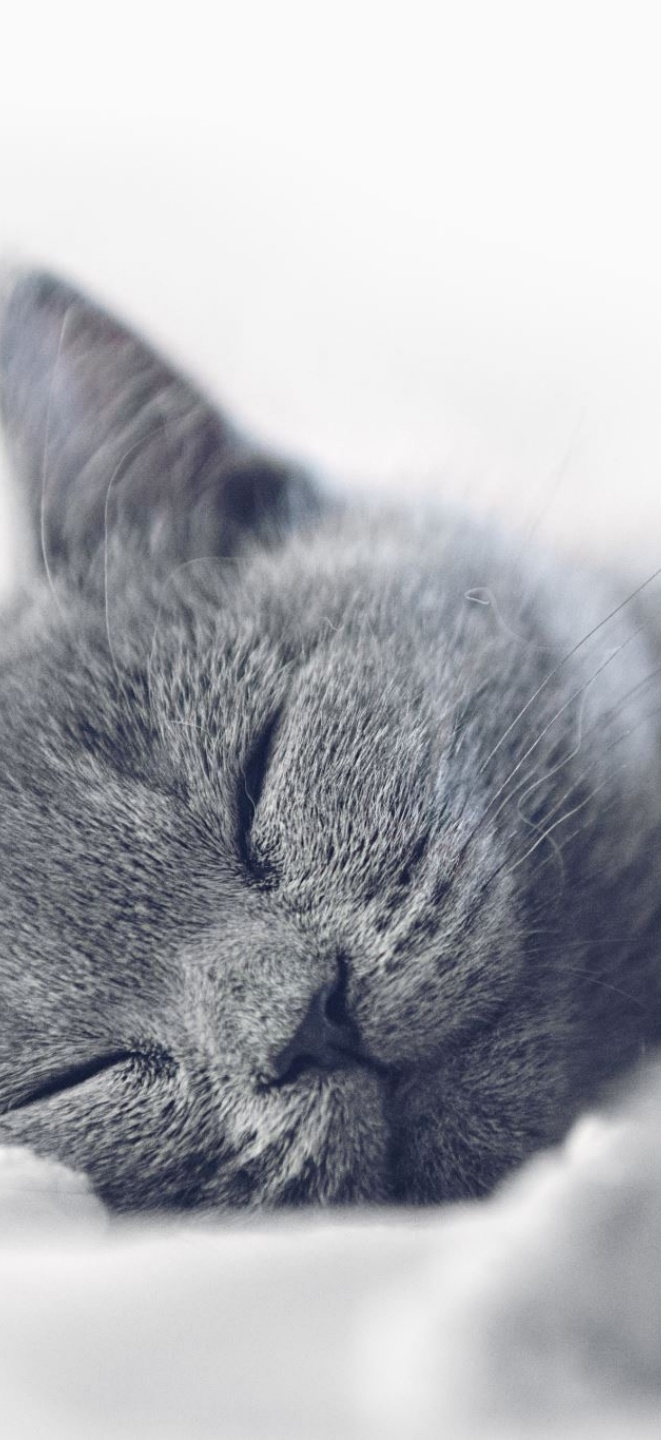
Sleep Deprivation

Topics of Discussion

- What is Sleep Deprivation?
- Functions of Sleep
- Impact of Sleep Deprivation
- Ways to Combat Sleep Loss

Sleep deprivation even affects famous people



Sleep Deprivation

- Sleep deprivation is a period of inadequate sleep
  - Can be acute (1-2 days) or chronic (prolonged)
- Adults need 7-9 hours of sleep a day
  - The younger a person is, the more sleep they need
- Less than required sleep results in sleep debt
- Excessive daytime sleepiness is a widespread complaint
- We are a 24/7 society
  - People got 10 hours of sleep per night before the light bulb was invented
  - 6.9 hours after the light bulb

Memory and Brain Function

- There are 3 functions of memory:
  - Acquisition = Introduction of new information into the brain
    - Happens during Wake
  - Consolidation = Processes by which a memory becomes stable
    - Happens during Sleep
  - Recall = Ability to access the information (whether consciously or unconsciously) after it has been stored
    - Happens during Wake

Memory and Brain Function

- Types of memories:
  - Declarative – What we know
    - Fact-based information
    - Benefits more from slow wave sleep
  - Procedural – How to do something
    - Benefits more from REM
  - Working memory is affected by sleep deprivation
    - Working memory is important because it keeps information active for further processing and supports higher-level cognitive functions such as decision making, reasoning, and episodic memory.

Memory and Brain Function

- The brain loses 5% of its weight between ages 30-80.
- Chronic sleep deprivation can age the brain 4-7 years.
- When sleep deprived, more difficult to retain new information or procedures in workplace.

Memory and Brain Function

- Different areas of the brain are impacted by sleep deprivation
  - Prefrontal cortex, what commands logical reasoning, shuts down after 24 hours affecting judgment calls, deciding what's right and wrong, what's real and illusion.
    - This shut down prevents the release of chemicals needed to calm down the fight-or-flight reflex.
  - Amygdala goes into overdrive
    - This is the fight or flight mechanism that makes you more paranoid.

Memory and Brain Function

- Locus coeruleus, the oldest part of the brain, is activated, which releases noradrenalin to ward off imminent threats to survival.
  - Shutdown of the prefrontal cortex coupled with activation of the locus coeruleus is a volatile mix.
- Frontal lobe controls speech and creative thinking.
  - When sleep deprived, you are unable to use complex vocabulary or make logical decisions.
    - You tend to slur, stutter or repeat words as the speech center of the brain shuts down due to lack of sleep.

Memory and Brain Function

- Hypothalamus regulates appetite, expenditure of energy, and the circadian rhythm.
  - Sleep deprivation tends to increase appetite as body needs energy to stay awake.
  - Increased caloric consumption is a factor in development of obesity.
  - Obesity can lead to sleep apnea which further disrupts sleep, leading to more sleep deprivation.

Memory and Brain Function

- Parietal lobe controls spatial learning, which includes remembering how to get to a new location.
  - Sleep deprivation damages spatial learning because the new brain cells developed from learning won't survive as well.
- Hippocampus controls memory function.
  - Memory loss and attention deficits are due to increased levels of adenosine.

Why does coffee help?

- Caffeine blocks effects of adenosine, giving temporary relief to memory impairments because of increased adenosine levels.

Responsiveness

- Slowed response time with sleep deprivation
- Poor at making complex decisions, ignoring the irrelevant, and communication
- Microsleeps

Responsiveness

- More risk for motor vehicle accidents
  - Some states now have drowsy driving laws due to increased accidents and cognition being equal to that of drunk driving.
    - Maggie's Law is the first of these laws
      - Named for Maggie McDonald, a 20-year-old college student who was killed when a driver crossed three lanes of traffic and hit her car head on. The driver admitted he had been awake for 30 hours before the accident and had also been using drugs. During the trial, the judge did not allow the jury to consider the driver's sleep deprivation, and he received a suspended jail sentence and a $200 fine.
      - Passed in 2003 and makes it illegal to drive while knowingly sleep deprived

Responsiveness

- Lab studies have shown that in terms of performance, being awake for 17 hours was like having a blood alcohol level of 0.05% and being awake 24 hours was like a blood alcohol level of 0.10% (legal limit for alcohol = 0.08%).

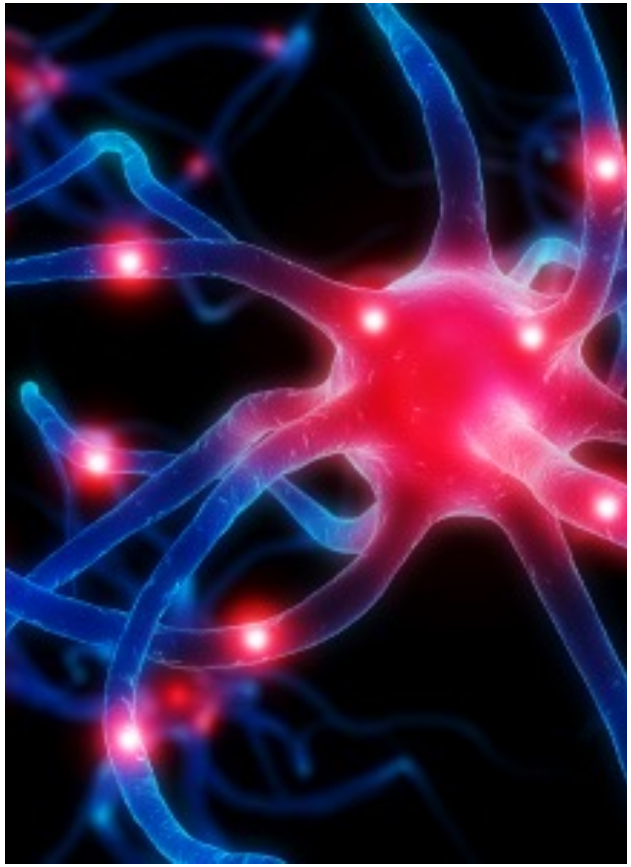
Ever wonder why it’s called beauty sleep?

Hormone Regulation

- "Adequate sleep is essential for human life to recover from the daily wear and tear the body undergoes," said Dr. Pradip Karmakar, clinical and interventional cardiologist at the Heart Institute of the Caribbean.
- Hormones regulated during sleep include:
  - Growth hormone
    - When deficient, leads to weakened bones, sagging skin, increased wrinkles on the forehead and under the eyes, decreased muscle mass, stunted growth.
  - Insulin
    - Sleep deprivation leads to high insulin levels that leads to Type II diabetes

Hormone Regulation

- Hormones regulated during sleep include:
  - Ghrelin
    - Tells you when to start eating. Is increased in sleep deprivation.
  - Leptin
    - Tells you when you are full. So decreased leptin levels because of sleep deprivation can lead you to overeat.
  - Cortisol
    - Increases because of sleep deprivation. This is the stress hormone that is linked to the accumulation of body fat.
  - Testosterone
    - Sleep deprivation can lead to lower testosterone levels, which can result in male impotence.



Why do we sleep when we're sick?

"If we treated machinery like we treat the human body, there would be breakdowns all the time." – James Maas

Minimizing Health Risks

- Health risks associated with sleep deprivation:
  - Stroke
  - Cardiac problems
  - Hypertension
  - Obesity
  - Diabetes
  - Weakened immune system
  - Pain perception
  - Body temperature maintenance

Emotional Resilience

- Prone to irritation, tension, and sadness
- Inappropriate behavior
- Impairs social and emotional skills
- Impacts relationships
- Paranoia tied to amygdala in overdrive
- Scientists from the Sleep and Neuroimaging Laboratory at the University of California, Berkeley, showed that sleep deprivation considerably exaggerates how much we anticipate impending emotional events, especially among those who are already highly anxious individuals.
- Some sort of sleep disruption is present in almost all psychiatric disorders.

Learning in a Sleep Deprived Society

- According to Medical News Today, school stress keeps 68% of students awake after their heads hit the pillow. Only 30% of students sleep eight hours a night, the average recommended amount for young adults. 20% of students pull an all-nighter at least once a month.
- Sleep after studying for best results on exams

Learning in a Sleep Deprived Society

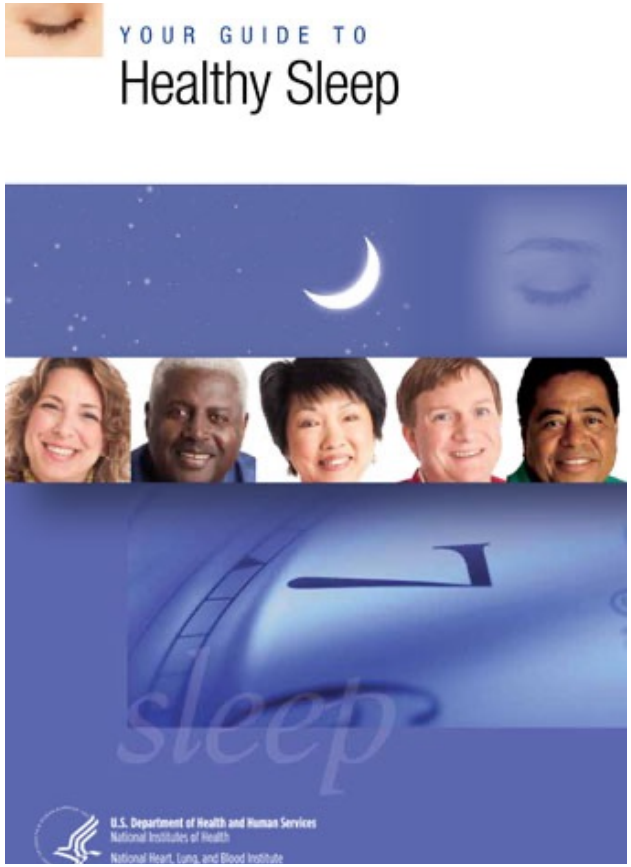
- Dr Karrie Fitzpatrick, sleep researcher at Northwestern University in Illinois, United States, said the lack of sleep was going to leave students more emotionally volatile, more potentially disruptive and physically struggling to learn.
  - Also noting that the loss of sleep and short-term attempts to catch up can cause further and complex disruptions to the way the brain tries to store information, she added that trying to study without sleep would be very difficult because the brain would be running on empty.

Learning in a Sleep Deprived Society

- However, she pointed out that if students started getting enough sleep on a regular basis, the loss to learning could be reversed.
- "As long as you haven't gone into extreme sleep deprivation, if you go back to seven to nine hours per night, as long as there has been no permanent damage, you can probably restore the functionality of accumulating, processing and being able to recall memories," Fitzpatrick stated.

What You Can Do

- Educate yourself
  - Learn about sleep to adopt better practices and routines to improve sleep.
  - The National Heart, Lung, and Blood Institute has a guide called “Your Guide to Healthy Sleep” that provides sleeping tips, information on sleep disorders, and how to seek help from sleep professionals.
- Make time for sleep
  - Allow enough time for sleep. You need 7-9 hours of sleep. Best to get this amount daily to avoid a build-up of sleep debt and associated risks. Maintain a regular and consistent bedtime and wake time on both workdays and non-workdays. Also, 15–20-minute naps during the day can provide temporary relief from the effects of sleep loss and fatigue.



What You Can Do

Prepare for sleep

- Prepare for sleep by avoiding heavy meals and alcohol before sleep and reducing intake of caffeine and other stimulants several hours before bedtime.
- Caffeine can remain active in the body for 3-5 hours after consumption and may cause fragmented sleep and decreased total sleep time.

Keep it cool, quiet, and dark

- Arrange a sleep environment that is very dark, comfortable, quiet, and cool to facilitate falling asleep quickly and staying asleep.
- Do relaxing pre-sleep rituals about 30 minutes before sleep onset.

What You Can Do

Exercise

- Follow an exercise routine (but not within 3 hours of bedtime). Daily physical activity improves sleep, helps with stress management, and promotes general health. Also, try to spend some time outside each day as exposure to sunlight helps with circadian rhythm regulation.

Look at what's keeping you from sleep

- Address other sources of sleepiness. For example, if a medication is causing you to be drowsy during the day, talk to your doctor about a non-sedating alternative.

Seek help from healthcare providers for continuing difficulties with sleep.

"Early to bed, early to rise makes a man healthy, wealthy and wise."
Benjamin Franklin