

Improving Sleep & Its Benefits

WHY PROPER SLEEP IS CRITICAL FOR GOOD HEALTH

A LACK OF SLEEP CAN CAUSE:

1. Decreased immune function.
 - Poor sleep for days before getting a flu shot will decrease the shot's efficacy by 50%.
2. Decreased hormone function.
 - Growth hormone (GH) release is sleep-dependent and is better released at night vs. the day (which can affect shift workers who sleep during the day).
 - Hormones leptin (full) and ghrelin (eat) are disrupted and may increase appetite.
3. Decreased cognition and focus.
4. Decreased mood.
5. Decreased learning plasticity.
6. Body fat accumulation.

OBTAINING ADEQUATE SLEEP CAN:

1. Counter the six negatives (noted above) that a lack of sleep can cause.
2. Decrease mortality rate by 49%.
3. Decreased the risk of cancer by 35%.
4. Decrease the risk of CV disease by 60%.

CIRCADIAN RHYTHM & ULTRADIAN CYCLES

TWO MAIN FORCES THAT DETERMINE WHEN AWAKE AND ASLEEP

1. 24-hour Circadian Rhythm.
2. Sleep pressure/sleep drive – based on one's level of adenosine during the day. More adenosine = more fatigue.
3. Both are independent of each other.

CIRCADIAN RHYTHM

The body's 24-hour master clock affects the functioning of all cells and is controlled by the suprachiasmatic nucleus in the hypothalamus.

ULTRADIAN CYCLES

Consecutive 90:00 cycles throughout the day, including sleep periods that contain non-REM/slow wave sleep (SWS) and deep rapid eye movement sleep (REM).

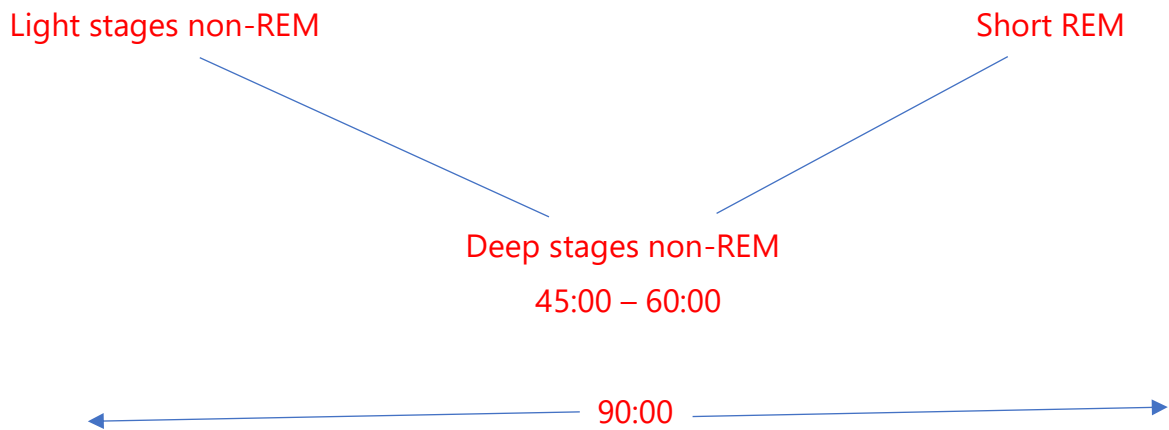
- Many wake up at the end of each 90:00 ultradian cycle, but most are unaware because they are not fully awake.

STAGES OF SLEEP DURING THE NIGHT

Four stages of approximately 90:00 each @ 4-6 periods per night.

1. SLOW WAVE SLEEP (SWS)/non-REM.

- Stage 1 = Light SWS/non-REM. Characterized by slow-rolling eye movements.
- Stage 2 = Light SWS/non-REM. Characterized by slow but large and sweeping brain waves.
- Early stages: the initial four to five hours of 90:00 ultradian cycles:
 - Deeper SWS/non-REM.
 - Less REM.
 - Skill learning and cognition occur.
 - Growth hormone (GH) is released significantly.
 - Protein synthesis occurs.
- Stages 3 & 4 = Deep SWS/non-REM. Characterized by:
 - Increased parasympathetic function, where everything slows down.
 - Calming.
 - Immune system increases.
 - Regular metabolic system function/stabilized blood sugar occurs.
 - Dozing and a fast gamma rhythm.
 - The transition between wakefulness & deep sleep.
 - SWS deep sleep cleans out the brain.
- To obtain and not miss the critical first two stages, one must go to bed at the same time each night because it cannot be made up.
- Obtaining the same sleep cycle (i.e., getting 8 hours) will allow one to experience the four stages to get well rested and clean out the brain. If not, they will miss the SWS/deep sleep stage cleanout.



2. RAPID EYE MOVEMENT SLEEP (REM).

- Eye movement details:

- A function of the Pons-Thalamus circuit connection to the cortex.
- Waves all over the place.
- Side-to-side eye movement.
- Phasic REM = eyes moving.
- Tonic REM = eyes not moving.

Latter stages: last three to four 90:00 ultradian cycles:

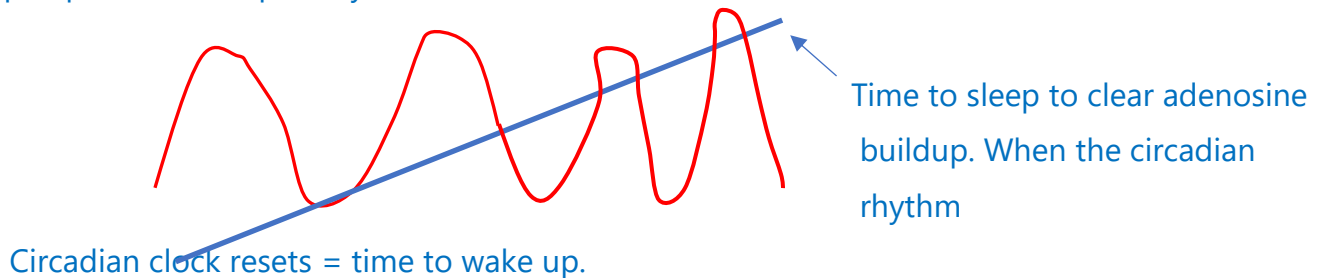
- Less deep SWS/non-REM.
- More REM.
- The locus coeruleus (LC) in the brain is filled with norepinephrine (the brain's version of epinephrine), and its neurons help us respond to stimuli (i.e., a loud noise).
- During REM sleep, the LC shuts down completely and allows working neurons to erase novel things (like resetting a computer), and the cortex codes essential things.

SLEEP PRESSURE/SLEEP DRIVE

- When waking in the morning, 1) the body temperature rises, and 2) the level of the hormone cortisol (stress hormone) increases:
 - Metabolism increases.
 - Mental focus increases.
- Because cortisol increases upon waking, a timer goes off that will cause the body to seek sleep 12-14 hours later.
- The circadian rhythm is affected by light, which is why viewing quality indirect sunlight from

2:00 to 10:00 is early, but it's essential to start the day.

- When indirect sunlight enters the eyes, it sets off several processes:
 - Photons from sunlight are needed to increase the effectiveness of the circadian rhythm.
 - Sunlight decreases melatonin (sleep hormone secreted by the pineal gland) because darkness increases (why we need less light later in the day).
- Cortisol is needed, but if it is too high at night, it will make it difficult to sleep. That is why being stressed at night can make it difficult to fall asleep.
- Adenosine also builds up in the brain during the day, creating greater fatigue.
- Adenosine is a nucleoside building block of RNA that is a byproduct of mitochondrial energy production.
- The caffeine in coffee antagonizes its ability to increase dopamine and the release of epinephrine to temporarily increase alertness.



- The body is constantly clearing adenosine during the day, but the greatest build-up occurs at the end of the day when deep REM sleep cleans it out.

SLEEP & MENTAL HEALTH

PTSD & TRAUMA

- PTSD = hyper-active Locus Coeruleus does not shut off during REM sleep = IS not erasing bad thoughts.
- Increased norepinephrine/noradrenaline (the most common neurotransmitter of the SNS) is not good.
- Prazosin blocks it & allows for quality REM sleep.
- Anxiety & sleep – if any one of the QQRT is off, it increases anxiety.

SUICIDE & SLEEP

- Poor sleep may increase thoughts about suicide.

- Suicide stages: Ideation, Attempt, & Completion.
- Darkness of night & bad thoughts = 10x greater than the light of day.

DEPRESSION & SLEEP

- Both anxiety (worried about the future) and depression (concerned about the past) are affected by sleep.
- The 1st stage of REM sleep occurs earlier in people with depression.
- STUDY: Sleep deprivation could alleviate depression in some cases due to traumatic experiences not becoming embedded in their memory.
- Some medications can delay the 1st stage of REM.
- Anhedonia = inability to feel pleasure/be around people.

SLEEP & EMOTIONAL STATE:

- The amygdala (which processes emotions) was severed when sleep was poor for several consecutive days.
- The medial prefrontal cortex (multi-sensory emotion regulator) has a connection to the amygdala.
- Overnight therapy – in REM sleep, noradrenaline can shut off in the brain.
- William Demont – REM pioneer: “REM sleep is the difference between sanity and insanity.”

IMPROVED LEARNING

LEARNING

We need proper sleep before 1) learning, 2) retaining knowledge, and 3) enhancing creativity.

Like a USB flash drive, info → hippocampus → info to cortex.

Pulling an all-nighter is not good because the hippocampus showed poor activity.

Memory consolidation and translocation occur in deep SWS/non-REM sleep.

Proper sleep “refreshes & reorganizes” the brain:

- Like having many file folders placed in the correct locations.
- The content is “bullet-pointed” and available for easy access.

Thomas Edison:

- Had nap cots in each room of his house.
- When napping, he held steel ball bearings in his hand with a steel pan directly below on the floor.
- When he dozed off, his hand would relax and drop the ball bearings that caused him to wake up and record his thoughts immediately.

STUDY: Being "under-slept" and on a calorie-restricted diet = subjects lost more muscle mass vs. stored fat.

TIPS FOR BETTER SLEEP

- ALL RECOMMENDATIONS BELOW WILL SET THE CIRCADIAN RHYTHM FOR THE DAY. THEY WILL AUGMENT THE PREDICTABILITY OF THE AUTONOMIC NERVOUS SYSTEM (I.E., WAKING AT THE SAME TIME EACH DAY).
- Use behavioral tools 1st, nutrition 2nd, and supplements 3rd.

BEHAVIORAL TOOLS

SLEEP QUALITY & QUANTITY

- Quantity – 7 to 9 hours.
- Quality – Avoid fragmentation/waking too many times.
- Regularity – Use a consistent bedtime and waking schedule. STUDY: Those who followed a regular schedule were more productive and healthier.

ENHANCING REM SLEEP

- Must go through all stages of sleep.
- Get most of deep sleep in the 1st half & most of REM in the 2nd half.
- Don't drink alcohol.
- Stay on a regular sleep schedule.
- Exercise.
- Sleep in a cool sleep environment.
- Take a warm bath before sleep: warm up to cool down.

VIEW SUNLIGHT EARLY WITHIN 30-60 MINUTES OF WAKING

- Triggers increase.
- Sets in motion the circadian rhythm "timer" that prepares the body for sleep 14 to 16 hours later.
- Look toward (not directly at) the sun from 2:00 to 10:00.
- If no direct sunlight is available, use indoor lights, but try to get outside as soon as possible.
- On cloudy days, one must get outside light for the full 10:00 of exposure.
- Viewing through windows or car windshields does not count.
- On dark, rainy days, use LED or ring lights for illumination.

INCREASE BODY TEMPERATURE

- One's minimum temperature (MINTEM) is when the body temperature is lowest, usually two hours before their normal wake-up time.
 - Example: typical wake-up time @ 7:00 AM = MINTEM = 5:00 AM.
 - If one views bright light, drinks caffeine, eats, exercises, or socializes **2-4 hours before MINTEM** the body will want to *sleep later the next day*.
 - The opposite is true: if done **2 hours after MINTEM**, the body will want to advance the body clock and *sleep earlier the next day*.
- Exercise – best times:
 - Immediately after waking.
 - Three hours post-waking.
 - 11 hours post-waking.

DECREASE LIGHT AND CORTISOL OVER THE DAY

- Darkness is needed to release melatonin (sleep hormone) vs. the light in the AM that increases cortisol and decreases melatonin.
- To decrease cortisol and increase melatonin, there are three critical periods of the day:
 1. Waking up → next 3 hours – increased cortisol is desirable, and caffeine is acceptable.
 2. Three hours post-waking → late afternoon:
 - It's okay to nap, but not long.
 - Decrease caffeine in midafternoon (<100 mg).
 - If you exercise, it may delay the circadian clock.

- Light during this period:
 - Get some late-afternoon sun.
 - The lower solar angle during that time has different wavelengths (yellow, blue, red) and descending signals that tell the body that sleep is coming.
 - If viewing afternoon sunlight, it can offset any viewing of artificial light at night.

3. Late evening (6-7 PM) → bedtime.

- Avoid bright artificial light as it decreases melatonin.
- Use dimmers, candles, and moonlight.
- A hot sauna or bath at night can initiate the cooling of body temperature needed to fall asleep.

OTHER BEHAVIORAL TIPS

- To fall asleep, the body's core temperature must drop 1 degree Fahrenheit.
- The brain also needs to cool down to fall asleep.
- Body heat dissipates better when lying horizontal vs. upright @ 45 degrees.
- Sleep "cool" by extending an arm or leg out from the covers.
- Elevate your feet to improve metabolism, blood circulation, and heart health.
- Can fall asleep better in a colder environment.
- To stay asleep, wear an eye mask.
- Naps can be effective for some, but if one wakes up groggy from one, it usually means they are not getting deep REM sleep.
- Clear the mind:
 - Use non-sleep deep rest methods (NSDR) – meditation & yoga @ 10:00
 - Toe-to-head focus with attention to breathing.
 - Walk it out. If one cannot sleep, get out of bed to disassociate the bed from being awake.
 - Don't count sheep, but do a mental walk outside with detail.
- If one gets poor sleep one night:
 - Get up at normal time.
 - Do not nap to "catch up."
 - Don't go to bed earlier the next night.
 - All the above to keep the adenosine clock on its regular schedule.

- Limit the amount of time spent in bed to restrict sleep to quality sleep only, which results in the body wanting to sleep immediately.

NUTRITIONAL INTAKE

METABOLISM IN SLEEP

- Sleep states regulate 50% of all metabolic processes.
- Proper sleep maximizes total body metabolism during the day.
- Energy sources during sleep (CHO, fat) can be measured from one's breath while sleeping.
- SWS/non-REM sleep periods can increase fat oxidation.
- The switch from sleep to waking decreases fat metabolism.

NUTRIENT TIMING

- Eating early in the day increases body temperature and metabolism.
- If one delays caffeine intake for 1.5 to 2 hours after waking, it can avoid an afternoon crash as it blocks adenosine buildup.
- The half-life of caffeine is 5 to 6 hours.
- Avoid drinking alcohol because it is a sedative that disrupts brain activity, which hinders deep REM sleep.
- Late-night eating diverts blood flow to digestive functions and creates fatigue.
- CHO intake increases body temperature due to a faster blood sugar spike that interferes with getting to sleep.
- New research on food intake before sleep showed that eating 45:00 pre-sleep was not good, but 90:00 did not create sleep disruption.

SUPPLEMENTS

- If using supplements, use sleep stack 30:00 – 60:00 before bedtime:
 - Magnesium threonate @ 145 grams.
 - Apigenin @ 5 mg.
 - Theanine 100-400 mg.
 - Combine or use it alone.
- Most melatonin OTC supplement doses are too high.
- Glycine @ 2 grams.

- Myo-inositol @ 2 to 10 grams.
- Mg @ 200 to 350 mg.
- GABA (gamma-aminobutyric acid) @ 100 to 200 mg.
- DORA drugs (dual orexin receptor antagonists) like daridorexant @ 25 to 50 mg.
- THC Tetrahydrocannabinol (cannabis) may decrease anxiety, thus augmenting sleep.

NIGHT OWL STUDY: - SUBJECTS WERE TOLD TO:

- Get up 3 hours earlier.
- Get outdoor light before noon.
- Go to bed 3 hours earlier.
- Reduce light exposure in the evening.
- Maintain a fixed sleep time of either + or – 30:00.
- Maintain the same meal schedule.
- No caffeine after 3:00 PM.
- No naps after 4:00 PM.
- Exercise early in the day.

RESULT: readjusted their circadian rhythms to get back to a regular sleep & waking schedule.