

# L I T E R A T U R E   S U M M A R Y

## UGA Sleep Study

Paige Hamby | Sammy Levine | Nikki Mehrjerdian | Emily Middleton | Sam Orr  
| Camille Young

### Overview

For the first component of our User Research for this project, our group read the book *Why We Sleep* by Dr. Matthew Walker. This text was recommended and provided to us by our client Dr. Courson, the Senior Associate Athletic Director of the UGA Department of Sports Medicine. This book has allowed us to gain insight on the importance of sleep and how it works on an anatomical level. Having read the book, we hope to apply this valuable information to our project and use it to gain insight on the student athletes we are aiming to help. Below, we have listed out key points and takeaways from each of the chapters in the book that we believe could be helpful in understanding how best to carry out this project. Some chapters we have covered more in depth than others, because the nature of the content is more relevant to our particular project.

# *Why We Sleep: Key Takeaways*

Dr. Matthew Walker

## Chapter 1

Chapter 1 serves as an introduction to how the author began his research on sleep and what the book will cover.

## Chapter 2

A key point in Chapter 2 is that there are two main factors that determine when we want to sleep and when we want to be awake:

1. The Internal circadian clock/rhythm in our brain, called the **suprachiasmatic nucleus**, signals to the body at consistent times of day and night whether it should feel tired or awake.
  - This internal circadian clock is approximately 24 hours in length and is influenced by external factors such as the sun, food, exercise, and body temperature.
  - Everyone has a different rhythm, which is why some people are “morning people” and others are “night owls”.
    - When we are forced to operate outside of our natural clock, our prefrontal cortex does not work as efficiently; it is not able to produce high level thought and logical reasoning.
  - The nucleus communicates this cycle of night and day to our body through **melatonin**, a chemical released from the brain into the bloodstream at night that signals to the body that it is night time. An important distinction to make is that melatonin does *not* generate sleep.
    - Jet Lag is when someone switches time zones so quickly that the nucleus has not yet adjusted its circadian clock, though it eventually takes signals from the sun and other factors.
2. **Adenosine**, a chemical substance that builds up in your brain throughout the day, makes you feel sleepier the longer you’ve been awake. The more of the substance that has built up, the sleepier you feel.
  - This can be mitigated by **caffeine**, which blocks the receptors in the brain that receive adenosine.

- Caffeine crashes come from the adenosine that has been built up, and subsequently blocked, being felt all at once, when the caffeine has worn off.

You will know you are not getting enough sleep if you need caffeine to function before noon and if you wake up and want to fall back asleep before 11AM.

## Chapter 3

Scientists use three things to measure the quality of sleep:

1. Brainwave Activity
  2. Eye Movement Activity
  3. Muscle Activity
- These measurements allow doctors to construct a **polysomnography**, or a graph that shows an individual's sleep cycle based on this movement.
  - There are two kinds of sleep: REM and NREM. NREM is broken up into four quadrants, one through four, with four being the deepest stage of sleep within NREM.
  - One sleep cycle lasts roughly 90 minutes and follows a pattern of wakefulness, NREM (quadrants one through four), and REM, and then repeats.
  - When you fall asleep, your brain cells unite and follow one clear, slow, brainwave.

There are three phases of information processing:

1. Wake: reception of information
2. NREM: reflection and processing of new information
3. REM: integration of new information with previously known information

## Chapter 4

Biphasic sleep (meaning not all at once) is very important. We are, in fact, biologically inclined to take an afternoon nap of about 30-60 minutes. In addition, napping has many health benefits. Mortality risk of working men who did not take naps increased by over 60% over a six year period compared to working men who took naps.

## **Chapter 5**

Chapter 5 discusses different types of sleep, including REM, NREM, and naps. Between 20-25% of sleep is dedicated to REM (Healthy Sleep). Deep NREM sleep is essential for memory. The book also says that twenty minute naps are extremely helpful in restoring the brain's reserves in improving memory.

## **Chapter 6**

Sleep helps perfect acquired skills of your waking life. It essentially hits "save" so that what you have learned during waking hours is processed effectively. Sleep is also essential for recovery and performance.

## **Chapter 7**

A person's concentration can be affected by even the smallest amount of sleep deprivation. Only sleeping 6 hours a night for a span of 10 nights can impair a person as much as not sleeping for 24 hours straight. "You do not know how sleep-deprived you are when you are sleep-deprived." A person is not capable of "catching up on sleep" on the weekends after sleeping poorly during the week. It is just impossible for the body to do. Being awake for 19 hours (and having no alcohol) will affect your body the same as if you were actually drunk. Nothing can actually replace sleep, not naps, caffeine, or willpower. It is scientifically proven that sleep deprivation affects a person's mood, irritability, aggression, and power to control their emotions.

## **Chapter 8**

Sleep is the foundation for good health and is more important than good health, diet, and exercise. All major diseases - obesity, cancer, heart disease - can all be linked to poor sleep in a person's life as a factor of developing these diseases. Not having healthy sleep habits is directly linked to bad heart health. The less a person sleeps, the more likely they are to eat. Not sleeping affects how the body processes food and sugars, in a negative manner. Sleep deprivation has been linked to Type 2 Diabetes, weight gain, and obesity. There is a direct link between sleep and a person's immune system. The less a person sleeps, the more likely they are to fall sick to something as simple as a cold. Sleep deprivation also affects how long it takes a person's immune system to fight off a sickness.

## **Chapter 9**

Most dreams people can remember, the super odd or life like ones, happen during REM sleep. Scientist still really do not know where dreams come from. People can have

haunches about what dreams mean but there is no scientific way to prove or translate what a person's dream actually means. No study has been able to prove that dreams have any function for people.

## Chapter 10

- REM sleep is essentially “overnight therapy.” The REM-sleep dreaming accomplishes two goals:
  1. “Sleeping to remember the details of those valuable, salient experiences, integrating them with existing knowledge and putting them into autobiographical perspective” and
  2. “Sleeping to forget, or dissolve, the visceral, painful emotional change that had previously been wrapped around those memories.”
- “Sleep, and specifically REM sleep, was clearly needed in order for us to heal emotional wounds.”

## Chapter 11

This chapter discusses dreams and what they represent.

## Chapter 12

- This chapter discusses fatal sleep disorders, sleep deprivation, and how much sleep people actually need.
- “After eight straight weeks of no sleep, Corke’s mental facilities were quickly fading. The cognitive decline was matched in speed by the rapid deterioration of his body.” “As Corke approached the six-month mark of no sleep, he was bedridden and approaching death. Despite his young age, Corke’s neurological condition resembled that of an elderly individual in the end states of dementia.”
- On Sleep Deprivation vs. Food Deprivation: “FFI is still the strongest evidence that we have that a lack of sleep will kill a human being.”
- “The problem is that some people confuse time slept with sleep opportunity time.”
- Is Sleeping Nine Hours Too Much?
  - o “Epidemiological evidence suggests that the relationship between sleep and mortality risk is not linear, such that the more and more sleep you get, the lower and lower your death risk (and vice versa). Rather, there is an upward hook in death risk once the average sleep amount passes nine hours, resulting in a tilted backwards J shape.”

## Chapter 13

- Artificial evening and nighttime light can masquerade as sleep-onset insomnia. This is the inability to begin sleeping soon after getting into bed.
  - o Artificial evening light makes it considerably less likely that you'll be able to fall asleep at a reasonable time because it is delaying the release of melatonin. In fact, even a hint of dim light has been shown to delay the release of nighttime melatonin in humans.
- A recent survey shows that 90% of individuals (of over 1,500 American adults) regularly used some form of portable electronic device sixty minutes or less before bedtime.
- Using LED devices at night impacts our natural sleep rhythms, the quality of our sleep, and how alert we feel during the following day.
- Alcohol sedates you out of wakefulness, but it does not induce natural sleep.
  - o It is like a light form of anesthesia.
- Alcohol also fragments sleep, causing brief awakenings throughout the night.
  - o People generally do not notice waking up, because the alcohol makes it difficult to remember.
- Alcohol is the one of the most powerful suppressors of REM sleep.
- Alcohol causes the body to produce byproduct chemicals called aldehydes and ketones.
  - o Aldehydes block the brain's ability to generate REM sleep
- Delirium tremens is a psychotic state that is a result of pent-up REM-sleep pressure that erupts forcefully into waking consciousness, causing hallucinations, delusions and gross disorientation.

## Chapter 14

- In younger, healthier adults, exercise tends to increase total sleep time, especially deep NREM sleep. It also deepens the quality of sleep, resulting in more powerful electrical brainwave activity.
- The relationship between sleep and exercise has been known to vary from one night to the next.
  - o Sleep has more of an influence on exercise than exercise has on sleep. For example, if you get a good night's sleep, you will have more energy to power through a workout the following day.

- Exercising right before going to bed causes difficulty for the body as it begins dropping its temperature to initiate sleep.
  - o Ideally, you should exercise 2-3 hours before going to sleep to prevent this.

## Chapter 15

Chapter 15 emphasizes how in the present day, all over the globe, people are not getting enough sleep. As a whole, 1 out of every 2 adults in developed countries do not get the necessary amount of sleep during the week. The author explains that our society and our culture seem to encourage little sleep in favor of more work. It discusses how getting little sleep is valued in the workplace, although research and multiple studies prove that lack of sleep decreases productivity and motivation, makes people more irritable and difficult to deal with, and ultimately loses companies money. Just because employees are getting less sleep to work more does not mean that the work they are doing is quality - more than likely, their productivity and the quality of their work is suffering as a result.

The author also talks about the detrimental effects on children that are the result of early school start times, which force teenagers to wake up as early as 5:15 in the morning. He emphasizes that this is comparable to an adult being forced to wake up around 3:30 in the morning, because teenagers' biologically determined circadian rhythms are set to have them sleep through the morning when deep REM sleep is most common. It even discusses research that proves that later school start times in high schools decreases the number of traffic accidents in students aged 16-18.

## Chapter 16

The following is a diagram created by Matthew Walker that "ascends through numerous levels of intervention opportunities" for sleep. We can start at the individual level and hopefully end by intervening on a societal level and improving sleep habits for everyone.

### Levels of Sleep Intervention

Individual → educational/interpersonal → organizational → public policy/government → societal

In the coming years, we will be able to use accurate and advanced sleep technology trackers to improve our sleep habits and environment. We could "intelligently curate a tailored thermal sleep environment that is personalized to the circadian rhythms of each individual occupant of each bedroom." The author also suggests using technology that can

manipulate the lighting in our sleeping environments. It could potentially regulate light to infuse a room with evening lighting that increases melatonin production and prepares us for sleep. In the morning, it could flood the room with powerful blue light that stops melatonin production and wakes us up.

With regards to education, the author points out that many schools world-wide implement some “form of dietary, exercise, and health-related schooling.” He suggests that we should do the same and implement educational programs in schools about the importance of sleep.

With regards to sleep in the workplace, the author suggests incentivizing sleep. If an employee can prove that he or she has gotten a certain amount of sleep, they could receive a bonus or additional vacation time. He also proposes flexible work schedules so that employees can choose to get work done when they feel most awake and alert.