890 feet – which required him to various life support systems in his suit - he then relied on an explosion device to separate him from the balloon.

How dangerous is sleep deprivation?

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How dangerous is sleep deprivation?

- His free-fall lasted 4 minutes and 27 seconds and stretched nearly 26 miles. His top speed was 822 miles per hour, he broke the sound barrier, and covered a total free-fall distance of **123,414 feet.**
- **He subsequently set the Guinness Book of World Records with this jump.**

Guinness – Record Safety Rules

Danger in records

Guinness World Records will not monitor any records involving unsuitable activities or those which could cause potential harm or danger to spectators.

Guinness – Record Safety Rules

Danger in records

Guinness World Records will not monitor any records involving unsuitable activities or those which could cause potential harm or danger to spectators.

- According to Guinness Book of World Records, what Alan Eustace did was fine, but they stopped recognizing sleep deprivation in 1989 because it has too many health implications, and because someone that is sleep deprived could become psychotic and injury someone.

Matt Walker – UC Berkeley

"The shorter your sleep, the shorter your life. The leading causes of disease and death in developed nations—diseases that are crippling health-care systems, such as heart disease, obesity, dementia, diabetes, and cancer—all have recognized causal links to a lack of sleep."

Matt Walker, PhD

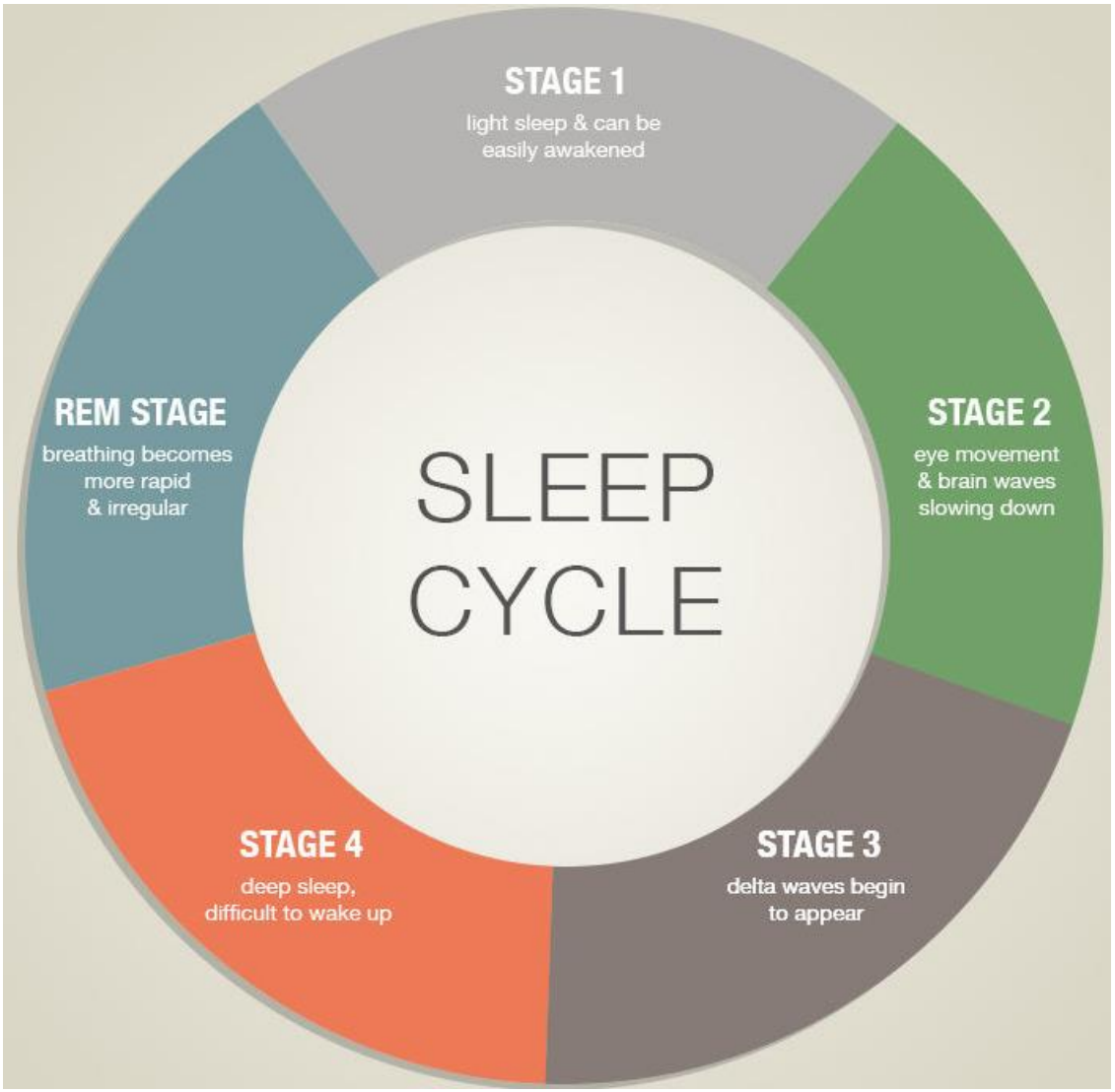
What is Sleep?

What is Sleep?

"Sleep is a naturally recurring state of mind and body, characterized by altered consciousness, relatively inhibited sensory activity, reduced muscle activity and inhibition of nearly all voluntary muscles during rapid eye movement (REM) sleep, and reduced interactions with surroundings. It is distinguished from wakefulness by a decreased ability to react to stimuli, but more reactive than a coma or disorders of consciousness, with sleep displaying different, active brain patterns." -Wikipedia

Phases of Sleep – Historical Model

- Non-REM
  - 4 stages
- REM
  - 1 stage
- 90 minutes per cycle
- In 9 hours of sleep you should have 6 cycles.



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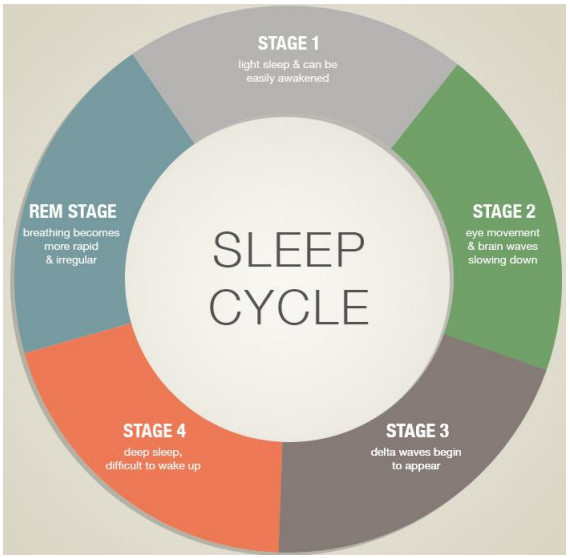
Phases of Sleep – Historical Model

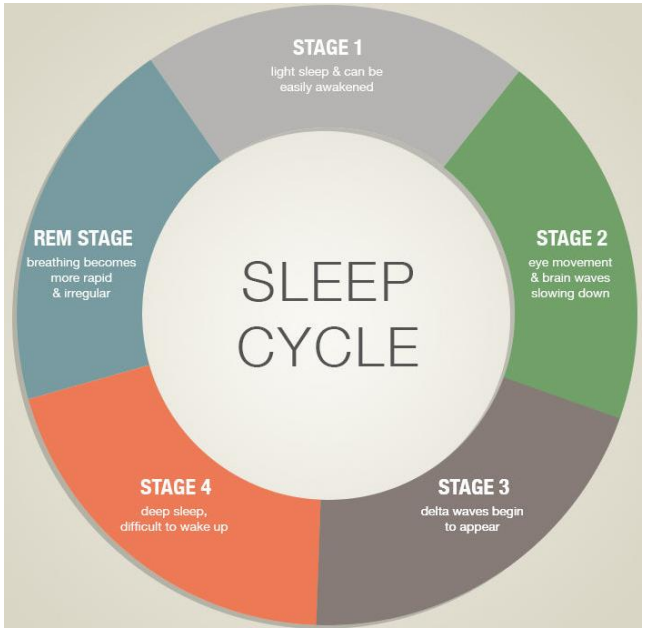
- This model was largely accepted during much of the 20th century.
- During this time, sleep was largely considered a "passive" activity during which the body and the brain were dormant.



A lot has changed in the last 20 years

National Institute of Neurological Disorders and Stroke

Last reviewed on July 25, 2022



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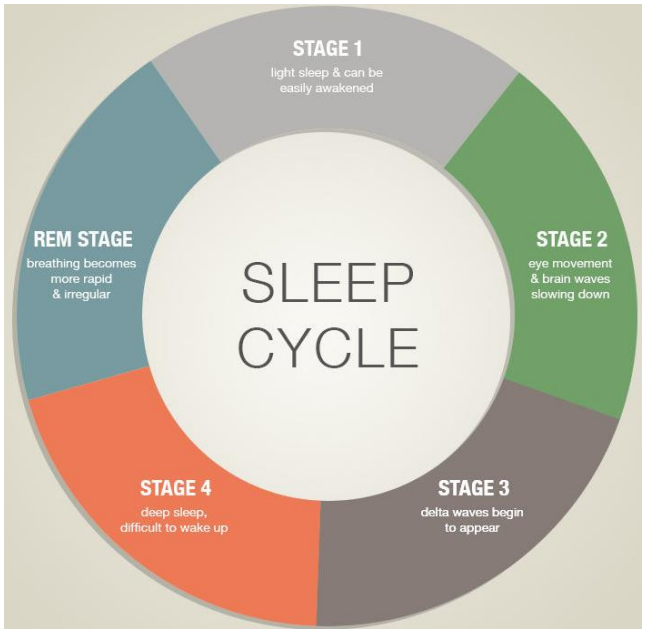

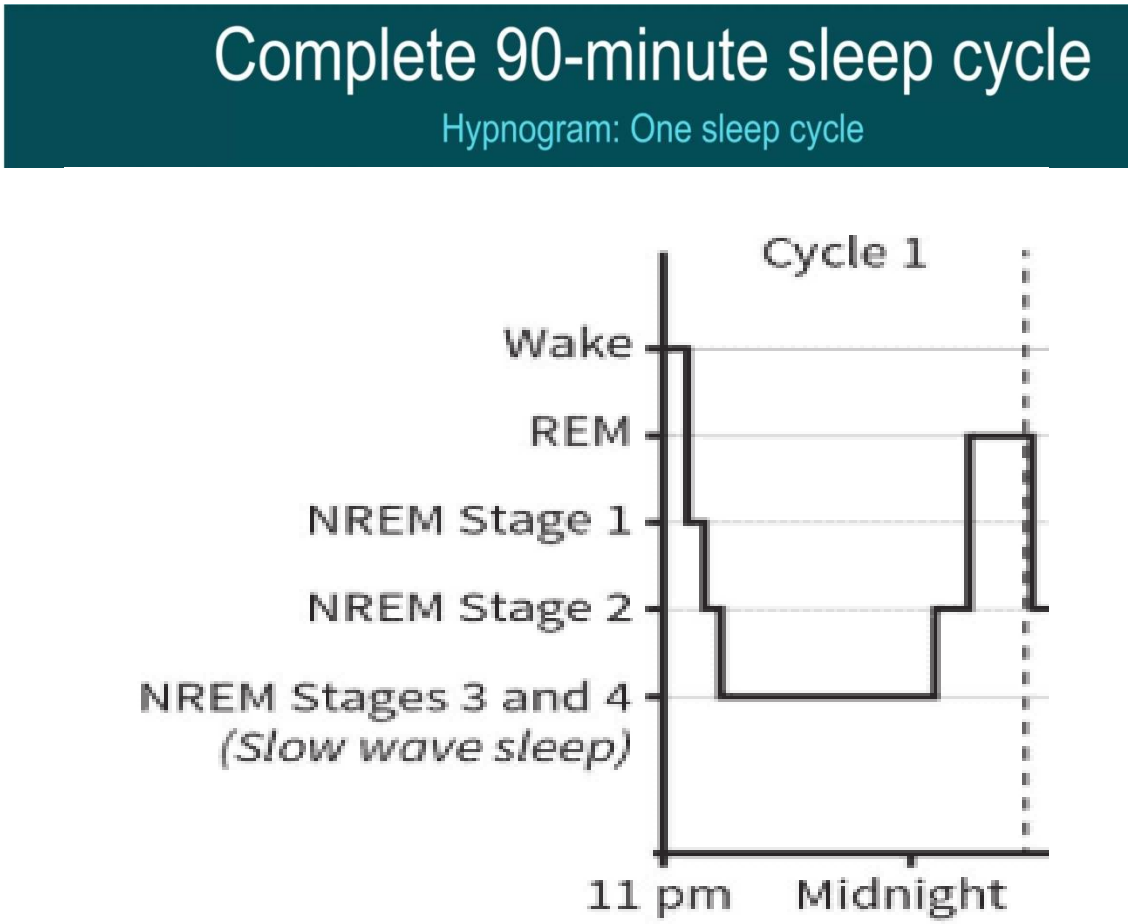

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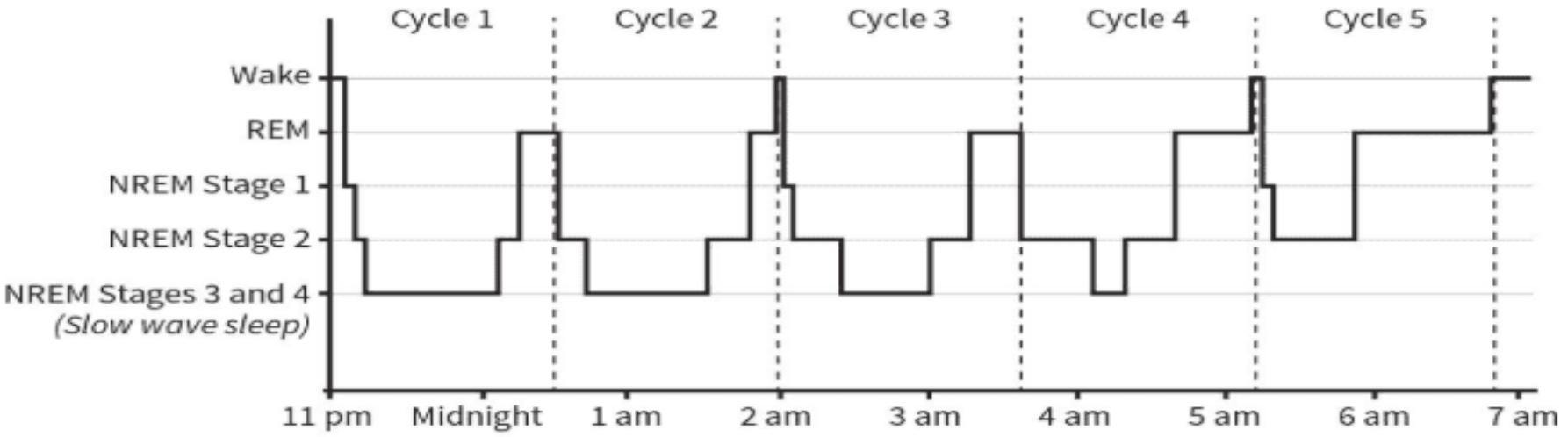
The Ratio of Non-Rem to Rem

As you progress through a night of sleeping, the time you spend in the deeper stages of sleep changes. For the first half, you are in Stage 3 and 4 more; in the second half, you spend more time in REM

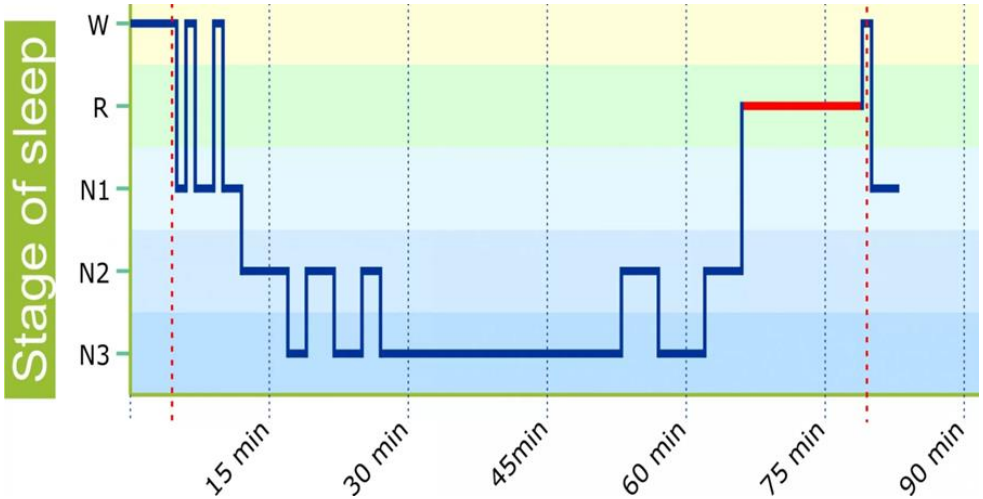


Sleep Stages – The basic stages of sleep

National Institute of Neurological Disorders and Stroke

Last reviewed on July 25, 2022

- **Non-REM (Rapid Eye Movement) Stage**
  - **Stage 1** – change from wakefulness to sleep
  - **Stage 2** – light sleep before deeper sleep
  - **Stage 3/4** – deepest NREM sleep
- **Rapid Eye Movement (REM) Stage –** Deepest sleep



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Sleep Stages – Brainwave Perspective

Last reviewed on July 25, 2022

- **Non-REM (Rapid Eye Movement) Stage**
  - **Stage 1** –Your brain waves begin to slow from their daytime wakefulness patterns.
  - **Stage 2** – Brain wave activity slows but is marked by brief bursts of electrical activity.
  - **Stage 3/4** – Brain waves become even slower.
- **Rapid Eye Movement (REM) Stage – Despite being your deepest sleep, your brainwave activity is similar to when you are awake.**

Sleep Stages – General Information

Last reviewed on July 25, 2022

- **Non-REM (Rapid Eye Movement) Stage**
  - **Stage 1** –Relatively short period – only several minutes long.
  - **Stage 2** – You spend more of your repeated sleep cycles in stage 2 sleep than in other sleep stages.
  - **Stage 3/4** – It occurs in longer periods during the first half of the night.
- **Rapid Eye Movement (REM) Stage –** until roughly age 35, most of your REM sleep occurs in the second half of the night.

Important Features of REM Sleep

Last reviewed on July 25, 2022

- Most of your dreaming occurs during REM sleep. Your arm and leg muscles become temporarily paralyzed, which prevents you from acting out your dreams. (sleep paralysis)
- You tend to engage in longer, deeper REM as the night progresses.
- As you age, you sleep less of your time in REM sleep.

Important Features of REM Sleep

Last reviewed on July 25, 2022

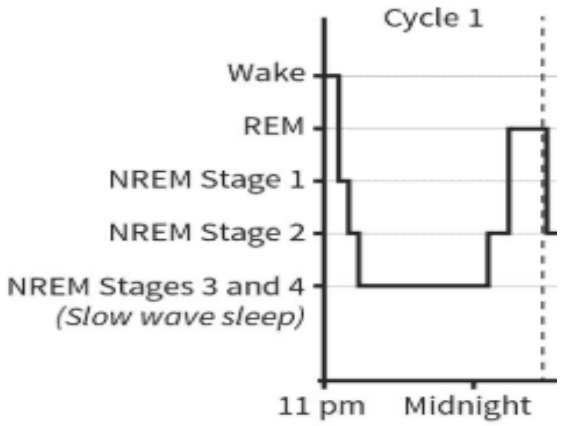
- Several emotional processing centers in your brain are up to 30% more active during REM than during any other time in a 24-hour period.
- REM acts as an “emotional soothing balm” that helps you process emotionally charging events and makes them less sharp.
- During this phase, the “stress-chemical” producing centers in the brain drop off.
- This allows you to process things without getting worked up.

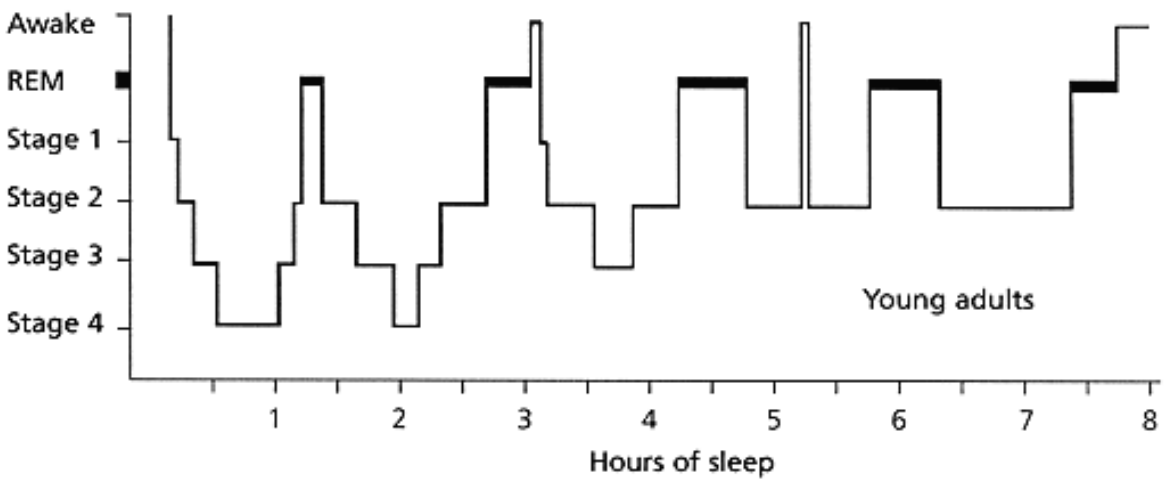
Important Features of REM Sleep

Last reviewed on July 25, 2022

- Recent research has shown that people with PTSD have a hard time recovering from distressing experiences and suffer reoccurring nightmares.
- These people's brains don't typically shut the stress centers down during REM.
- It is a reason why blood pressure medication is beginning to show benefits for those with PTSD.
- BP meds shut down stress chemicals in the brain, so these people can begin to process their dreams better and recover over time.

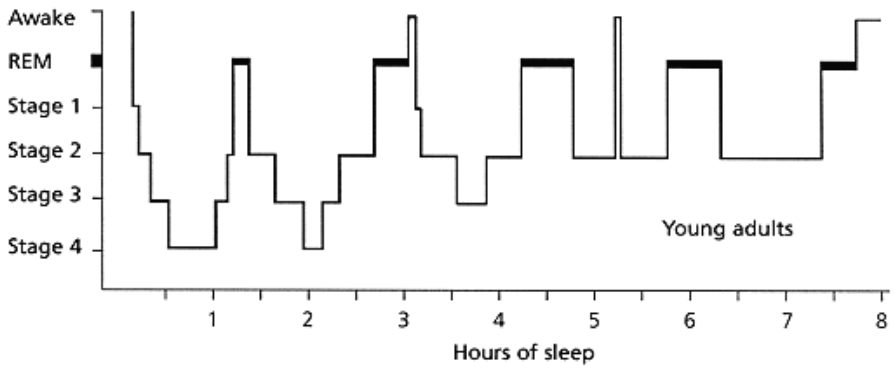
Looking at a full night hypnogram

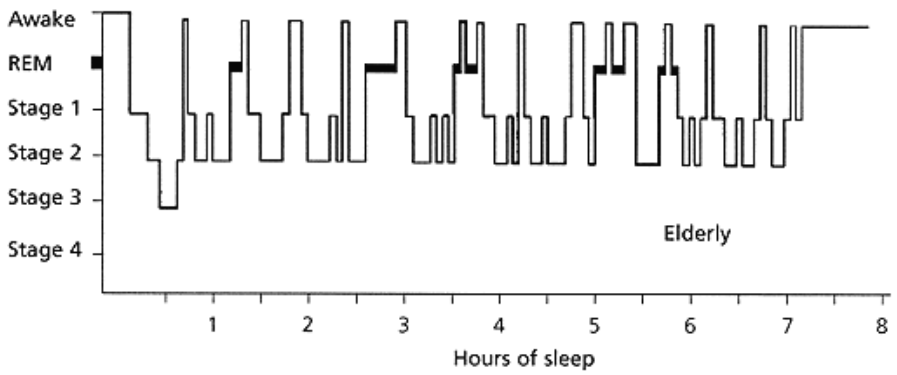




- The first half of sleep - which has more slow wave sleep - is largely responsible for healing your body.
- The second half of sleep – which has more REM - is more responsible for healing your brain and your mind, and forming memories.

Your sleep stages change as you age





Elderly people spend more time in Stage 1 and 2.

- “Lighter sleepers” and wake easier.
- Less energy
- Memory issues.
- Spending less time in Stages 3/4 results in less Human Growth Hormone production, which is why people get weaker as they age.

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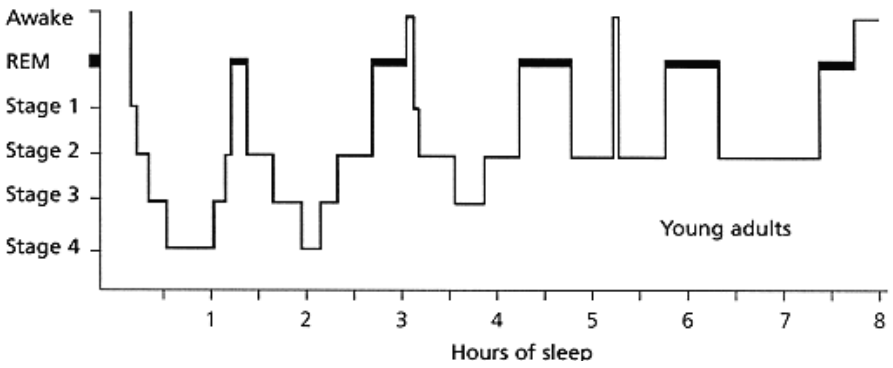
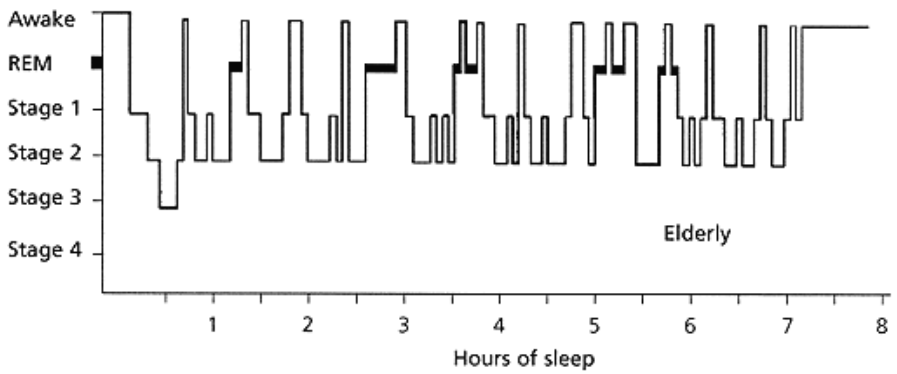
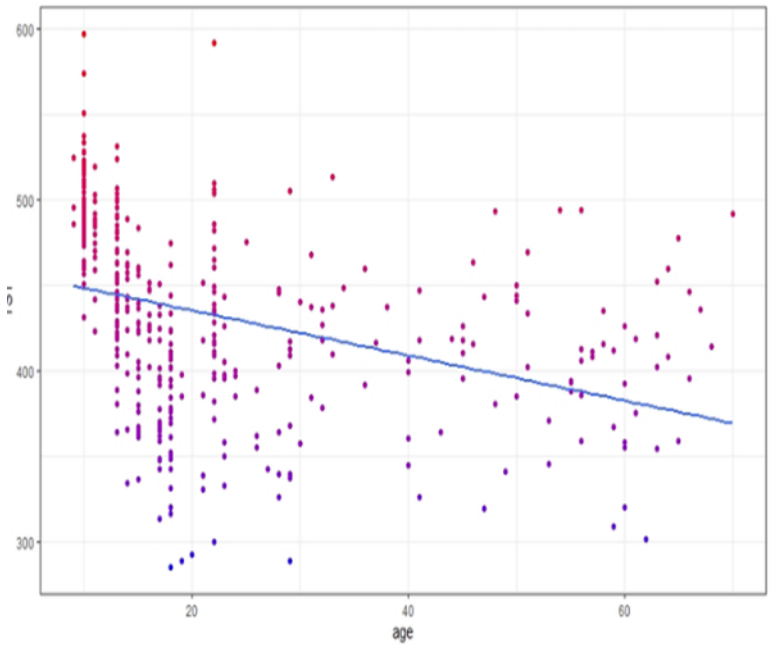
So let's look at some interesting graphs







Sleep quality AND total sleep time decreases.

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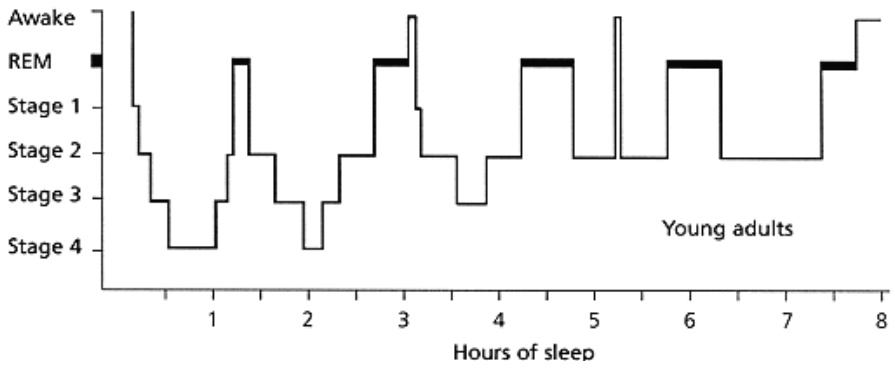
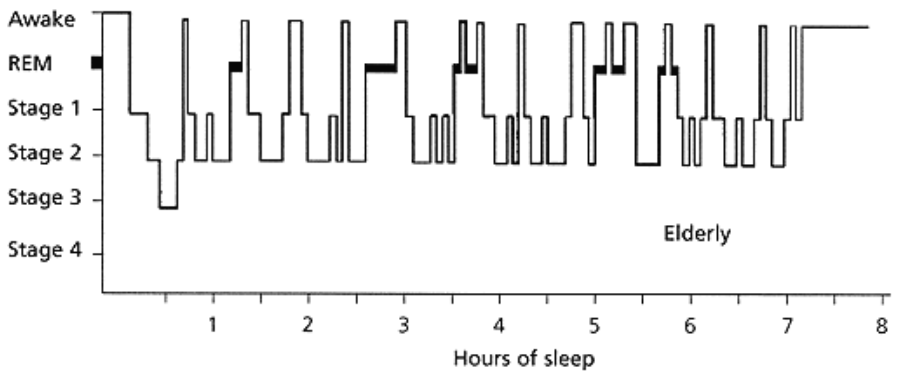
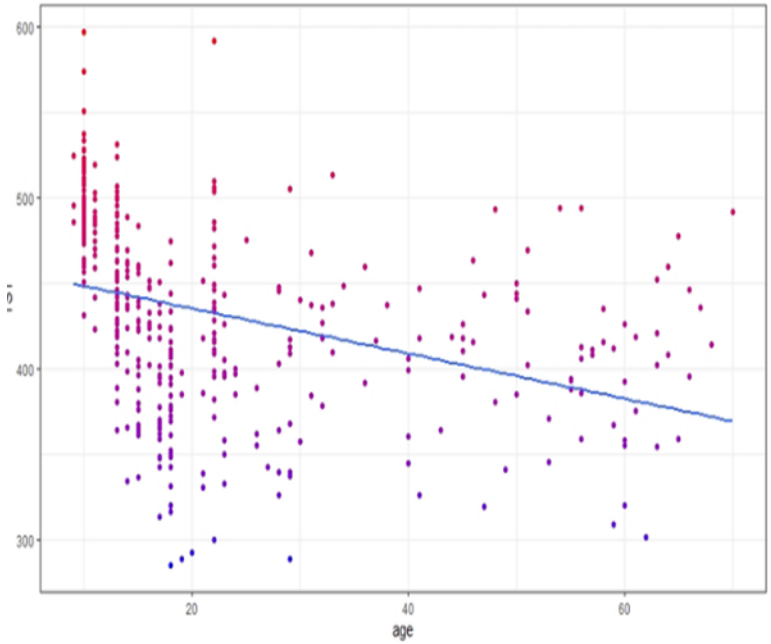
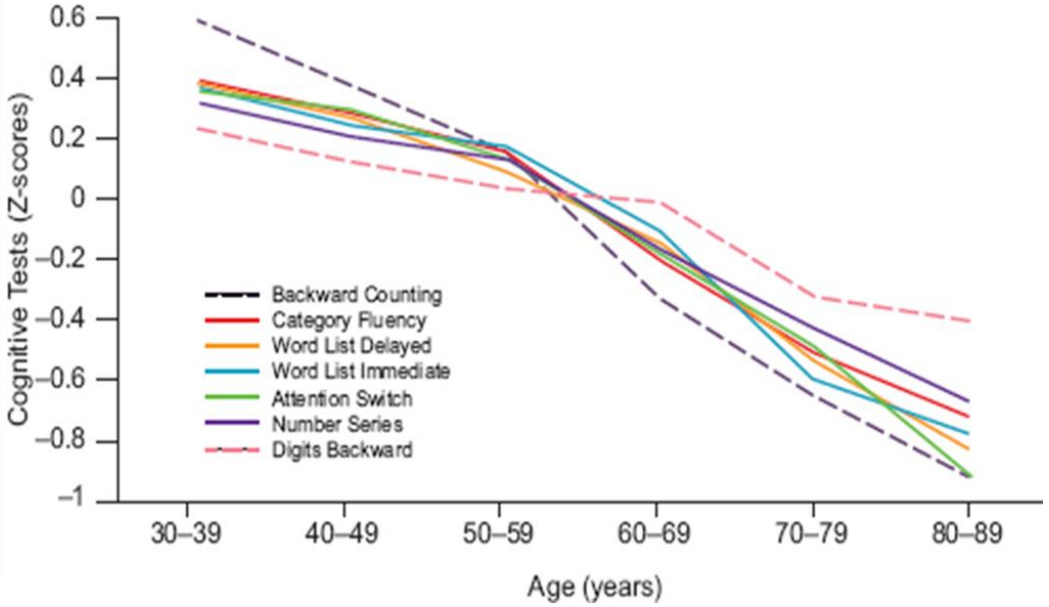
So let's look at some interesting graphs









Sleep quality AND total sleep time decreases. And their cognition declines!

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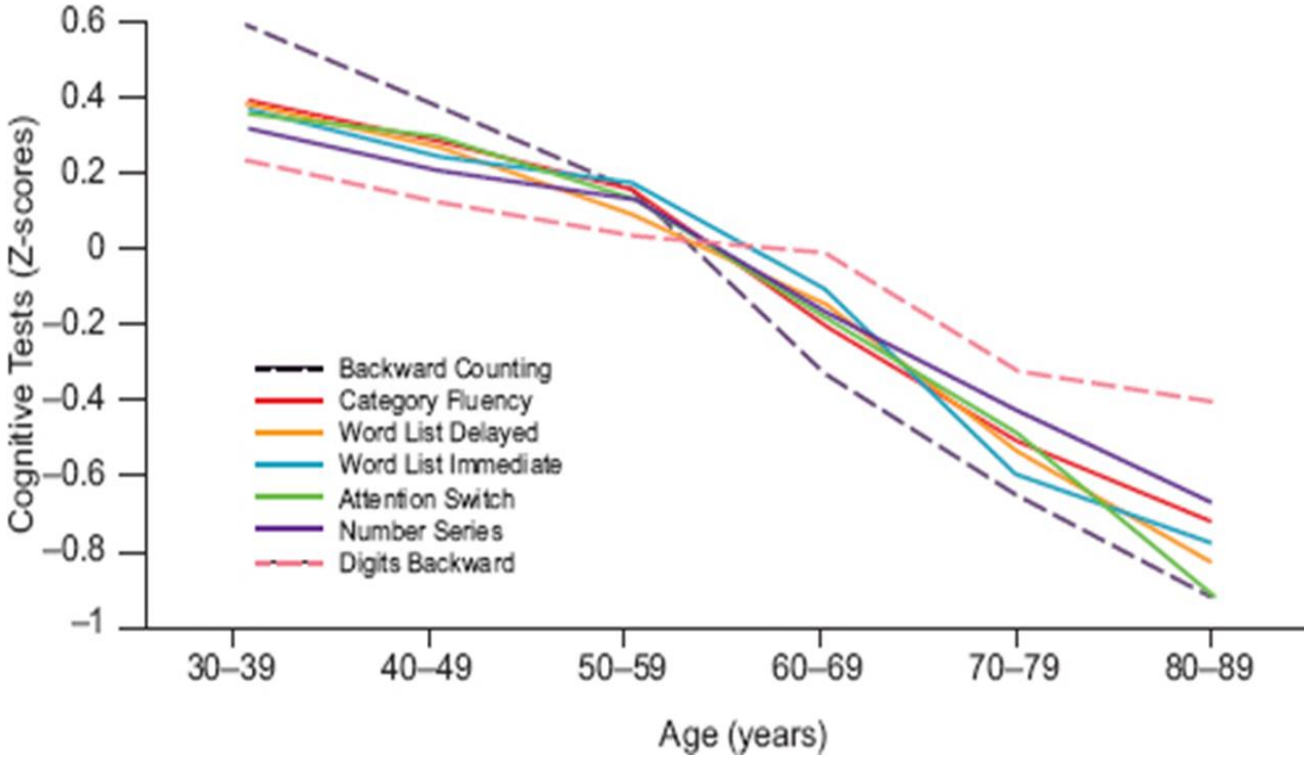
The drop in cognition over this same span...



Is highly correlated to the decrease in sleep quality and total sleep time!

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Age-Related Cognitive Decline

While everyone pictures this…

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This is who should be concerned…

Most of the processes in the brain begin to decline around age 35, and sharply drop at around age 50.

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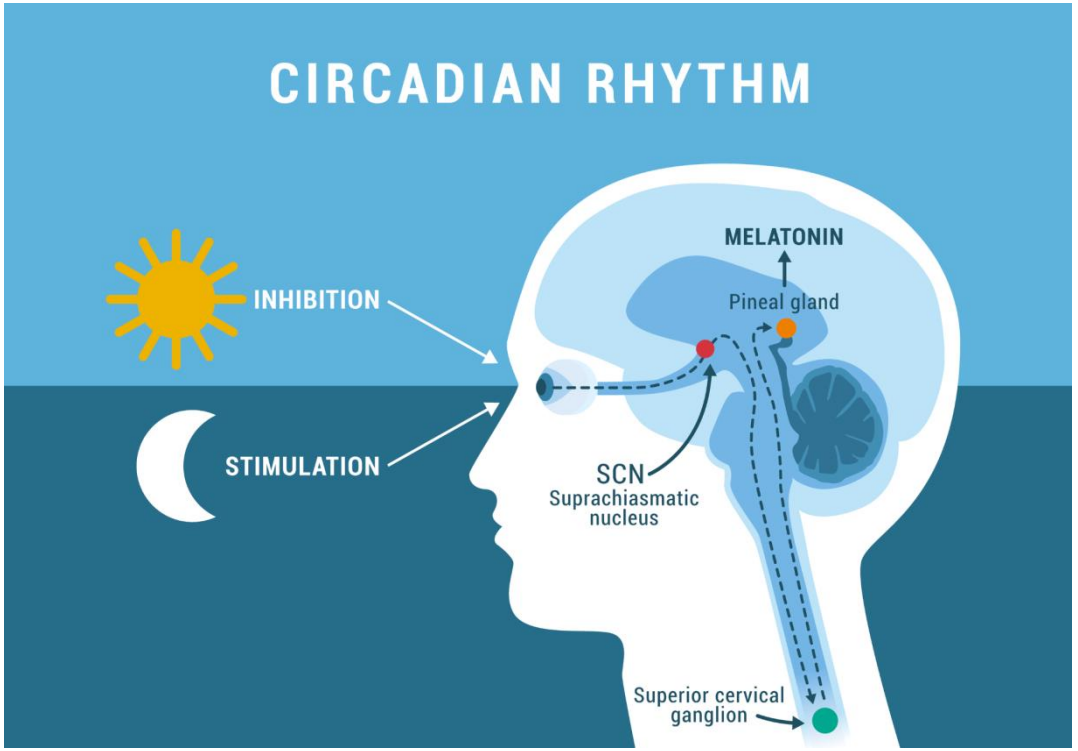
Brain systems involved

- The sleep cycle is regulated by the circadian rhythm, which is driven by the suprachiasmatic nucleus (SCN) of the hypothalamus – **controls melatonin production.**

- The SCN has only about 20,000 neurons.
- There are specific receptors in the eyes that connect directly to the SCN to trigger onset of sleep.



- This is further driven by a build of a chemical in the brain called adenosine. These processes work in concert with one another and help someone enter natural sleep [Later].

Brain System Involvement – SCN, plus:

- **Hippocampus:** memory region active during dreaming
- **Amygdala:** emotion center active during dreaming
- **Thalamus:** prevents sensory signals from reaching the cortex
- **Reticular formation:** involved in arousal and consciousness – suppresses information that would wake someone
- **Pons:** helps initiate REM sleep.

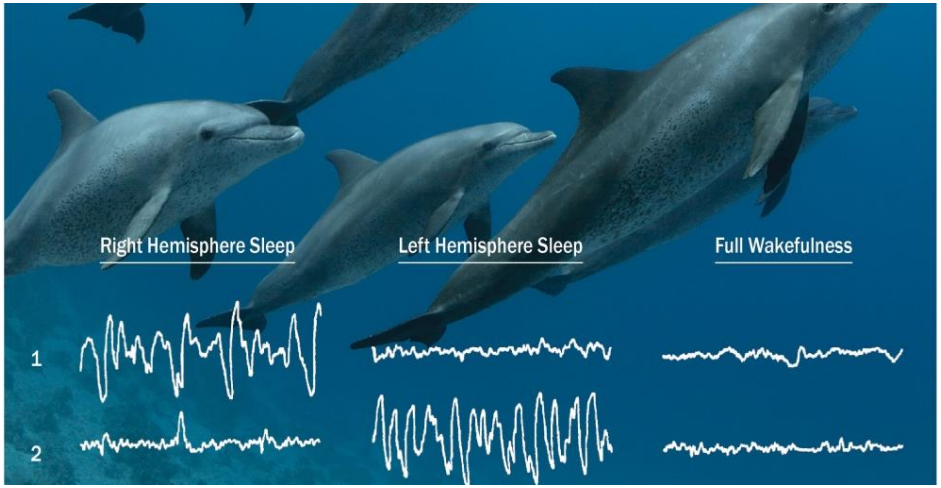
That is as deep as we are going to go…

Why do we Sleep?

- The first thing to understand is that from a species survival perspective, sleep makes no sense.
- Anything sleeping is extremely vulnerable to predation.
- Yet not one species has figured out to evolve away from sleep entirely.

Fun Fact – How dolphins and tuna sleep

- They shut one eye and will sleep the opposite side of the brain while the other stays awake.
- Every 24 hours, each hemisphere gets 4 hours of sleep.
- **This is Unihemispheric Sleep**



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Many birds have modified their sleep…

- Many migrating birds demonstrate unihemispheric sleep behavior during their long migrations.
- Some ducks do this - they all sleep the same hemisphere simultaneously, so you'll see one facing the other way.

Recent Finding – unihemispheric sleep behavior has been discovered in humans.

Curr Biol. 2016 May 9;26(9):1190-4. doi: 10.1016/j.cub.2016.02.063. Epub 2016 Apr 21.

Night Watch in One Brain Hemisphere during Sleep Associated with the First-Night Effect in Humans.

Tamaki M[1], Bang JW[1], Watanabe T[1], Sasaki Y[2].

- The first night in new environment, humans will demonstrate unihemispheric sleep tendencies, with the left hemisphere being more active than the right hemisphere to maintain greater vigilance in the new place.
- Most regular travelers will report that the second night sleep is always much better.

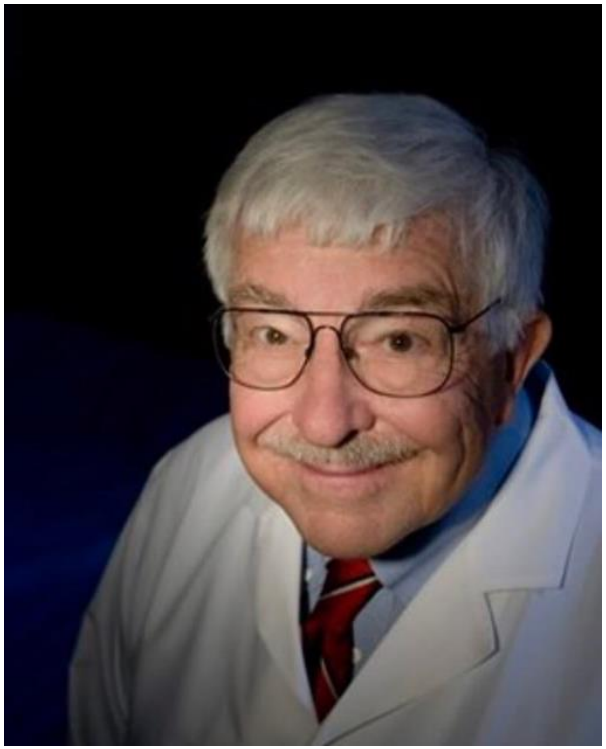
So Why do We Sleep?

This is very interesting question, and is one that has been asked many times over the centuries.

And it was asked of the person considered the “Father of Sleep” at his retirement ceremony.

William Dement – MD, PhD

- Studied Sleep for 50 years at UCLA
- Died in 2020 at 91.
- Made a number of discoveries concerning sleep over that time.



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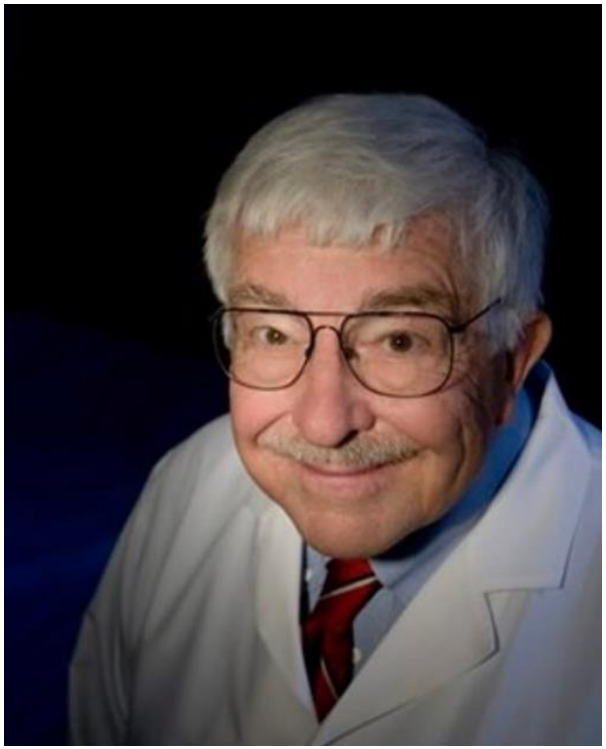
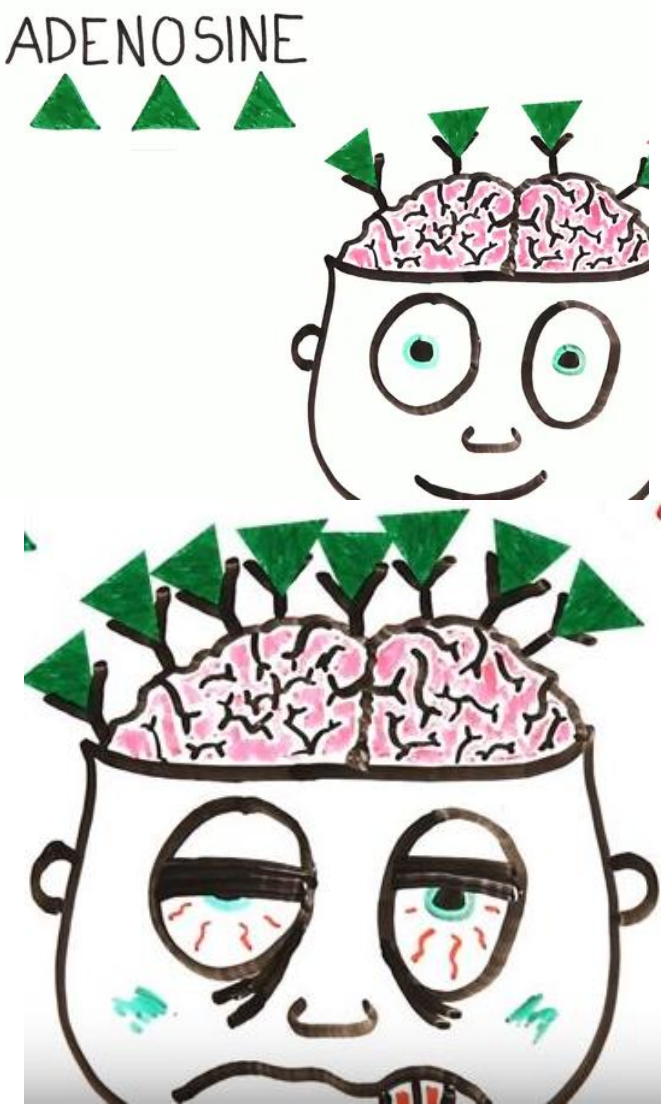


"As far as we know, the only reason that we need to sleep that is really solid is because we get sleepy."

Why do we get sleepy?

Build up of Adenosine

- The brain uses ATP for energy – a by-product of that is Adenosine.
- Adenosine binds to receptor sites on the brain, and gradually these receptors get filled – this is what makes you sleepy.
- Once the level reaches a maximum, it is difficult to stay awake. (16 hours)
- Adenosine gets cleared out of the brain during sleep.



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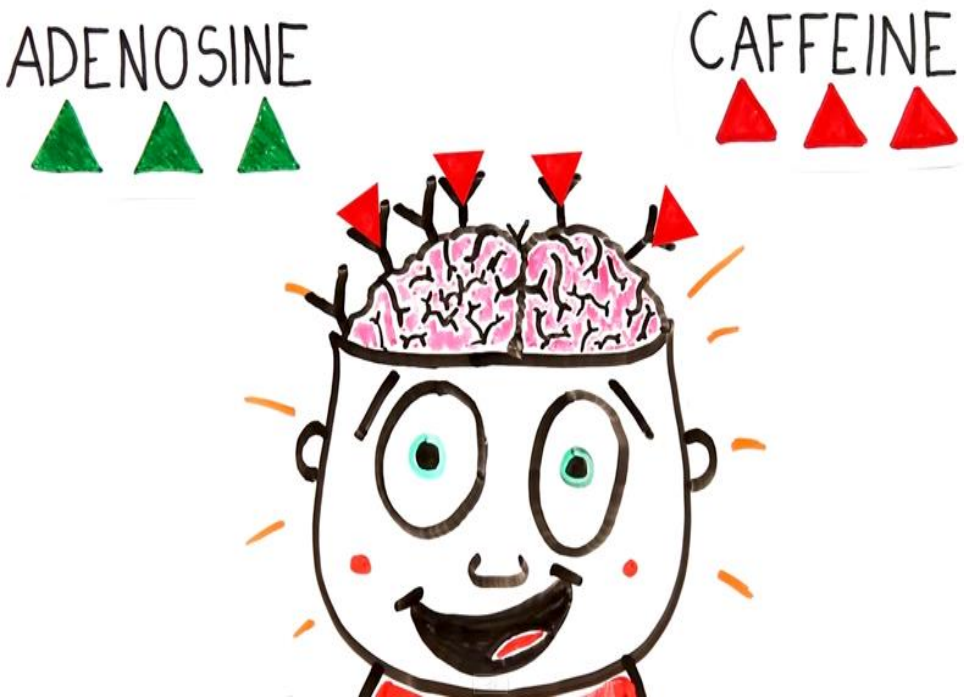
Caffeine

- Caffeine binds to adenosine receptors, preventing you from realizing how tired you are, or preventing you from falling asleep.
- Medium Starbucks has 300 mg of caffeine.
- If you drink it at noon, you will have 150 mg still in your brain at 6:00 pm, and then will have 75 mg at midnight.



Caffeine

Caffeine is a stimulant drug, and is the only addictive substance that we readily give to our children and teens.

Evening Espresso

- Some people think that they can fall asleep just fine when they drink coffee later in the day or even in the evening – but

just because someone can fall asleep easily doesn't mean that they are not affected by that caffeine. In fact, several studies show their sleep is much more fragmented with caffeine than when they do without it.

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JCSM | Journal of Clinical Sleep Medicine

Journal of Clinical Sleep Medicine → Volume 09, Issue 11

Free Access • NEW RESEARCH

Caffeine Effects on Sleep Taken 0, 3, or 6 Hours before Going to Bed

- Caffeine mostly affects Slow Wave Sleep, but did not show as much affect on REM

Napping

- The build up of adenosine is like a kettle building with pressure, and once it begins to whistle, then you have to fall asleep.
- Naps clear out some of the adenosine that you have created through the day.
- So naps release some of this building pressure, so it can be harder to fall asleep at night.

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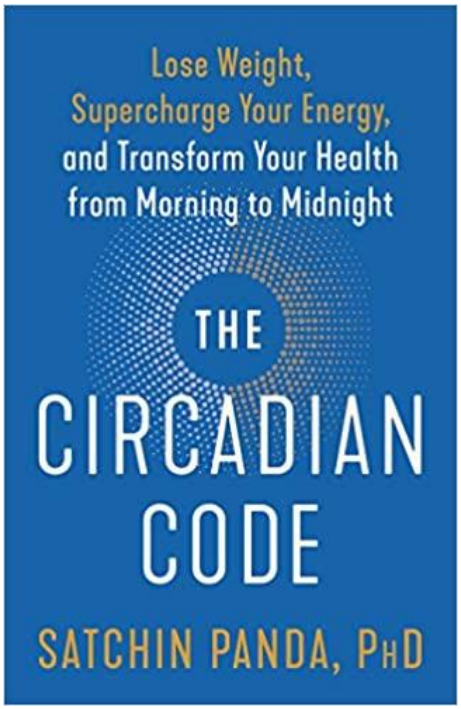
Napping Recommendations

- You should only nap for about 25-30 minutes – sleeping longer puts you into deeper level so sleep, so you can feel very groggy if you nap for 75-90 minutes.
- You should only nap if you have no issues falling asleep at night and are able to get adequate amount of sleep.
- **If you struggle, you should not nap.** Napping breaks a normal sleep routine, and confuses the brain. Sleep is like children – it does better with routine.

Circadian rhythm

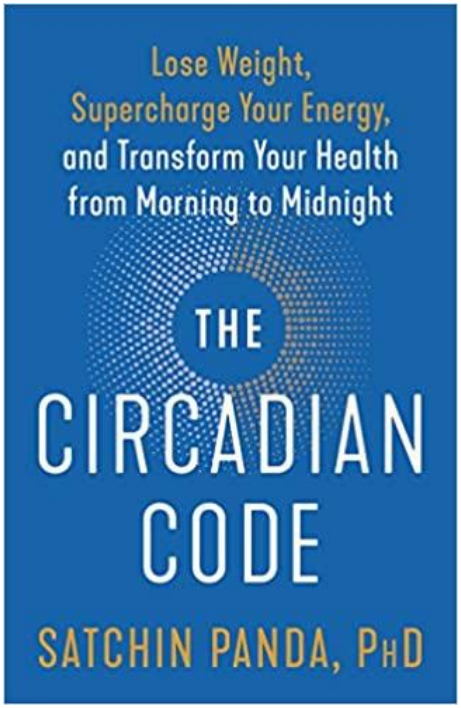
The Circadian Code – Satchin Panda

- **Extensively studies circadian rhythms in the body.**
- **This is not just for sleep – every cell in your body has some circadian cycle associated with it.**
- The number one cause of death and work disability for active-duty firefighters is not fire or accident.
- It is heart disease, which is now thought to be linked to a disruption of the circadian rhythm and sleep in general.



The Circadian Code – "Blue Light" Issues

- The main trigger for these rhythms is light.
- Specialized "Melanopsin" cells recognize light indicating that it is daytime or that daytime approaching.
- These cells are activated by blue light, telling the brain it is still daytime.
- Most electronics and common light sources emit this light.



“Blue Light” Glasses

- So initially you would have people wearing these.

iPad use at night – decreases melatonin 23-50%

iPad use at night decreases melatonin production.

- Significantly decreases the amount of REM sleep compared to reading a paper book.
- People felt **less rested and were sleepier** throughout the day following iPad use at night.
- Third was a lingering aftereffect. A week of nighttime iPad use resulted in those people experiencing a **ninety-minute lag in their evening rising melatonin levels for several days after iPad use ceased**—almost like a digital hangover effect.

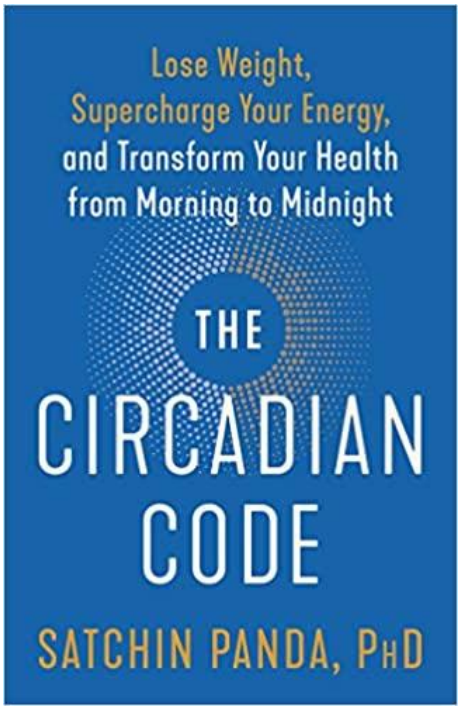
“Blue Light” Glasses

- Dave Asprey – founder of Bulletproof Coffee and the Bulletproof Lifestyle advocates the regular use of these glasses. Blue light is not only in electronic devices – it is emitted by most light sources.

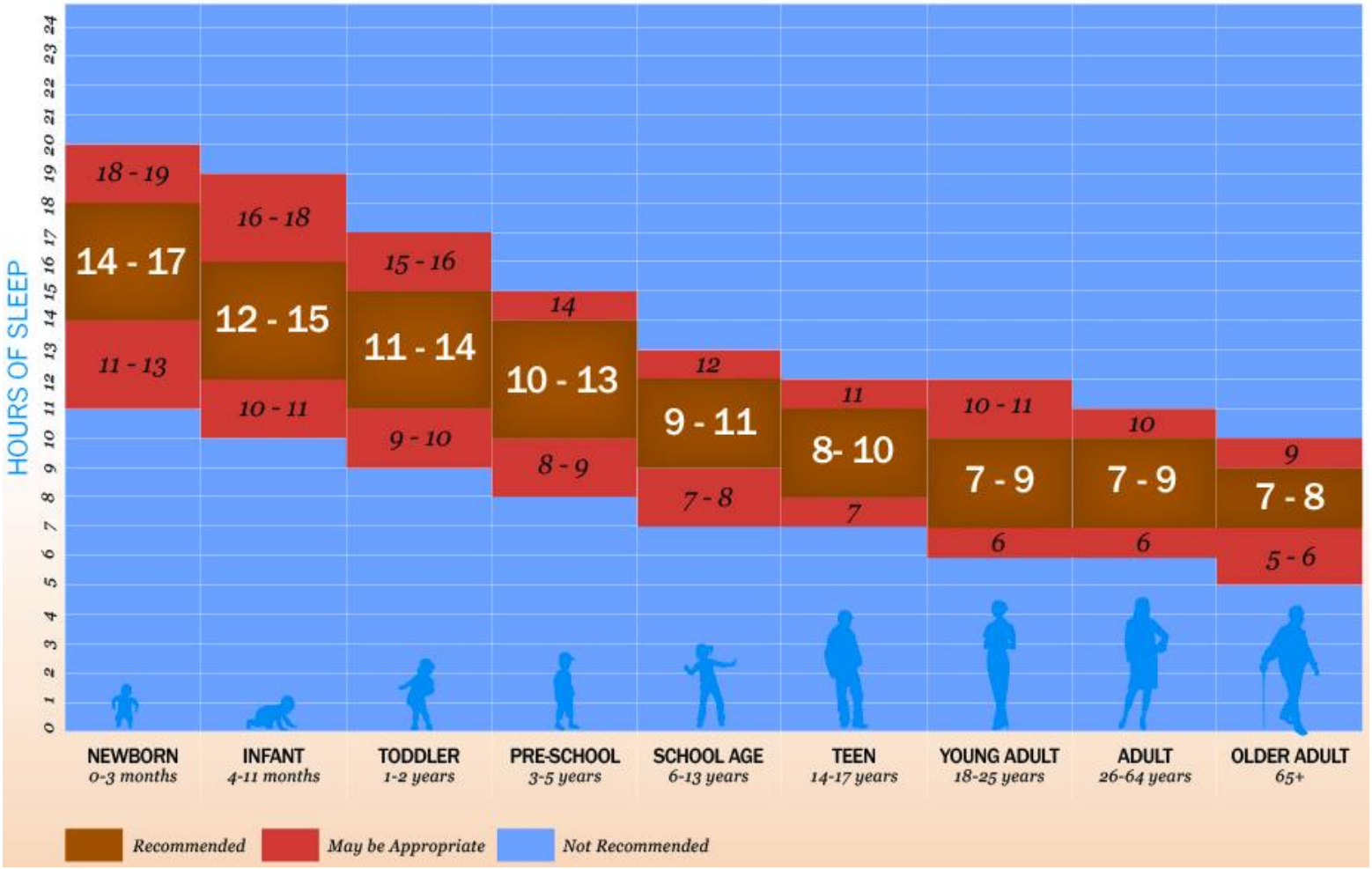
The Circadian Code – much more to it.

- Circadian rhythm processes are seriously complicated.
- Look up Satchin Panda if you wanted to learn more.

- Moving forward…



How much sleep should we get?



Adults should get between 7-9 hours, with 8 being the goal.

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Why should we get 8 hours of sleep?

- The recycle rate of a human being is around sixteen hours.
- After sixteen hours of being awake, the brain begins to fail.
- Humans need more than seven hours of sleep each night to maintain cognitive performance.

Why should we get 8 hours of sleep?

- After ten days of just seven hours of sleep, the brain is as dysfunctional as it would be after going without sleep for twenty-four hours.
- The human mind cannot accurately sense how sleep-deprived it is when sleep-deprived.
- You don’t notice because you become habituated to it.

How are we doing on getting sleep?

AGE GROUP	% NOT GETTING ENOUGH SLEEP
18-24 years old	32%
25-34 years old	38%
35-44 years old	38%
45-54 years old	39%
55-64 years old	36%
65+ years old	26%

Prevalence of sleep issues

Prescription Sleep Aid Use Among Adults: United States, 2005–2010

- Americans maintain among the worst sleeping habits of all advanced industrialized nations, with only 44.0% of adults getting adequate sleep.
- **This means 56% are not getting enough sleep!**
- 60 million prescription medication annually as of 2013.

How are our students doing?

Students

- Middle school students (6-12) getting less than 9 hours of sleep – **57.8% (should get 9-11)**
- High school students (13-18) getting less than 8 hours of sleep – 72.7% **(Should get 8-10)**

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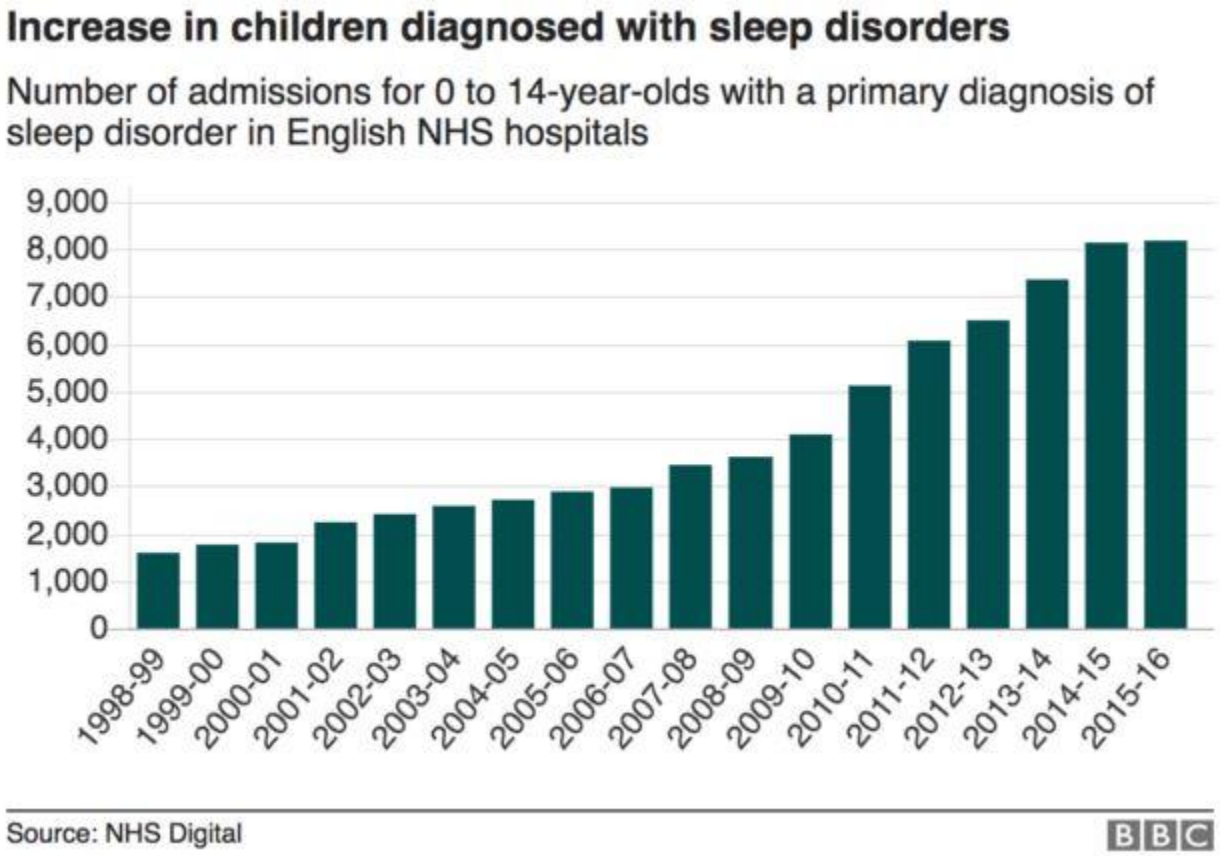
How are our students doing?

Students

- Middle school students (6-12) getting less than 9 hours of sleep – **57.8% (should get 9-11)**
- High school students (13-18) getting less than 8 hours of sleep – 72.7% **(Should get 8-10)**
- Sleep is critical to learning, emotional regulation, stress reduction, and memory consolidation. The massive increase in pediatric psychiatric conditions in recent years are highly correlated with many changes in society today, with decreased sleep quantity being a main contributor.

National Health Service – 2017 study



- **Hospital visits for children under 14 with sleep disorders have tripled in 10 years**

Neurology Clinical Practice
An Official Journal of the American Academy of Neurology
Neurol Clin Pract. 2014 Feb; 4(1): 82–87.
doi: 10.1212/01.CPJ.0000442521.30233.ef

Medications for sleep disturbances in children

Barbara T. Felt, MD, MS and Ronald D. Chervin, MD, MS

Author information ► Copyright and License information ►

Febuary 2014

- At least 25% of children have sleep issues between infancy and adolescence.
- 75% of pediatricians recommend prescription or OTC medications.

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Medications for sleep disturbances in children

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Febuary 2014

- At least 25% of children have sleep issues between infancy and adolescence.
- 75% of pediatricians recommend prescription or OTC medications.
- This problem will only get worse in the coming years…

'Touchscreen-toddlers' sleep less, researchers say

By James Gallagher
Health and science reporter, BBC News website

13 April 2017 | Health | Share

- **Research suggests every hour spent using a touchscreen each day was linked to 15 minutes less sleep in toddlers.**

Sleep Quantity – 1942 to 2013

	1942	1990	2001	2004	2013
	%	%	%	%	%
Five hours or less	3	14	16	14	14
Six hours	8	28	27	26	26
Seven hours	25	30	28	28	25
Eight hours	45	22	24	25	29
Nine hours or more	14	5	4	6	5
NET: Six hours or less	11	42	43	40	40
NET: Seven hours or more	84	57	56	59	59
Average hours per night	7.9	6.7	6.7	6.8	6.8

GALLUP

- Average hours of sleep dropped from 7.9 hours to 6.8 hours.
- **This is less than the minimum 7 hours (ideal being 8) we should get!**

NEXT LEVEL NEUROFEEDBACK

Summary –Sleep Deprivation

- The average sleep time for adults is 6.8 hours per night
- Examining various statistics, roughly 33-56% of American Adults are not getting sufficient sleep.
- Why not?

Sleep disorders

According to the American Academy of Sleep Medicine, approximately 70 million Americans have a sleep disorder.

- Chronic Insomnia
- Obstructive Sleep Apnea
- Central Sleep Apnea
- Restless Leg Syndrome
- Narcolepsy

Statistics about sleep disorders

- 12.5% have chronic insomnia
- 6% - severe obstructive sleep apnea
- <0.9% - central sleep apnea (CSA).
- 3% - restless leg syndrome
- <0.5% - narcolepsy.
- This is roughly 70 million Americans

Statistics about sleep disorders

- 12.5% have chronic insomnia
- 6% - severe obstructive sleep apnea
- <0.9% - central sleep apnea (CSA).
- 3% - restless leg syndrome
- <0.5% - narcolepsy.
- This is roughly 70 million Americans

- **But 45% of adults are not getting enough sleep – which means more people could get more sleep, but just don't.**

Sleep disorders

So we are going to briefly review sleep disorders, and then spend the majority of the time talking about why those others should prioritize sleep more!

Sleep disorders

Insomnia is a chronic sleep condition characterized by difficulty sleeping.

- Falling asleep
- Staying asleep
- Or both.

Insomnia often causes excessive daytime sleepiness and fatigue.

Sleep disorders - treatment

- Cognitive behavioral therapy – Insomnia (CBTi) is the said to be the primary treatment recommendation for insomnia.
- CBT may also be combined with sleep medications, which are able to help people fall and stay asleep.

Sleep Medication

- These usually fall into two general categories of medication – benzodiazepines and “z-hypnotics”
- Sleep medications essentially knock out your cortex – they do not drive natural sleep patterns; they just make you less aware of your surroundings.
- They do not provide you with normal sleep cycles.
- And they have serious implications associated with them.

Sleep Medication

Editorial > Neurotherapeutics. 2020 Jan;17(1):153-155. doi: 10.1007/s13311-019-00827-z.

The Long and the Short of Benzodiazepines and Sleep Medications: Short-Term Benefits, Long-Term Harms?

- Long term use has been shown to increase risk of dementia and Alzheimer's.
- OTC sleep aides have also found the same risks.
- Why? It probably has little to do with medications, and more with the fact that their sleep is compromised.

NIH RESEARCH MATTERS

April 27, 2021

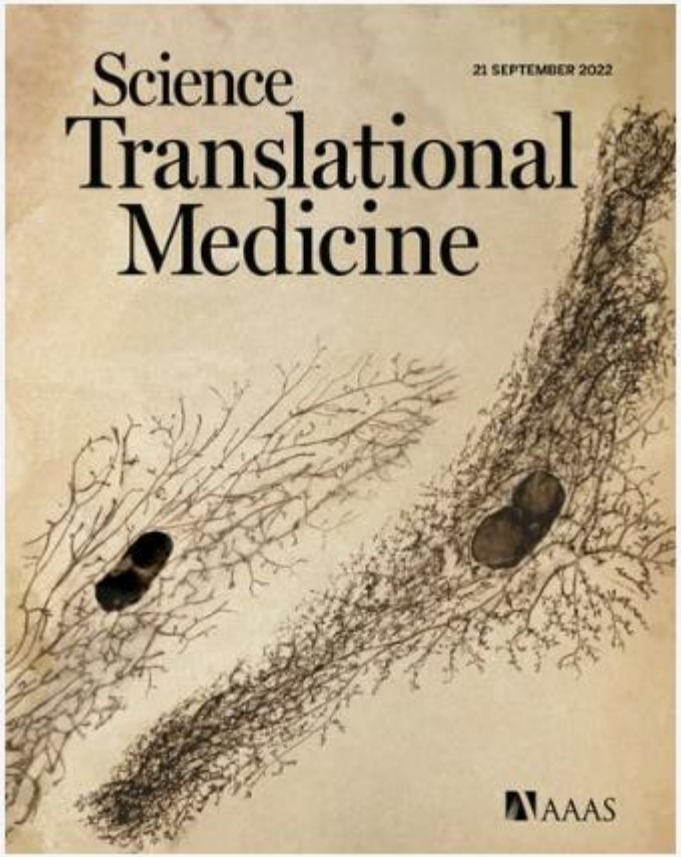
Lack of sleep in middle age may increase dementia risk

- People who slept six hours or less per night in their 50s and 60s were more likely to develop dementia later in life.
- What's going on?
- It likely is due to what is not going on.

- **Sleep is "neurological sanitation."**

Glymphatic System -

A Paravascular Pathway Facilitates CSF Flow Through the Brain Parenchyma and the Clearance of Interstitial Solutes, Including Amyloid β



15 August 2012

Discovered that there is an cleaning system in the brain similar to the lymph system in the body.

NEXT LEVEL
NEUROFEEDBACK

Glymphatic System -

A Paravascular Pathway Facilitates CSF Flow Through the Brain Parenchyma and the Clearance of Interstitial Solutes, Including Amyloid β

- Glymphatic system – clears out debris in the brain similar to how the lymph system clears the body.
- **It only becomes active during sleep – specifically slow wave sleep.**
- **One protein it is found to clear out is beta amyloid plaque – the protein that builds up in Alzheimer's disease.**

International Journal of
Molecular Sciences

MDPI

Review

Is Sleep Disruption a Cause or Consequence of Alzheimer's Disease? Reviewing Its Possible Role as a Biomarker

2020

- **Research is shifting on sleep issues being causative of Alzheimer's, not being a consequence of it.**

Good Sleep Hygiene:

- When you get ready for bed
- What you do before you go to bed
- What time you get up
- Eating late, drinking alcohol, nicotine and caffeine can all negatively effect sleep.
- What time you wake up.

- Only use your bed for sleep and sex – don't watch TV or lie in bed for hours.

Good Sleep Hygiene – additional factors:

- How dark the room is.
- Using electronic devices before bed.
- How bright the interior of your house is.
- The temperature of your bedroom.
- Understanding that sleep is critically important to your health and the quality of your life - most people know this, but still, we as a society have devalued sleep.

Alternative supplements

Sleep and Melatonin

- Melatonin is not considered a sleep aide; it helps time the onset of sleep,
- The analogy is that it is the starting official at a 100 meter race. It says go, but doesn't participate in the race itself.
- It is most appropriate when traveling between time zones to help re-regulate to the existing time zone.

Sleep and Melatonin

Melatonin has other health benefits.

- It is considered the body's most efficient free-radical scavenger;
- It is also involved in many anti-inflammatory and immune functions as well.
- Many people take too much melatonin, leading to feeling hungover the following day.
- Generally speaking, 2-3 mg is the maximum recommended dose.

Sleep and Magnesium

J Res Med Sci. 2012 Dec; 17(12): 1161–1169.

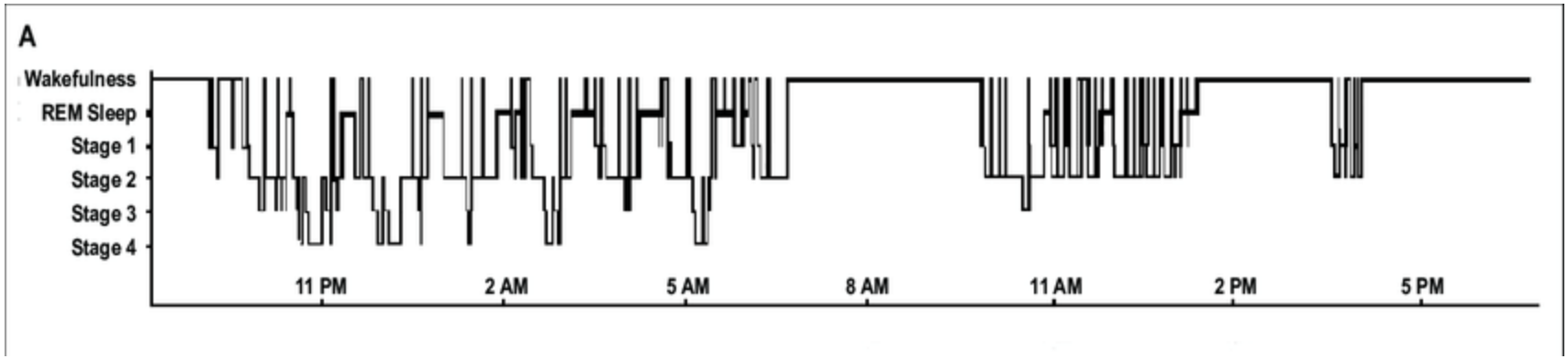
PMCID: PMC3703169 | PMID: 23853635

The effect of magnesium supplementation on primary insomnia in elderly: A double-blind placebo-controlled clinical trial

- Magnesium appears to improve insomnia
- Improved sleep efficiency, sleep time and sleep onset latency, early morning awakening in elderly people.
- 300-420 mg per night
- FYI – 48% of Americans are deficient in Mg

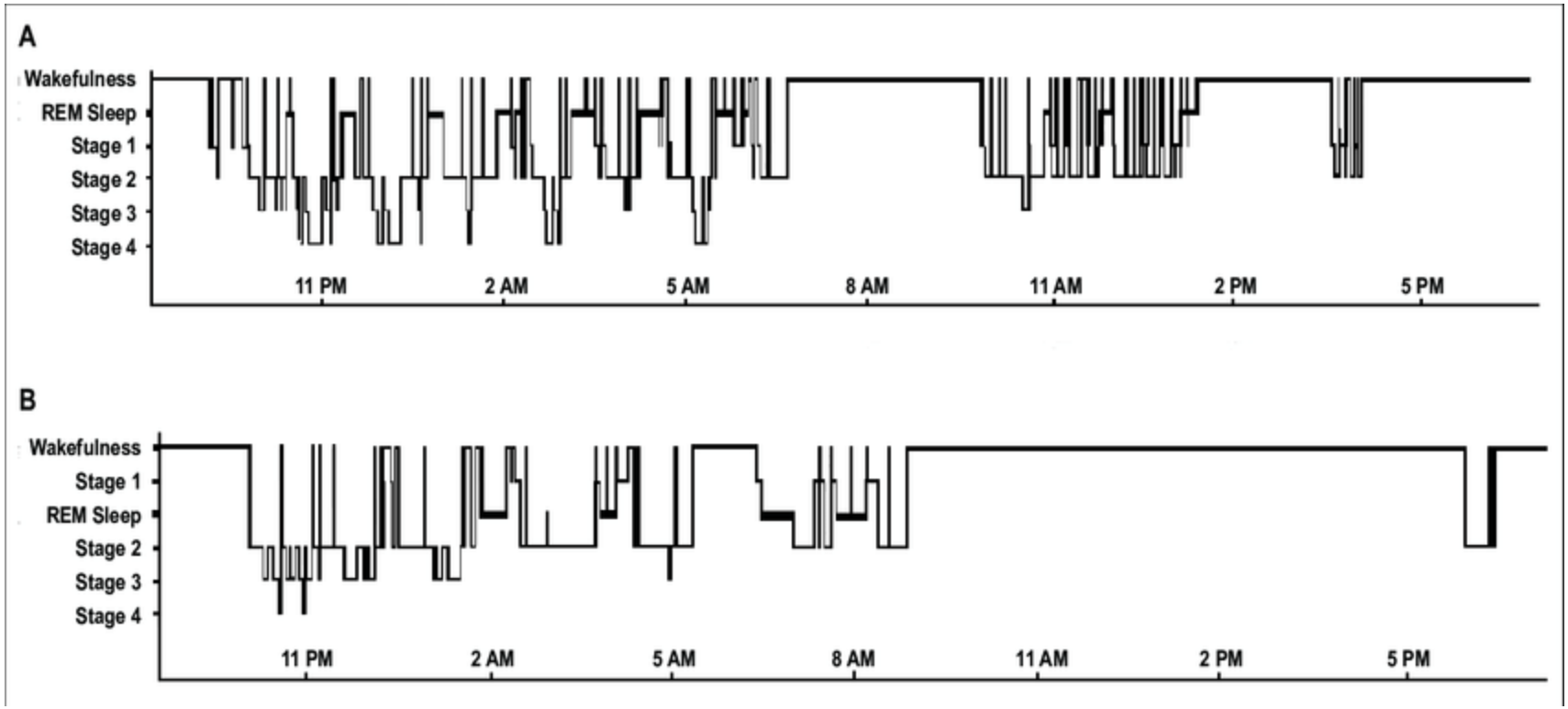
Insomnia and 5-HTP

Sleep and Rhythm Consequences of a Genetically Induced Loss of Serotonin



Insomnia and 5-HTP

Sleep and Rhythm Consequences of a Genetically Induced Loss of Serotonin



Insomnia and 5-HTP

Sleep and Rhythm Consequences of a Genetically Induced Loss of Serotonin

March 2010 · Sleep 33(3):307-14

Involved in the serotonin pathway

I honestly didn't have time to look into this more! If you have anything on this, please send it to me.

nextlevelneurofeedback@gmail.com

NEXT LEVEL NEUROFEEDBACK

What Should People Consider?

› Appl Psychophysiol Biofeedback. 2022 Sep 17. doi: 10.1007/s10484-022-09560-4.
Online ahead of print.

Effects of SMR Neurofeedback on Cognitive Functions in an Adult Population with Sleep Problems: A Tele-neurofeedback Study

Neurofeedback Therapy

- Improved cognitive functions in adults with sleep issues.
- Improved sleep itself.

What Should People Consider?

› Appl Psychophysiol Biofeedback. 2022 Sep 17. doi: 10.1007/s10484-022-09560-4. Online ahead of print.

Effects of SMR Neurofeedback on Cognitive Functions in an Adult Population with Sleep Problems: A Tele-neurofeedback Study

Neurofeedback Therapy

- I have been offering NFB for 12 years
- Started to improve my sleep and focus
- Sleep improvements are the most consistent outcome we see in almost every patient.

What Should People Consider?

Randomized Controlled Trial > Appl Psychophysiol Biofeedback. 2022 Jun;47(2):95-106.
doi: 10.1007/s10484-022-09534-6. Epub 2022 Feb 11.

A Randomized Controlled Trial Comparing Neurofeedback and Cognitive-Behavioral Therapy for Insomnia Patients: Pilot Study

This study confirmed that neurofeedback training could alleviate the symptoms of insomnia by reducing cortical hyperarousal in patients, despite the limited effect in reducing cognitive dysfunction compared to CBT-I.

Sleep disorders

Sleep apnea

- Obstructive sleep apnea (OSA) is a condition in which the body stops breathing during sleep.
- These periods of no breathing, **called apnea**, happen because the airways of the throat become too narrow to allow air flow.

Like insomnia, this condition can negatively affect sleep quality.

Sleep disorders

Treatment – the primary treatment for this is the CPAP machine (continuous positive airway pressure).

- The CPAP creates enough airflow to allow a person with sleep apnea to breathe properly during sleep.

Sleep disorders

- Restless leg syndrome (RLS) is a neurological disorder where there is an uncomfortable sensation in the legs.
- Typically, this begins as the evening advances and the person begins to try and fall asleep.
- Treatment
  - Some medications are FDA approved
  - Good sleep hygiene can also help relax the body before bed and make it easier to fall asleep.
  - Chiropractic and neurofeedback therapy can do the same – relax the body.

NEXT LEVEL
NEUROFEEDBACK

Sleep disorders

Narcolepsy is a chronic sleep disorder characterized by overwhelming daytime drowsiness and sudden attacks of sleep.

- Type 1 narcolepsy also causes cataplexy, which is a sudden, physical collapse caused by loss of muscle control, usually in response to sudden emotion experiences.
- Type 2 narcolepsy is without the cataplexy from emotional experiences.

Narcolepsy

NEXT LEVEL
NEUROFEEDBACK

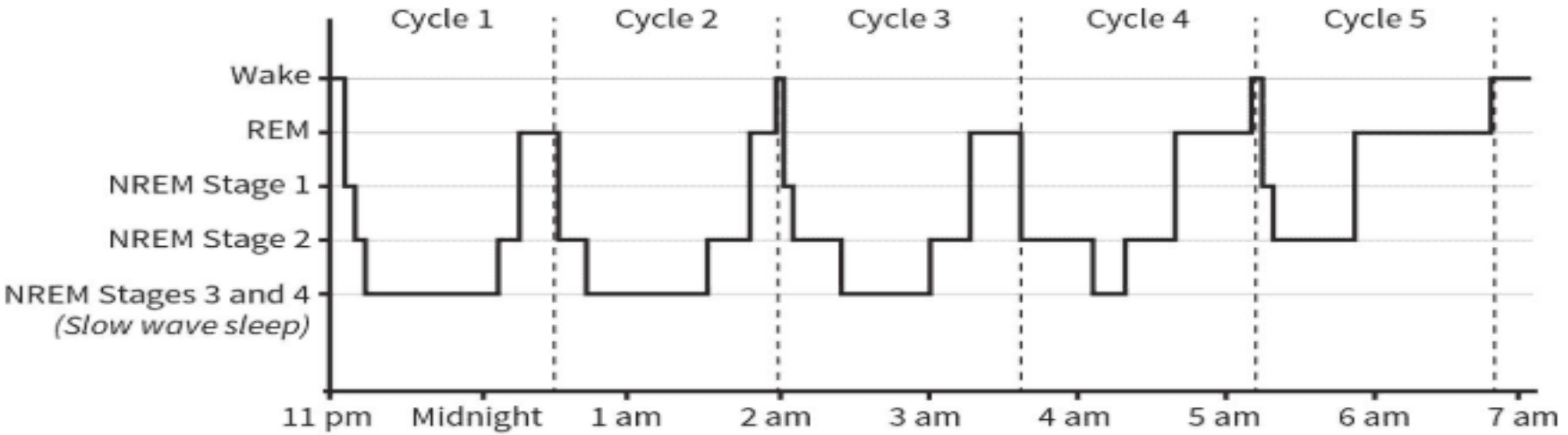
Sleep disorders

Narcolepsy is a difficult condition.

- Stimulants and SSRIs are used to treat the symptoms of narcolepsy.
- Good sleep hygiene, diet and regular exercise can help to promote healthful sleep.
- Strategic napping, support groups and counseling can the person cope with narcolepsy.

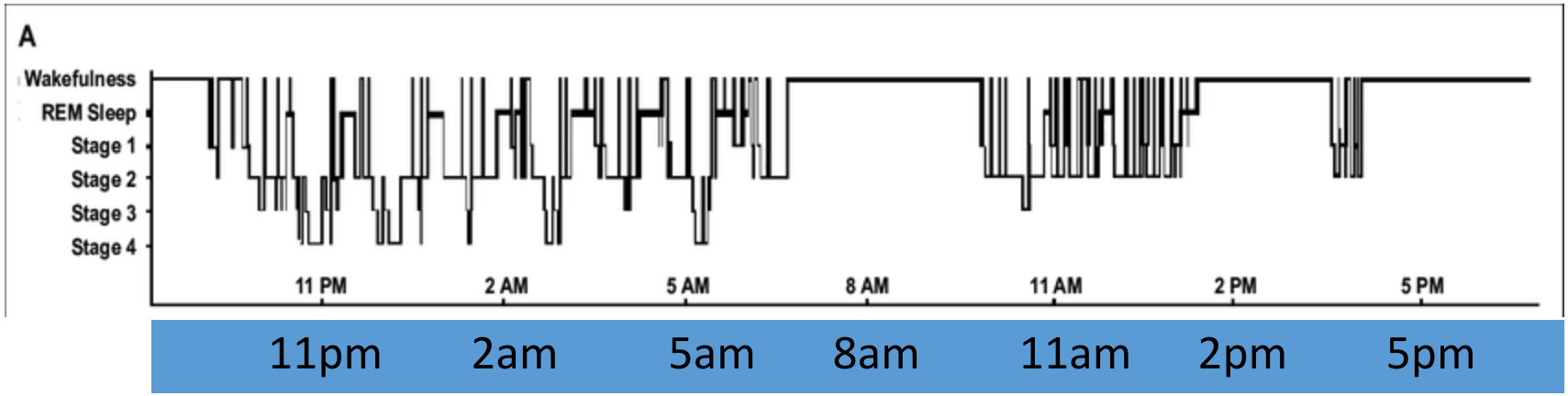
Reviewing the Hypnogram

As you progress through a night of sleeping, the time you spend in the deeper stages of sleep changes. For the first half, you are in Stage 3 and 4 more; in the second half, you spend more time in REM



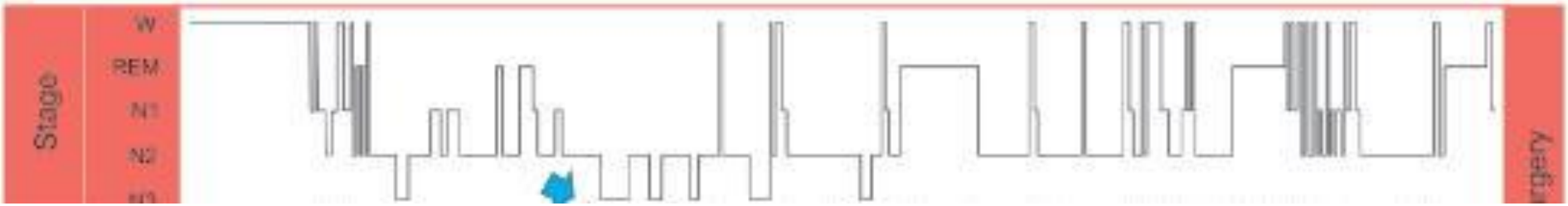
NEXT LEVEL
NEUROFEEDBACK

Insomnia

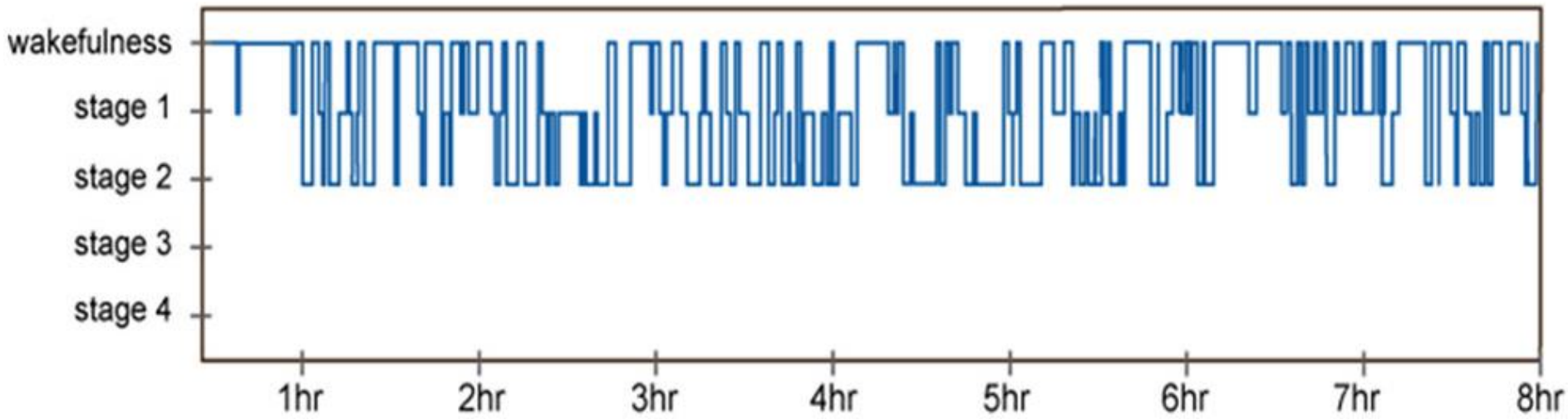


Hypnogram showing frequent wakeful periods, and then subsequent light sleep in the afternoon.

Sleep Apnea – Hypnograms



The hypnogram shows most of the time these people stay in Stage 2 sleep, and then wake very often during the latter stages of sleep.



NEXT LEVEL
NEUROFEEDBACK

Statistics about sleep disorders

45% of adults are not getting enough sleep

- 12.5% of adults struggle with chronic insomnia
- 6% have moderate to severe obstructive sleep apnea
- <0.9% have central sleep apnea (CSA).
- 3% have restless leg syndrome
- <0.5% have narcolepsy.

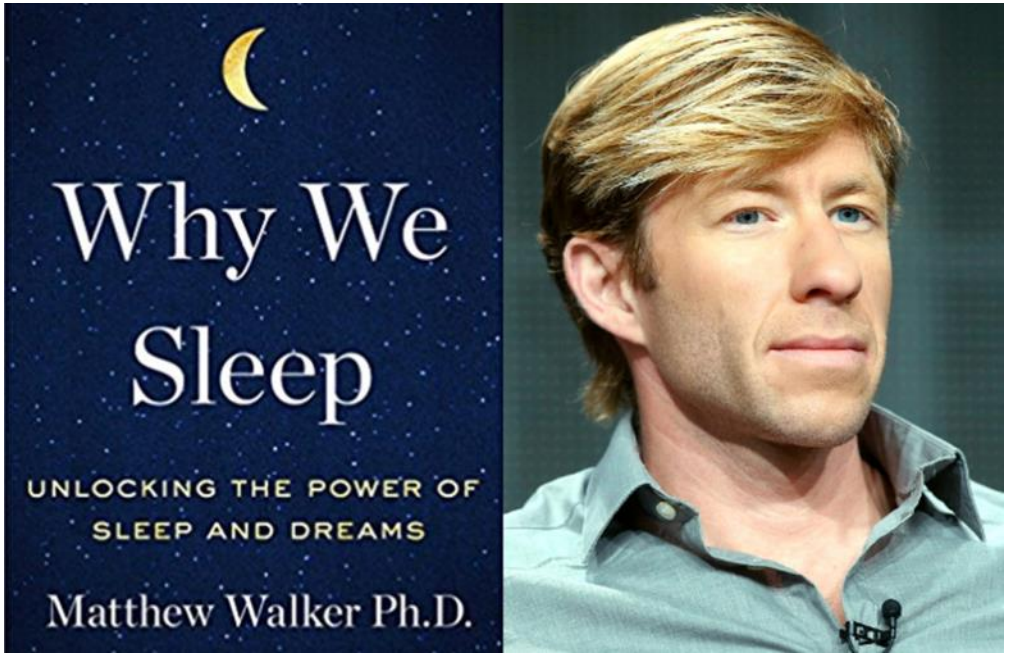
Statistics about sleep disorders

While 20% of the population have a sleep disorder, more people are simply choosing to not get the sleep that they need.

Roughly 22% of people get less than 7 hours of sleep despite being capable of doing so.

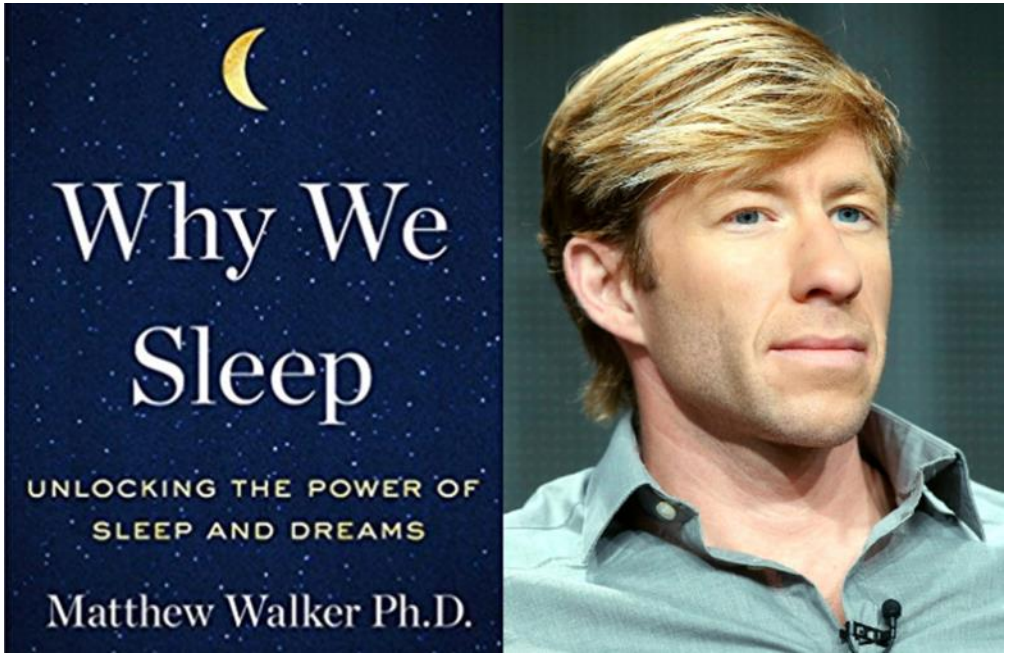
Why We Sleep – Matthew Walker

"Humans are the only species on earth that deliberately deprive themselves of sleep for no apparent gain."



Why We Sleep – Matthew Walker

- PhD at UC Berkeley
- Probably has summarized the benefits of sleep more than anyone in the last 70 years.

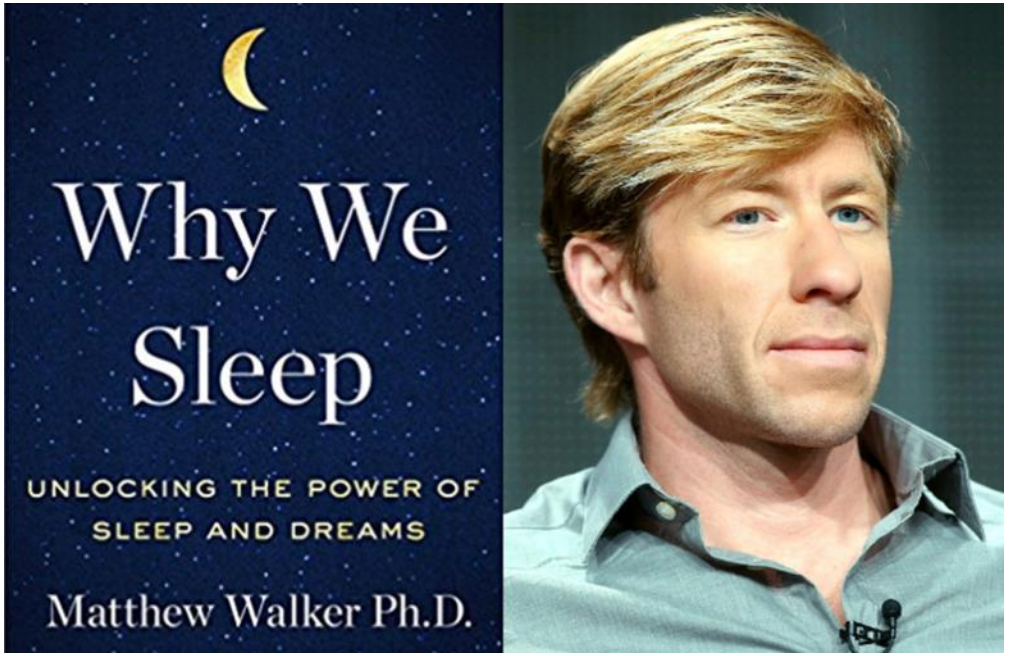


Why We Sleep – Matthew Walker

- Has written a number of books that discuss all of the health benefits of sleep.
- Hundreds of research articles on sleep and expanded our understanding of sleep.
- **The benefits of good sleep include increased concentration, lower blood pressure, higher immunity, and added fertility, along with positive mood regulation, and much more.**

Why We Sleep – Matthew Walker

"Humans are the only species on earth that deliberately deprive themselves of sleep for no apparent gain."



Sleep has evolved with all species

To date, there is only one species that has adapted to demonstrate extended sleep deprivation with seemingly little compromise, and **it is not humans.**

Pectoral Sandpiper

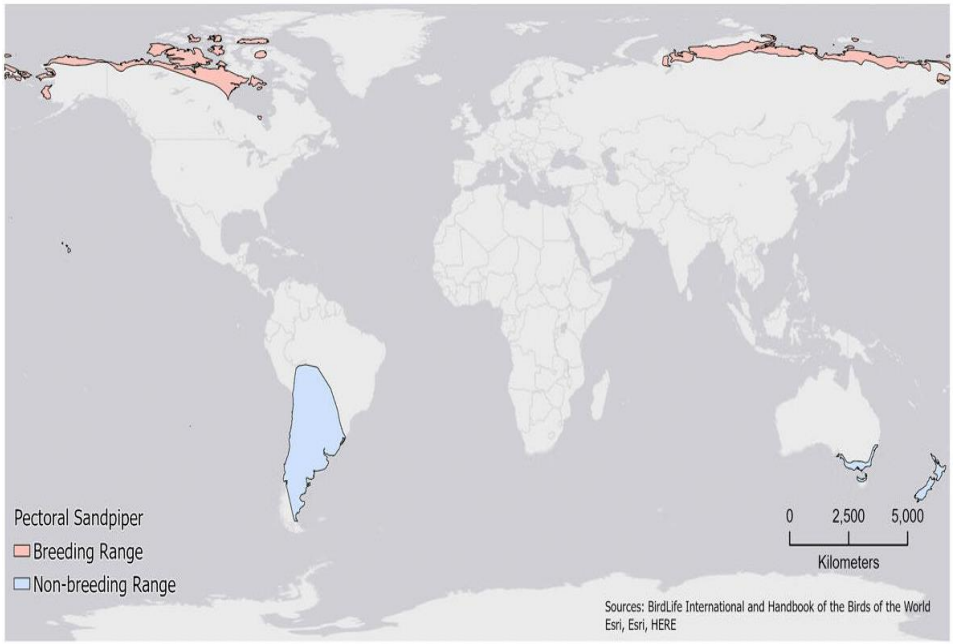
- This is the pectoral sandpiper – migrates 1000's of miles to breeding grounds, and then males stay awake for as much as 14 additional days .

Pectoral Sandpipers will forgo sleep

SCIENCE

Male sandpipers do better by choosing sex over sleep

- These males are trying to impress the females, who only will mate with those that have stayed awake the longest.
- Those few males who are selected mate with the overwhelming majority of the females.



- **This is the closest that any species has come to evolving away from sleep – every species sleeps!**
- **And every other species aside from humans will get the sleep they need!**

Let’s get back to humans.

NEXT LEVEL
NEUROFEEDBACK

Why We Sleep – Matthew Walker

"There is no major health system within your body or operation within your brain, that isn't wonderfully enhanced by sleep when you get it, or demonstrably impaired when you don't get enough."

NEXT LEVEL
NEUROFEEDBACK

Why We Sleep – Matthew Walker

"Once you drop below seven hours, we can start to measure objective impairments in your brain and your body. The shorter your sleep, the shorter your life. Short sleep predicts all-cause mortality."

NEXT LEVEL
NEUROFEEDBACK

Walker – Negative outcomes with less sleep

Group of healthy adults getting 8 hours of sleep had a gene profile done, and then were restricted to get only 6 hours of sleep. Then did another gene profile. 711 genes were distorted compared to when getting 8 hours of sleep.

Walker – Negative outcomes with less sleep

Of the 711 genes that were distorted:

- Some genes were decreased in activity – they were all related to immune function.
- Those genes that were increased in their activity were associated with tumor growth, chronic inflammation and stress (cardiovascular disease).
- So while many of you are conscious of not eating genetically modified food, you are conducting a genetic experiment every time you get less than 6 hours of sleep or less.

NEXT LEVEL
NEUROFEEDBACK

Walker – Negative outcomes with less sleep

- For immune function – Natural killer cells – identify dangerous foreign elements and destroy them. Cancer kept in check due to these cells.
- If you decrease sleep to 4 hours in one single night – you see a 70% drop in Natural Killer Cells production.
- The link between short sleep and prostate, bowel and breast cancer is so strong that the WHO listed "Night Time Shift Work" as a probable carcinogen.

David Gozal -

Fragmented sleep accelerates tumor growth and progression through recruitment of tumor-associated macrophages and TLR4 signaling

Fahed Hakim,[1] Yang Wang,[1] Shelley XL Zhang,[1] Jiamao Zheng,[1] Esma S. Yolcu,[2] Alba Carreras,[1] Abdelnaby Khlayfa,[1] Haval Shirwan,[2] Isaac Almendros,[1] and David Gozal[1]

- Cancer study with mice- injected cancer into mice and let it grow for 30 days.
- Half were allowed to sleep normally; the half had their sleep disrupted – more play when they would like to sleep. Not deprived, but restricted.

David Gozal -

- Normal sleep

NEXT LEVEL
NEUROFEEDBACK

David Gozal -

- Normal sleep

- Restricted sleep
  - 200% increase in the speed of the growth;
  - The tumors in this group metastized.

- Sleep emphasis should be paramount to cancer treatment

Walker – Immune Function

- Additionally, there is further evidence that sleep is critical to strong immune function.
- Flu Shot - the flu shot is only “effective” if your body actually reacts to it by generating antibodies.

Walker – Immune Function

- A 2002 study demonstrated that sleep profoundly impacts your response to a standard flu vaccine.
- Insufficient sleep in the week before getting a flu shot can lead to the production of less than 50% of the normal antibody response – a reaction that would render the flu shot largely ineffective.

NEXT LEVEL
NEUROFEEDBACK

Walker – Immune Function

CNN health | Life, But Better | Fitness | Food | Sleep | Mindfulness | Relationships

Before you get a flu shot, get good sleep to increase its effectiveness, experts say

By Emmet Lyons and Sandee Lamotte, CNN

Published 4:13 AM EDT, Wed October 21, 2020

Walker – Mental Health

- For the brain - they have not found one psychiatric condition in which sleep is normal.

- "The best bridge between despair and hope is a good night's sleep."

- Also critical to cognitive function

NEXT LEVEL
NEUROFEEDBACK

Sleep and ADD/ADHD – a Catch-22

Dahl RE. The impact of inadequate sleep on children's daytime cognitive function. Seminars in Pediatric Neurology 1996;3:44–50.

- Children diagnosed with ADHD have been shown to have a higher incidence of sleep problems and shorter average sleep duration than children without ADHD.
- Many kids take stimulants to improve focus and concentration.

Sleep and ADD/ADHD – a Catch-22

PEDIATRICS®
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS
December 2015, VOLUME 136 / ISSUE 6

Stimulant Medications and Sleep for Youth With ADHD: A Meta-analysis

Katherine M. Kidwell, Tori R. Van Dyk, Alyssa Lundahl, Timothy D. Nelson

- Compared the effects of stimulant medication on sleep patterns in kids with ADHD.
- Those taking stimulants took longer to fall asleep and slept less than those with ADHD not taking medication.

Sleep and ADD/ADHD – a Catch-22

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- Compared the effects of stimulant medication on sleep patterns in kids with ADHD.
- Those taking stimulants took longer to fall asleep and slept less than those with ADHD not taking medication.
- **Are these stimulants further compromising sleep, and subsequently augmenting the problem?**

Review > Appl Psychophysiol Biofeedback. 2022 Sep;47(3):145-181.
doi: 10.1007/s10484-022-09547-1. Epub 2022 May 25.

Results of Neurofeedback in Treatment of Children with ADHD: A Systematic Review of Randomized Controlled Trials

"Neurofeedback training was associated with significant long-term reduction in symptoms of ADHD…and documented improvements in school, social, and family environments."

Walker – Metabolic Activity

- One week of short sleep, your blood sugar levels are disrupted so significantly that you would be considered pre-diabetic.

NEXT LEVEL
NEUROFEEDBACK

Walker – Cardiovascular Impacts

- “Adults over 45 years old who sleep fewer than six hours a night are 200 percent more likely to have a heart attack or stroke during their lifetime, as compared with those sleeping seven to eight hours a night.”

Walker – Cardiovascular Impacts

- Losing one hour of sleep for just one night has been shown to increase heart attacks by 24%;
- Gaining one hour of sleep has been shown to heart attacks by 21%.

- This happens every year during daylight savings

Walker – Cardiovascular Impacts

Journal of the American College of Cardiology

JACC Journals › JACC › Archives › Vol. 63 No. 12_Supplement

Previous | Next

THE IMPACT OF DAYLIGHT SAVINGS TIME ON THE TIMING AND INCIDENCE OF PATIENTS UNDERGOING PERCUTANEOUS CORONARY INTERVENTION FOR ACUTE MYOCARDIAL INFARCTION

Acute Coronary Syndromes

Amneet Sandhu, Milan Seth, and Hitinder Gurm

J Am Coll Cardiol. 2014 Apr, 63 (12_Supplement) A65

And Federal Judge sentencing is more harsh the day after DST and more lenient in the fall when we go back to standard time

Walker – Sexual Health

- Men who sleep five hours or less have smaller testicles than those that sleep for 8 hours.
- Men who sleep 5-6 hours a night will have testosterone levels equal to someone 10 years older.

JAMA. Author manuscript; available in PMC 2015 May 27.

Effect of 1 Week of Sleep Restriction on Testosterone Levels in Young Healthy MenFREE

Rachel Leproult, PhD and Eve Van Cauter, PhD

Chronic sleep curtailment is endemic today.

- **The majority of the daily testosterone release in men occurs during sleep**.
- In older men, morning testosterone levels are partly predicted by total sleep time.
- Testosterone also has important beneficial effects on muscle mass and strength, adiposity, bone density, and vigor and well-being.

J Circadian Rhythms. 2020; 18: 1.
Published online 2020 Mar 23. doi: 10.5334/jcr.190

Sleep and Reproductive Health

Olubodun Michael Lateef[1] and Michael Olawale Akintubosun[1]

- Women have similar compromises – they produce less follicle stimulating hormone, have irregular menses and difficulty conceiving.
- **Sleeplessness among female shift workers suppresses melatonin production as well as excessive HPA activation which results in early pregnancy loss, failed embryo implantation, anovulation and amenorrhea.**

Alcohol – and its affects on REM

- People who drink regularly do not engage in consistent REM sleep.
- Dr. Walker – in full knowledge of the information – abstinence is best. But life is for living, but understanding the effects might change someone's decisions.

Walker – Brain Benefits

Memory and learning

- You need sleep after learning – it is like hitting the save button.
- And you need sleep before learning – it prepares the brain like a wringing out a sponge; without sleep, your brain becomes water logged and can't soak up new information.

Who is being severely compromised in this area?

Sleep Deprivation and cognition

Sleep deprivation: Impact on cognitive performance

Paula Alhola[1] and Päivi Polo-Kantola[2]

3 October 2007

Both total and partial Sleep Deprivation induce adverse changes in cognitive performance.

- Total Sleep Deprivation impairs attention and working memory, as well as long-term memory and decision-making.
- Partial Sleep Deprivation is found to influence attention, especially vigilance.

APA PsycArticles: Journal Article

Effects of total sleep deprivation on procedural placekeeping: More than just lapses of attention.

- Total sleep deprivation (TSD) impairs attention as well as higher-order cognitive processes, like "placekeeping", which is the ability to perform a set of steps or tasks in a particular order without making mistakes.
- Compared how they did with normal sleep, then after being sleep deprived.
- They committed many more errors when sleep deprived compared to when they were well rested.

APA PsycArticles: Journal Article

Effects of total sleep deprivation on procedural placekeeping: More than just lapses of attention.

- Essentially, placekeeping is the ability to follow multiple-step instructions. How many parents get frustrated with their children because they cannot go upstairs, get into their PJs, brush their teeth and come back downstairs?
- The inability to follow simple instructions is often a reflection of inadequate sleep.

Sleep and ADD/ADHD

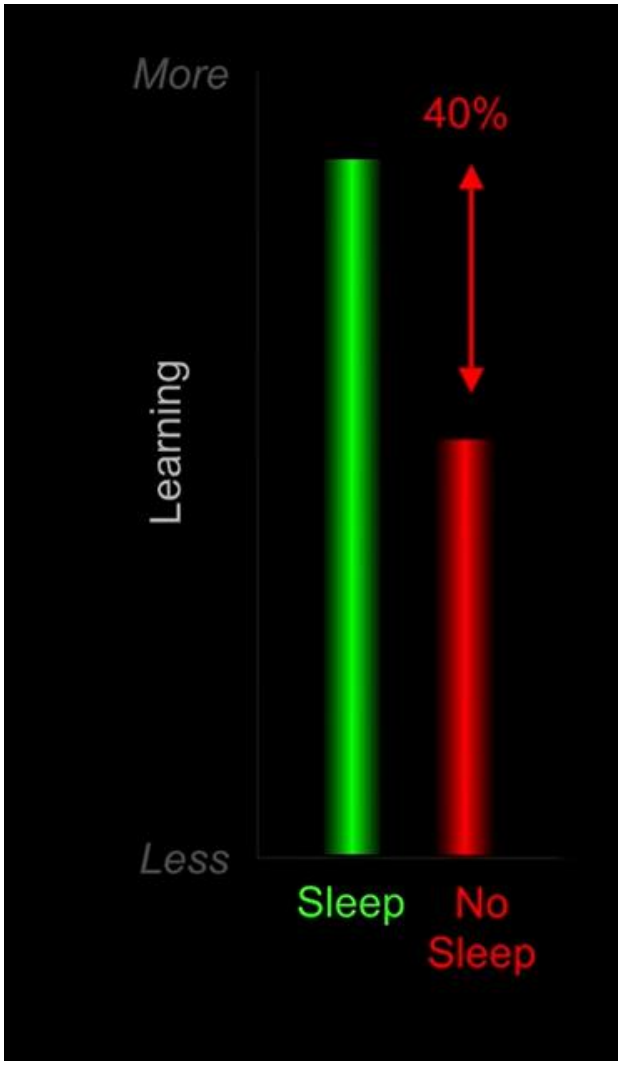
Dahl RE. The impact of inadequate sleep on children's daytime cognitive function. Seminars in Pediatric Neurology 1996;3:44–50.

- A link seems to exist between typical symptoms of inadequate sleep in children and symptoms characteristic of attention deficit/hyperactivity disorder (ADHD)
- Additionally, children diagnosed with ADHD have been shown to have a higher incidence of sleep problems and shorter average sleep duration than children without ADHD.

Walker – Brain Benefits

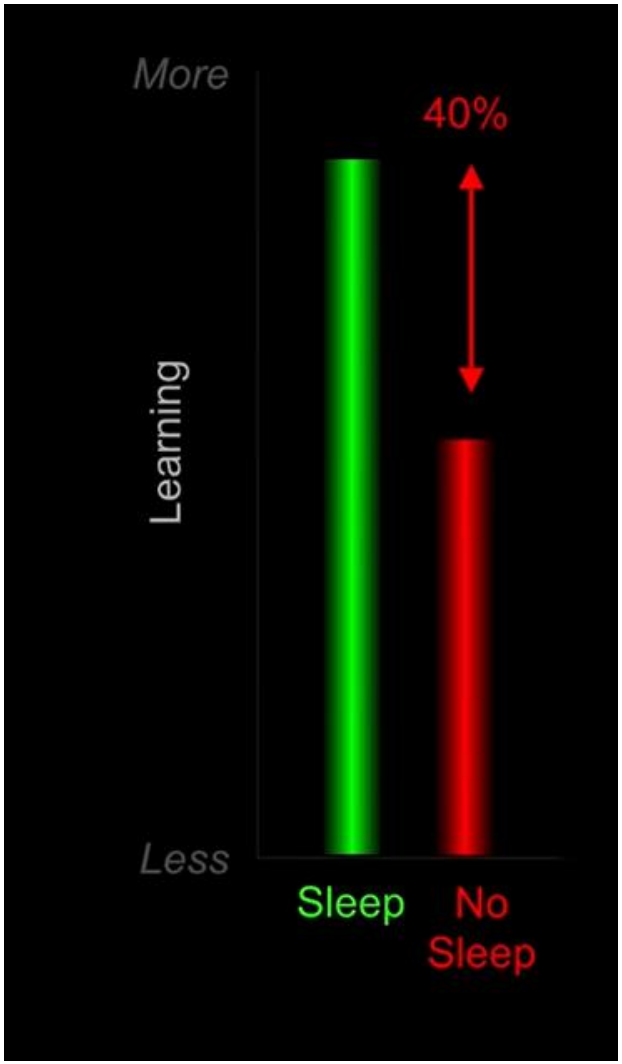
Learning

- Took two groups of adults – one slept normal 8 hours, and one group was forced to pull the all-nighter.
- They then set them up in an MRI machine while they were given a list of things to learn, and then tested them afterwards.
- The deprived group scored 40% lower then then group that slept normal.



Walker – Changing sleep time for school

Based on this information



School-aged Kids!

Students

- Middle school students (6-12) getting less than 9 hours of sleep – 57.8% (should get 9-11)
- High school students (13-18) getting less than 8 hours of sleep – 72.7% **(Should get 8-10)**

Sleep is critical to learning!

NEXT LEVEL
NEUROFEEDBACK

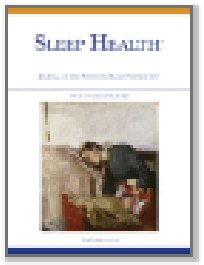
School start times

The average time high schoolers have to wake up.

ELSEVIER

Sleep Health

Volume 8, Issue 1, February 2022, Pages 11-22



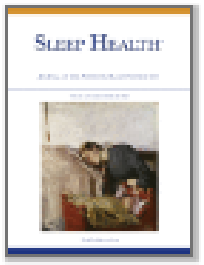
Adolescent sleep health and school start times: Setting the research agenda for California and beyond. A research summit summary

- Circadian cycles shift in adolescents, resulting in a delay of melatonin being released.
- This is further confirmed through EEG studies that show that sleep pressure, measured by the timing of slow wave activity, is delayed in this same demographic.

ELSEVIER

Sleep Health

Volume 8, Issue 1, February 2022, Pages 11-22



Adolescent sleep health and school start times: Setting the research agenda for California and beyond. A research summit summary

- So their natural timing of sleep shifts to later times. Asking the average high school student to got to bed at 10 is like asking their parents to go to bed at 7:30.
- This is physiological and outside of volition or self control.
- Making them get up at 5:30 am means that they are missing critical sleep.
- They do not stay up later when school starts at 8:30; they just get more sleep.

ELSEVIER

Sleep Health

Volume 3, Issue 2, April 2017, Pages 119-125

Delayed high school start times later than 8:30 AM and impact on graduation rates and attendance rates

Attendance rates and graduation rates significantly improved in schools with delayed start times of 8:30 AM or later.

Nat Sci Sleep. 2020 Dec 10;12:1161-1172. doi: 10.2147/NSS.S273875. eCollection 2020.

The Association Between School Start Time and Sleep Duration, Sustained Attention, and Academic Performance

- All students turned their lights off at similar times (
- Later school students woke up later.
- They got 10% more sleep starting later.
- Changes in sleep duration had parallelled significant differences in sustained attention, with LSC students outperforming ESC students.
- Longitudinal changes of sleep and sustained attention were associated with a coherent pattern of changes in academic performance.

SLEEPJ, 2021, 1–14

doi: 10.1093/sleep/zsab048
Advance Access Publication Date: 15 April 2021
Original Article

Changing school start times: impact on sleep in primary and secondary school students

Lisa J. Meltzer[1,*], Kyla L. Wahlstrom[2], Amy E. Plog[3] and Matthew J. Strand[1]

[1]National Jewish Health, Denver, CO, USA [2]University of Minnesota, Minneapolis, MN, USA and [3]Cherry Creek School District, Greenwood Village, CO, USA

*Corresponding author. Lisa J. Meltzer, National Jewish Health, 1400 Jackson Street, G311, Denver, CO 80206, USA. Email: meltzerL@njhealth.org.

- Sleep duration significantly increased and clinically significant daytime sleepiness decreased.

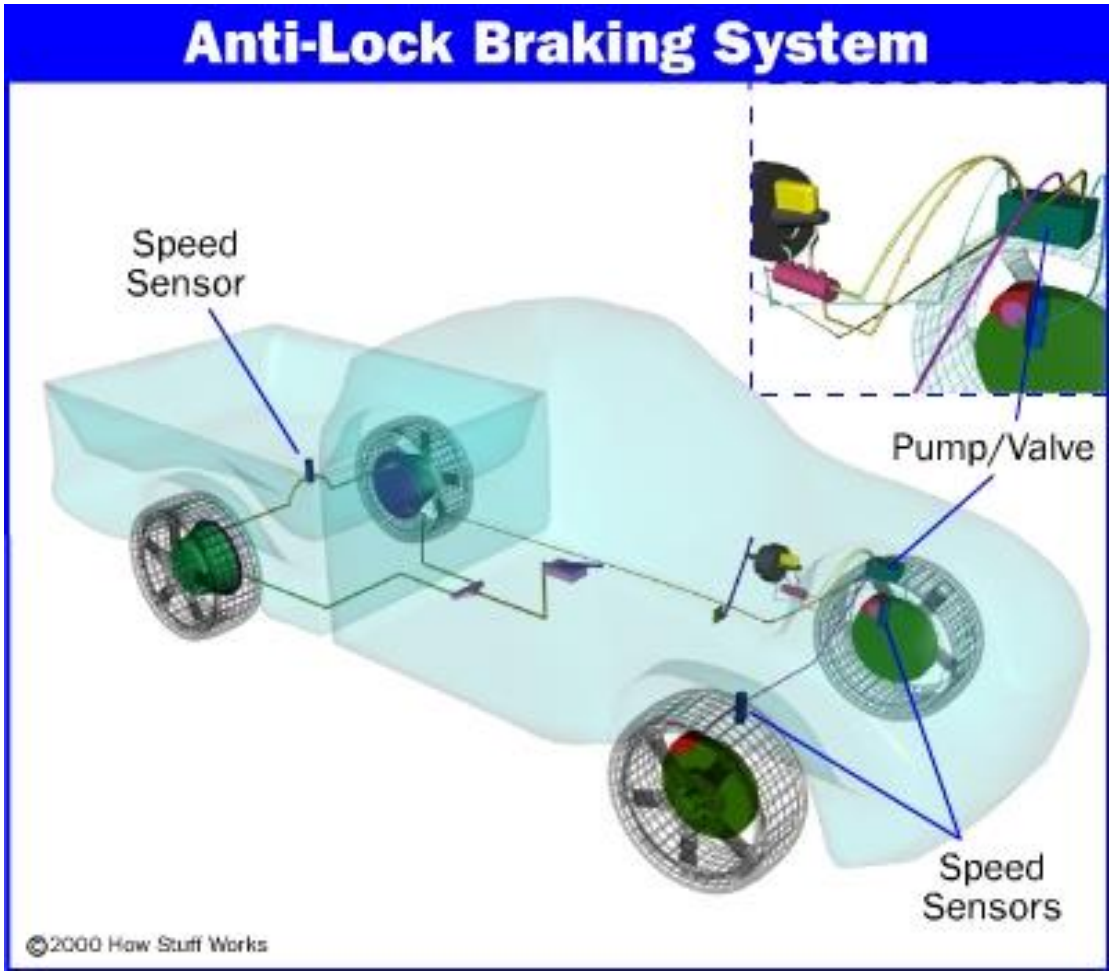
What else increased?

Walker – random points of interest.

- “Yet something even more profound has happened in this ongoing story of later school start times - the life expectancy of students increased.”
- The leading cause of death among teenagers is road traffic accidents, which increases with insufficient sleep.
- There was a 60 percent reduction in traffic accidents in drivers sixteen to eighteen years of age.”

Walker – random points of interest.

- Preventing and decreasing auto accidents has been a long public health goal.
- **Anti-Locking Braking Systems decreased traffic accidents by 20% -** it was heralded as being revolutionary.



NEXT LEVEL
NEUROFEEDBACK

NEXT LEVEL
NEUROFEEDBACK

- Neurofeedback therapy has been shown to be “encouraging” as an intervention for insomnia and should be the focus of additional studies going forward.

Sleep Deprivation and Performance

The impact of sleep deprivation in resident physicians on physician and patient safety: Is it time for a wake-up call?

Issue: BCMJ, vol. 50 , No. 10 , December 2008

“Long work hours are a tradition in the medical profession, and work schedules are especially intense among postgraduate resident physicians. However, because of the sleep loss and fatigue that result, these intense work schedules may pose threats to both physician and patient safety. Understanding the potential impacts of fatigue on resident physician performance and safety and using this knowledge to optimize shift schedules may reduce risks to both staff and patients.”

Review of Burnout

Insomnia

Anxiety

Depression

Chronic fatigue

Forgetfulness decreased

Decreased concentration and attention.

Neurofeedback has been shown to mitigate burnout symptoms

NEXT LEVEL
NEUROFEEDBACK

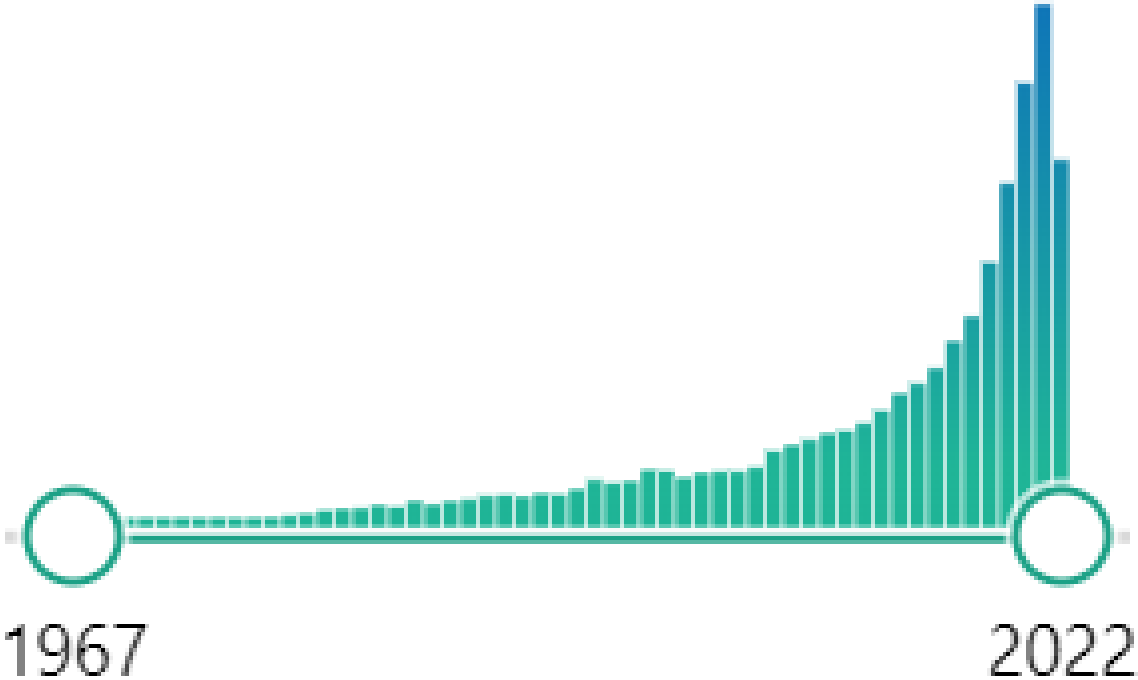
“Burnout”

Burnout is a form of exhaustion caused by constantly feeling swamped. It’s a result of excessive and prolonged emotional, physical, and mental stress. In most cases, burnout is related to one’s job.

Burnout results in a significant reduction in executive function, and there is a significant decrease in brain efficiency during these episodes.

Burnout

- **Burnout is not a formal medical diagnosis**, but it has gained tremendous attention in recent years.
- Research on burnout has exponentially increased over the last 10 years – going from 600 journal entries in 2011 to 3400 in 2021.



NEXT LEVEL NEUROFEEDBACK

Burnout affects those in healthcare

1. Mediating effect of sleep disturbance and rumination on work-related burnout of nurses treating patients with coronavirus disease.
   Zarei S, Fooladvand K.
   BMC Psychol. 2022 Aug 12;10(1):197. doi: 10.1186/s40359-022-00905-6.
   PMID: 35962404

2. Through the eyes of hospital-based healthcare professionals: exploring their lived experience during the COVID-19 pandemic.
   Mathura P, Li M, Vegt J, Penrod Z, Suranyi Y, Osborne C, Kassam N.
   BMJ Open Qual. 2022 Aug;11(3):e001878. doi: 10.1136/bmjoq-2022-001878.
   PMID: 35961682

3. Subjective COVID-19-related work factors predict stress, burnout, and depression among healthcare workers during the COVID-19 pandemic but not objective factors.
   Spányik A, Simon D, Rigó A, Griffiths MD, Demetrovics Z.
   PLoS One. 2022 Aug 12;17(8):e0270156. doi: 10.1371/journal.pone.0270156. eCollection 2022.
   PMID: 35960781

4. Burnout in health care workers during the fourth wave of COVID-19: A cross sectional study from Pakistan.
   Ahmad S, Yaqoob S, Safdar S, Cheema HA, Islam Z, Iqbal N, Tharwani ZH, Swed S, Ijaz MS, Rehman MU, Shahid A, Tahir U, Ahmad S, Bilal W, Essar MY, Iqbal S, Choudry ZA.
   Ann Med Surg (Lond). 2022 Aug;80:104326. doi: 10.1016/j.amsu.2022.104326. Epub 2022 Aug 7.
   PMID: 35958288 **Free PMC article.**

Even the chiropractic profession has been studied!

NEXT LEVEL
NEUROFEEDBACK

Burnout within the Chiropractic Profession

Chiropr Man Therap. 2016 Feb 22;24:2. doi: 10.1186/s12998-016-0083-1. eCollection 2016.

Chiropractors' perception of occupational stress and its influencing factors: a qualitative study using responses to open-ended questions

Shawn Williams [1]

Affiliations + expand

PMID: 26904183 PMCID: PMC4762157 DOI: 10.1186/s12998-016-0083-1

Free PMC article

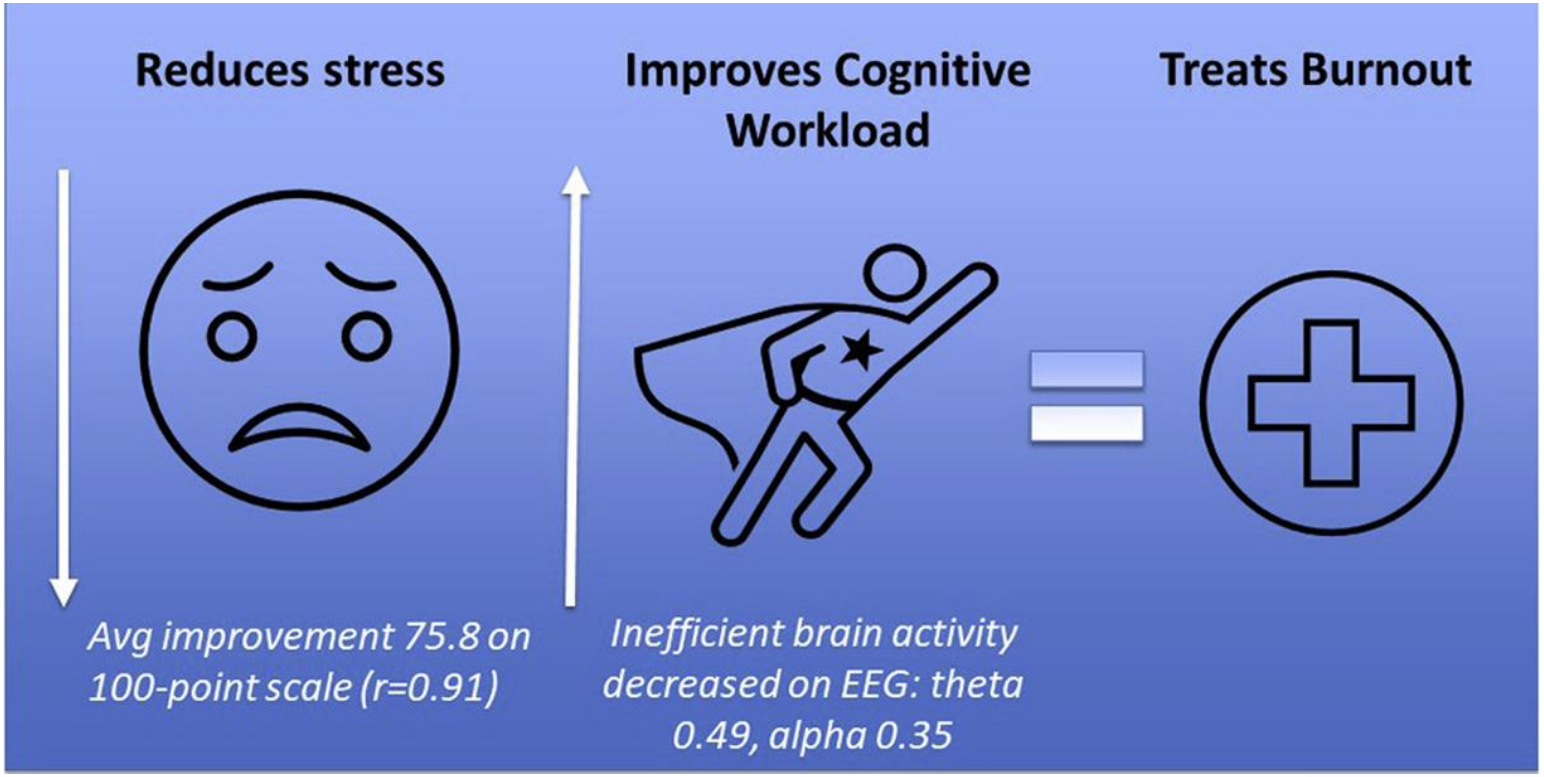
Abstract

Background: Job stress and emotional exhaustion have been shown to have a negative impact on the helping professional. The development and causal relations of job stress and emotional exhaustion are rather unclear in the chiropractic profession. The objective of this study is to understand the main sources of occupational stress and emotional exhaustion among doctors of chiropractic.

September 2020

J Am Coll Surg. 2020 Sep 11;S1072-7515(20)32302-4. doi: 10.1016/j.jamcollsurg.2020.08.762. Online ahead of print.

Pilot Study Using Neurofeedback as a Tool to Reduce Surgical Resident Burnout



NEXT LEVEL NEUROFEEDBACK

Front Psychol. 2020 Dec 3;11:571739. doi: 10.3389/fpsyg.2020.571739. eCollection 2020.

Improving Cognitive Workload in Radiation Therapists: A Pilot EEG Neurofeedback Study

- Radiation therapy therapists (RTTs) face challenging daily tasks that leave them prone to high attrition and burnout and subsequent deficits in performance.
- “This study presents promising behavioral improvements as well as brain performance-related evidence of neurophysiological changes following neurofeedback and the use of neurofeedback as a tool to mitigate burnout.”

September 2020

J Am Coll Surg. 2020 Sep 11;S1072-7515(20)32302-4. doi: 10.1016/j.jamcollsurg.2020.08.762.
Online ahead of print.

Pilot Study Using Neurofeedback as a Tool to Reduce Surgical Resident Burnout

STUDY: Burnout in surgical residents – NFB vs. Control. Randomly assigned – Both groups had high cognitive workload in the pre-assessment.

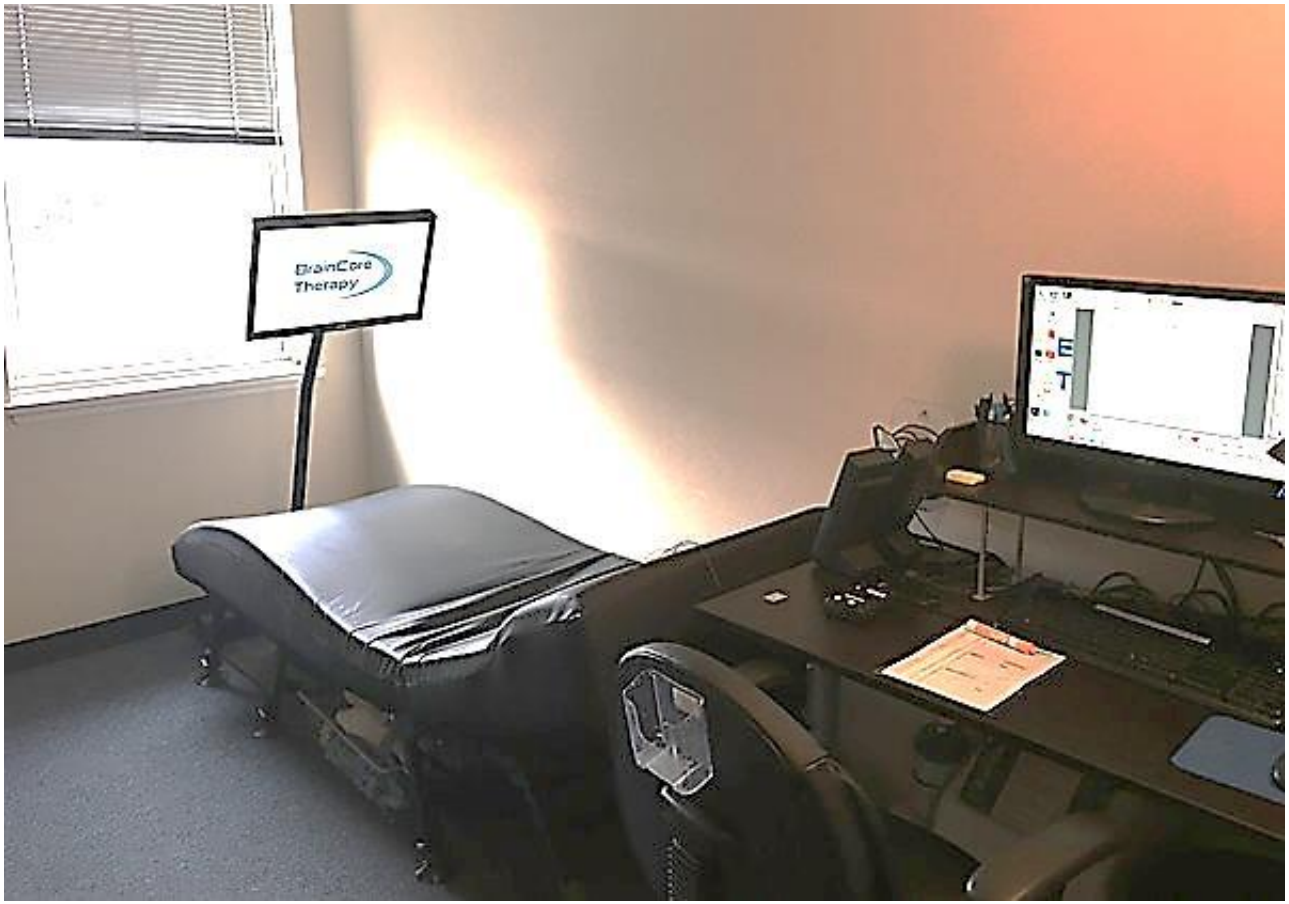
RESULTS:

NFB group showed a significant improvement in cognitive workload during the working memory task. These differences were not noted in the control group.

CONCLUSIONS: There was a notable change in cognitive workload following the NFB, suggesting a return to a more efficient neural network.

Neurofeedback Therapy

Neurofeedback setup in my office



NEXT LEVEL
NEUROFEEDBACK

We started in 2010 – BCN

- We started in 2010
- Board Certified 2012
- Incredibly Effective!
- It can literally change someone's life.
- **We can help you experience in-office, or remotely with our at-home rental program.**

NextLevelNeurofeedback.com

NEXT LEVEL
NEUROFEEDBACK

Case Study of an 83 year old woman with sleep issues, low energy and anxiety.

She did 33 sessions of neurofeedback.

“I don’t know what you did to my brain, but it was better than sex, and it lasts a lot longer!

NEXT LEVEL
NEUROFEEDBACK

If you were interested in neurofeedback, either as a patient or as a provider of it, I do zoom presentations explaining it to health care professionals at no charge.

Nextlevelneurofeedback@gmail.com

203.316.8212

NextLevelNeurofeedback.com

NEXT LEVEL
NEUROFEEDBACK

“An adult’s owlness or larkness, also known as their chronotype, is strongly determined by genetics. If you are a night owl, it’s likely that one (or both) of your parents is a night owl. Sadly, society treats night owls rather unfairly on two counts. First is the label of being lazy, based on a night owl’s wont to wake up later in the day, due to the fact that they did not fall asleep until the early-morning hours. Others (usually morning larks) will chastise night owls on the erroneous assumption that such preferences are a choice, and if they were not so slovenly, they could easily wake up early. However, night owls are not owls by choice. They are bound to a delayed schedule by unavoidable DNA hardwiring. It is not their conscious fault, but rather their genetic fate.”

Sleep disorders

Treatment for shift work disorder includes strategic napping, avoiding stimulants like light at the correct time, and, if possible, reducing the number of hours worked. For people who sleep during the day, it can also help to use light-blocking tools like eye shades or curtains.

Walker – Negative outcomes with less sleep

"There is no aspect of physiology that is not negatively affected by decreased sleep."

"Sleep is not an optional lifestyle luxury, it is a non-negotiable biological necessity."

"There is a silent sleep loss epidemic, and it is fast becoming one of the greatest public health challenges that we now face in the 21st century."

Matt Walker, PhD

- Slide 56 Slow wave sleep in babies

- Slide 56 Slow wave sleep in babies

Walker – random points of interest.

- In the weeks and months before cognitive and developmental milestones occur in developing children, there are changes in deep NREM sleep. This implies that deep sleep is the driving force to brain maturation, not that the matured brain changes sleep.