Walker states that sleep is universal in animals (even in insects and worms). These deep biological roots suggest that sleep is a vital function and that it isn't simply a vestigial byproduct of evolution.

(Shortform note: At least one study disputes the claim that sleep is a vital function, showing that a certain type of fly is “virtually sleepless.” The findings of the study thus present a different perspective when it comes to the biological role of sleep.)

**Part 1: How Sleep Works**

Walker begins by discussing the mechanisms regulating sleep as well as the human sleep cycle.

**Sleep Rhythm**

He explains that there are two mechanisms that regulate sleep: the circadian rhythm and adenosine.

1. **Circadian rhythm**—regulated by melatonin (produced by the suprachiasmatic nucleus in the brain), it's the natural “wake drive,” which responds to light and darkness and thus makes you stay awake during the day and wanes at night.

(Shortform note: In the first edition, Walker had written that "every living creature on the planet with a life span of more than several days" has a circadian rhythm. In his blog, researcher Alexey Guzey says that this is false—brewer's yeast, which lives for more than 20 days, does not go through this cycle. Walker addresses this point in the second edition by changing the phrasing to "most living creatures on the planet" (emphasis ours). He also clarifies in his blog that there are exceptions to the seemingly universal phenomenon, mentioning mammals that don't seem to have a circadian rhythm.)

2. **Adenosine**—a chemical that causes “sleep pressure,” or the increased desire to sleep. It rises consistently throughout the day without sleep. Sleep naturally happens when your adenosine is at its highest and your circadian “wake drive” is at its lowest. In the morning, your wake drive starts up again and your adenosine has been depleted by sleep—you feel awake because you’ve reduced the adenosine-circadian gap.

Walker says that this explains an odd phenomenon: Pulling an all-nighter and getting a second wind in the morning. Your adenosine keeps rising, so when your wake cycle dips at 3AM the gap is larger and you feel tired. But at 8AM, your wake cycle restarts and closes the gap and you feel more awake.

(Shortform note: It's best to avoid pulling an all-nighter, but if you must, you can minimize the disruption to your sleep routine by keeping yourself awake until your next bedtime. Stay hydrated, and resist the urge to take a long nap—stay active, chew gum, or smell rosemary, peppermint, or coffee to help keep you up.)

**What Happens When You Disrupt Your Rhythm**

Too much sleep disruption can lead to a sleep deficit, or the difference between the amount of sleep you need and the amount of sleep you get. This comes with unpleasant symptoms such as drowsiness even after sleeping and a lack of concentration.

(Shortform note: Keeping a sleep diary can give you a clearer picture of your sleep habits, making it easier to determine any problems. Fill in your bedtime, wake-up time, length of time it takes to fall asleep, number of times you wake up and for how long, and caffeine and alcohol consumption for at least one week, then review the data to determine underlying causes of sleep disruption.)

**The Human Sleep Cycle**

Your brain switches between two types of sleep: rapid eye movement (REM) and non-REM (NREM) sleep. Walker explains that each type has different functions:

- **NREM**, characterized by slow electrical activity in the brain, clears out old memories and mental “trash,” and moves information into long-term storage.
- **REM** is characterized by faster, frenetic brain waves. It strengthens the valuable information that remains, and it forges creative novel connections between them. During REM sleep, your sense of time is dilated, you consciously perceive your senses, and you experience muscle atonia (your voluntary muscles are completely limp) to prevent you from acting out your dreams.

(Shortform note: Walker indicates five stages of sleep—one stage of REM and four stages of NREM—but other sources such as the American Academy of Sleep Medicine, the Sleep Foundation, and the National Institute of Neurological Disorders and Stroke say there are four stages: NREM 1, the point of crossing over from wakefulness to sleep; NREM 2, when your heart rate slows...
and eye movements stop; NREM 3, deep sleep; and REM, the dream state.)

How Sleep Changes From Childhood to Adulthood

- **Babies**—during the last two weeks of pregnancy, fetuses get up to 12 hours of REM sleep a day, which helps build neural pathways throughout the brain. Alcohol impedes REM sleep in fetuses and babies, thus disrupting the construction of neural connections. Walker suggests this is connected to autism. (Shortform note: A 2020 study found that sleep difficulties in infants who were later diagnosed with autism may be linked to a change in the size of the hippocampus, a key part of the brain related to learning and memory. So far, studies have only found a correlational, not causal, relationship between sleep difficulties and autism.)

- **Childhood**—NREM plays a larger role in brain refinement, pruning the associations that are most valuable and unique to that child’s...

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Here’s a preview of the rest of Shortform’s Why We Sleep summary:guide:

**Why We Sleep Summary**

**Why We Sleep Guide**

**Shortform Introduction**

You’re probably getting less sleep than you should be. Many people are more chronically sleep-deprived than they realize, and the punishments for this are severe—reduced productivity and happiness, and increased risk of a panel of diseases. *Why We Sleep: Unlocking the Power of Sleep and Dreams* discusses the mechanisms of sleep, its importance and major benefits, and the best ways to get better sleep.

**About the Author**

Matthew Walker, Ph.D.—self-branded “Sleep Diplomat”—is the director of the Center for Human Sleep Science, which investigates the role of sleep in human health. He’s also a professor of neuroscience and psychology at the University of California, Berkeley and was previously a professor of psychiatry at Harvard Medical School.

He has published over 100 scientific studies, mostly on sleep science, and has appeared on numerous television programs, including 60 Minutes, BBC News, and CBS This Morning.

Beyond TV programs and podcasts, Walker spreads the gospel of sleep through events, forums, and workshops—his [2019 TED...](#)

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**Why We Sleep Summary Why We Sleep Guide Part 1: How Sleep Works | Chapter 2: Your Daily Sleep Rhythm**

(We've omitted chapter 1, which is an introduction that serves as an overview of topics explored in later chapters.)

Walker states that sleep is universal in animals, even in insects and worms, despite its apparent drawbacks (vulnerability to predators, loss of time for productivity). When a biological feature is preserved deep in evolutionary history, it is usually a critical function. He argues that this must mean sleep is a critical function, and it's crucial to understand why it's important.

(Shortform note: At least one study disputes the claim that sleep is a vital function, showing that a certain type of fly is “virtually sleepless.” The findings of the study thus present a different perspective when it comes to the biological role of sleep.)
How Sleep Rhythm Works

Walker says that sleep is regulated by two mechanisms: the circadian rhythm and adenosine.

Circadian Rhythm

The first mechanism, the circadian rhythm, is regulated by melatonin (produced by the suprachiasmatic nucleus in the brain). He describes this as a natural "wake drive," making you stay awake during the day and waning...

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Why We Sleep Summary Why We Sleep Guide Chapters 3-5: The Human Sleep Cycle

Now you understand how your sleep rhythm gives a regular schedule of sleep from night to night. Next, we'll look into how, within a single night, your brain cycles between different phases of sleep. This is important to understanding the function of sleep for your brain.

In summary, your brain switches between two types of sleep—REM (rapid eye movement) and non-REM (NREM) sleep. The two types of sleep have different functions:

- NREM clears out old memories and mental “trash,” and moves information into long-term storage.
- REM strengthens the valuable information that remains, and it forges creative novel connections between them.

When you sleep, your brain goes through sleep cycles that each last about 90 minutes. Each sleep cycle generally begins with NREM sleep, then ends with REM sleep. As one cycle ends, the next begins. In total for a single night, there's about an 80/20 split between NREM/REM sleep. You can see this in a sleep graph here:
Stage 1 (Lightest Sleep)

Stage 2

Stage 3

Stage 4 (Deepest Sleep)

NREM
Walker says that getting good sleep improves your brain in three ways:

1) Sleep Improves Long-term Factual Recall

Your brain stores different memories in different places. The hippocampus stores short-term memory with a limited capacity; the cortex stores long-term memory in a large storage bank.

The slow-wave, pulsating NREM sleep moves facts from the hippocampus to the cortex. This has two positive effects: 1) It secures memories for the long term, and 2) it clears out short-term memory to make room for new information, improving future learning.

Have you ever woken up recalling facts that you couldn't recall before sleeping? Walker says this happens because sleep may make corrupted memories accessible again.

(Shortform note: Sleeping for too long may have an interesting effect on memory, as in the case of a man from North London who was in a coma for three weeks. He woke up with memories of things that didn't really happen—going on an interview with MI6, owning a private plane, and expecting twins with his girlfriend. One possible theory is that...)

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**Why We Sleep Summary Why We Sleep Guide Chapter 7: How Sleep Deprivation Harms the Brain**

While getting great sleep is good for the brain, sleep deprivation is unambiguously harmful for the brain. Walker discusses three...
ways sleep deprivation is damaging: it worsens attention, worsens emotion control, and contributes to Alzheimer's Disease.

Sleep Deprivation Worsens Attention and Concentration

Walker notes that sleep deficits—the difference between the amount of sleep you need and the amount you actually get—are very bad for attention and concentration. They add up over time, and performance progressively worsens with greater sleep deficit. Having 10 six-hour nights of sleep is equal in damage to one all-nighter, as is six four-hour nights of sleep.

(Shortform note: Research suggests that it takes four days to make up for one hour of sleep debt, and sleeping in on the weekend doesn't make up for it, especially if it's a chronic problem. Try adding an hour or two a night until you get back on track, then stick to a consistent sleep schedule.)

Think you can get by on six hours of sleep? Chances are, you can't. **Walker...

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Why We Sleep Summary Why We Sleep Guide Chapter 8: How Sleep Deprivation Harms the Body

In addition to the damage it causes to the brain, sleep deprivation disrupts the normal function of many physiological processes, likely contributing to chronic diseases. In this chapter Walker covers nine health issues associated with sleep deprivation.

At a high level, sleep deprivation of even just one to two hours triggers the sympathetic nervous system (fight or flight response) and disrupts hormonal balances. He says that this also implies that sleep is necessary for the normal maintenance of physiology.

(Shortform note: Guzey includes a graph from this chapter that illustrates how average sleep time has decreased by more than two hours between the 1940s and 2000s. However, he has been unable to find the source of the data. He argues that evidence shows no reduction, or even suggests an increase, in sleeping time over this time period.)

A Note on the Studies in Why We Sleep

Many of the population studies cited in Why We Sleep are correlational—for example, their results show that people...

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Why We Sleep Summary Why We Sleep Guide Part 3: The Science of Dreams | Chapters 9-11: The Benefits of Dreaming

Dreaming is a bizarre experience. You're unconscious, but you perceive intense vivid sensations and hallucinate things that aren't there. You feel like you're moving in the world, but your muscles are in a state of paralysis. You remember faces and memories that you haven't thought about for years, maybe decades. You have no control over your emotions, swinging from intense rage and jealousy to exuberance. Finally, when you wake up, you promptly forget everything. If you experienced all of this while awake, you'd think you were having a psychosis episode.

It's not surprising then that dreaming has had a complicated history. Walker explains that in the ancient past, Egyptians and Greeks wondered if dreams were divine gifts from gods.

Freud helped dispel this myth, firmly centering dreaming within the human brain. He considered dreams as expressions of repressed desires, and he built a psychological movement around interpreting dreams as such.

◆ The critical flaw in Freudian analysis was its unprovability—the interpretation methods were so subjective that different approaches yielded different results, and there was no strict hypothesis that was testable.

◆ ...
Somnambulism (Sleepwalking)
Sleepwalking is the act of walking and performing other behaviors while asleep. Automatic, nonconscious routines are executed, like brushing teeth or opening the refrigerator.

Sleepwalking happens during NREM sleep, and not REM dreaming sleep (as some think). Neurologically, sleepwalking is accompanied by an unexpected spike in nervous system activity, causing the person to be stuck somewhere between sleep and wakefulness.

(Shortform note: A 2021 study suggests that men who sleepwalk may have a higher risk of developing Parkinson's disease. The two share a common neural pathway and both involve involuntary movements, confusion, and amnesia.)

Sleepwalking is more common in children than adults, for unknown reasons—possibly because kids...
to sleep. If you ever drink coffee and then feel a crash later, this comes from the caffeine wearing off and leaving you with the adenosine that’s been increasing all day. Walker provides some information to help you make smarter choices about your caffeine consumption:

- Caffeine has a half-life of five to seven hours, which means it takes 10 to 14 hours to flush out of your system completely. Walker notes that some people metabolize caffeine more quickly than others—it depends on your genetics and the amount of cytochrome P450 enzyme in your liver. (Shortform note: Unfortunately, there is no instant way to instantly flush out caffeine from your body, but you may be able to make your body more efficient at reducing...

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Why We Sleep Summary Why We Sleep Guide Chapter 14: How to Get Better Sleep

Now that you know how sleep works and are more aware of the main sleep disruptors, you can implement practices to help you improve your sleep. Walker suggests the following actions:

- Keep the same waking and sleeping time each day. Erratic sleep schedules disrupt sleep quality.
- Practice sleep hygiene—lower bedroom temperature, reduce noise, reduce light.
- No alcohol, caffeine, exercise, or long naps before sleep.
- Get some exercise, which may increase total sleep time and increase quality of sleep. Exercising has more of a chronic effect, meaning it helps in the long run and doesn’t take effect on a day-to-day scale—exercise on one day doesn’t necessarily lead to better sleep that night. But worse sleep on one night does lead to worse exercise the following day.
- Eat a normal diet (not severe caloric restriction of below 800 calories per day). Avoid very high carb diets (>70% of calories) since this decreases NREM and increases awakenings.

(Shortform note: In Atomic Habits, James Clear writes that your environment shapes your behavior. You can thus...

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Why We Sleep Summary Why We Sleep Guide Chapter 15: Society Causes Sleep Deprivation

Sleep deprivation goes far beyond our individual sleep practices. Walker argues that our society has structurally locked in sleep deprivation in two ways.

1) Work Schedules Disrupt Sleep

The ethos at many companies sees sleep as an indulgence for the weak. They lionize the road warrior who fearlessly crosses time zones on tiny amounts of sleep and answers emails at 1AM. In their minds, more hours worked equals more productivity.

This is short-sighted. The effects of sleep deprivation are costly to employers:

- Lost productivity per sleep-deprived worker is in the thousands of dollars a year. Walker argues that insufficient sleep costs 2% of GDP. In a natural experiment studying workers on opposite edges of a time zone, workers who obtained an hour of extra sleep earned 5% higher wages.
- Sleep-deprived workers show bad traits like reduced work performance, creativity, motivation, and social cohesion, as well as increased risk-taking, impulsiveness, and desire to cheat.
- Leaders who sleep worse are rated worse by their team and cause less engagement in their workers. This is visible day-by-day—poor sleep one night is immediately seen as worse performance the...

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Why We Sleep Summary Why We Sleep Guide Chapter 16: Improving Sleep in Society

We've seen chronic sleep deprivation caused by a variety of factors, from the individual scaling up to the societal. Walker finishes with ways to improve sleep quality systemically:

**Individual**

- Automated “internet of things” household that can automatically sense your circadian rhythm and personalize the temperature and lighting to maximize sleep. Furthermore, if you have an upcoming disruption to your sleep schedule (like a flight), it can adjust your circadian rhythm to smoothen the transition. (Shortform note: There are many gadgets in the market that claim to address various sleep issues from snoring to temperature, like a cooling pillow pad that helps those who suffer from night sweats and hot flashes.)
- Sophisticated body trackers that record a host of factors—sleep, physical activity, light exposure, temperature, heart rate, mood, happiness, social performance, productivity—and shows how your sleep correlates with better performance on all dimensions. (Shortform note: Tools like this are now within your reach. Smartwatches can track sleep, activity, heart rate, water...)

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**Shortform Exercise: Sleep Better Tonight**

Think about how you can apply the book's insights to get the best sleep possible.

What did you learn about sleep that surprised you? Why was it surprising?

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