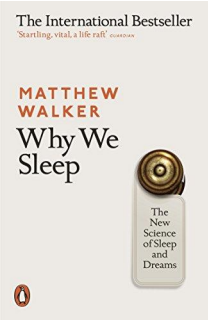

YOUR KINDLE NOTES FOR:

Why We Sleep: The New Science of Sleep and Dreams (English Edition)

by Matthew Walker

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59 Highlights

Highlight (Yellow) | Location 253

> It is no coincidence that the likelihood of breaking an Olympic record has been clearly tied to time of day, being maximal at the natural peak of the human circadian rhythm in the

Highlight (Yellow) | Location 287

> The tall bed legs were each seated in a bucket of water, castle-moat style, to discourage the innumerable small (and not so small) creatures lurking in the depths of Mammoth Cave from joining them in bed.

Highlight (Yellow) | Location 364

> 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.

Highlight (Yellow) | Location 379

> As a social species, should we not all be synchronized and therefore awake at the same time to promote maximal human interactions? Perhaps not. As we'll discover later in this book, humans likely evolved to co-sleep as families or even whole tribes, not alone or as couples. Appreciating this evolutionary context, the benefits of such genetically programmed variation in sleep/wake timing preferences can be understood. The night owls in the group would not be going to sleep until one or two a.m., and not waking until nine or ten a.m. The morning larks, on the other hand, would have retired for the night at nine p.m. and woken at five a.m. Consequently, the group as a whole is only collectively vulnerable (i.e., every person asleep) for just four rather than eight hours, despite everyone still getting the chance for eight hours of sleep. That's potentially a 50 percent increase in survival fitness. Mother Nature would never pass on a biological trait—here, the useful variability in when individuals within a collective tribe go to sleep and wake up—that could enhance the survival safety and thus fitness of a species by this amount. And so she hasn't. MELATONIN

Highlight (Yellow) | Location 433

> For every day you are in a different time zone, your suprachiasmatic nucleus can only readjust by about one hour.

Highlight (Yellow) | Location 501

> Aging also alters the speed of caffeine clearance: the older we are, the longer it takes our brain and body to remove caffeine, and thus the more sensitive we become in later life to caffeine's sleep-disrupting influence.

Highlight (Yellow) | Location 514

> To impress upon you the effects of caffeine, I footnote esoteric research conducted in the 1980s by NASA. Their scientists exposed spiders to different drugs and then observed the webs that they constructed.fn10 Those drugs included LSD, speed (amphetamine), marijuana, and caffeine. The results, which speak for themselves, can be observed in figure 3. The researchers noted how strikingly incapable the spiders were in constructing anything resembling a normal or logical web that would be of any functional use when given caffeine, even relative to other potent drugs tested.

Highlight (Yellow) | Location 607

> Other questions that can draw out signs of insufficient sleep are: If you didn't set an alarm clock, would you sleep past that time? (If so, you need more sleep than you are giving yourself.) Do you find yourself at your computer screen reading and then rereading (and perhaps rereading again) the same sentence? (This is often a sign of a fatigued, under-slept brain.) Do you sometimes forget what color the last few traffic lights were while driving? (Simple distraction is often the cause, but a lack of sleep is very much another culprit.)

Highlight (Yellow) | Location 870

> When it comes to information processing, think of the wake state principally as reception (experiencing and constantly learning the world around you), NREM sleep as reflection (storing and strengthening those raw ingredients of new facts and skills), and REM sleep as integration (interconnecting these raw ingredients with each other, with all past experiences, and, in doing so, building an ever more accurate model of how the world works, including innovative insights and problem-solving abilities).

Highlight (Yellow) | Location 879

> Gearing up for the leap into REM sleep, however, an impressive change occurs. Mere seconds before the dreaming phase begins, and for as long as that REM-sleep period lasts, you are completely paralyzed. There is no tone in the voluntary muscles of your body. None whatsoever. If I were to quietly come into the room and gently lift up your body without waking you, it would be completely limp, like a rag doll. Rest assured that your involuntary muscles—those that control automatic operations such as breathing—continue to operate and maintain life during sleep. But all other muscles become lax.

Highlight (Yellow) | Location 930

> Many of the explanations for why we sleep circle around a common, and perhaps erroneous, idea: sleep is the state we must enter in order to fix that which has been upset by wake. But what if we turned this argument on its head? What if sleep is so useful—so physiologically beneficial to every aspect of our being—that the real question is: Why did life ever bother to wake up? Considering

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Highlight (Yellow) | Location 1164

> As with countless Greek tragedies, the end result was heartbreaking, but here in the most serious, literal way. None of the individuals had a history of coronary heart disease or stroke at the start of the study, indicating the absence of cardiovascular ill health. However, those that abandoned regular siestas went on to suffer a 37 percent increased risk of death from heart disease across the six-year period, relative to those who maintained regular daytime naps. The effect was especially strong in workingmen, where the ensuing mortality risk of not napping increased by well over 60 percent. Apparent from this remarkable study is this fact: when we are cleaved from the innate practice of biphasic sleep, our lives are shortened.

Highlight (Yellow) | Location 1202

> Fire would deter large carnivores, while the smoke provided an ingenious form of nighttime fumigation, repelling small insects ever keen to bite into our epidermis.

Highlight (Yellow) | Location 1271

> Through speech or song, expecting parents will often thrill at their ability to elicit small kicks and movements from their in utero child. Though you should never tell them this, the baby is most likely fast asleep. Prior

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Highlight (Yellow) | Location 1274

> Any co-occurring arm flicks and leg bops that the mother feels from her baby are most likely to be the consequence of random bursts of brain activity that typify REM sleep.

Highlight (Yellow) | Location 1368

> Beyond alcohol abstinence during pregnancy, the time window of nursing also warrants mention. Almost half of all lactating women in Western countries consume alcohol in the months during breastfeeding. Alcohol is readily absorbed in a mother’s milk. Concentrations of alcohol in breast milk closely resemble those in a mother’s bloodstream: a 0.08 blood alcohol level in a mother will result in approximately a 0.08 alcohol level in breast milk.fn9 Recently we have discovered what alcohol in breast milk does to the sleep of an infant.

Highlight (Yellow) | Location 1591

> The problem in aging is that family members observe these daytime features in older relatives and jump to a diagnosis of dementia, overlooking the possibility that bad sleep is an equally likely cause. Not all old adults with sleep issues have dementia.

Highlight (Yellow) | Location 1629

> am not, however, suggesting that older adults stop exercising in the morning. Exercise can help solidify good sleep, especially in the elderly. Instead, I advise two modifications for seniors. First, wear sunglasses during morning exercise outdoors. This will reduce the influence of morning light being sent to your suprachiasmatic

> clock that would otherwise keep you on an early-to-rise schedule. Second, go back outside in the late afternoon for sunlight exposure, but this time do not wear sunglasses. Make sure

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Highlight (Yellow) | Location 1634

> Older adults may also wish to consult with their doctor about taking melatonin in the evening. Unlike young or middle-age adults, where melatonin has not proved efficacious for helping sleep beyond the circumstance of jet lag, prescription melatonin has been shown to help boost the otherwise blunted circadian and associated melatonin rhythm in the elderly, reducing the time taken to fall asleep and improving self-reported sleep quality and morning alertness.fn21

Highlight (Yellow) | Location 1672

> More generally, these and similar studies have confirmed that poor sleep is one of the most underappreciated factors contributing to cognitive and medical ill health in the elderly, including issues of diabetes, depression, chronic pain, stroke, cardiovascular disease, and Alzheimer's disease.

Highlight (Yellow) | Location 1864

> 2006, a research team in Germany recruited a group of healthy young adults for a pioneering study in which they applied electrode pads onto the head, front and back. Rather than recording the electrical brainwaves being emitted from the brain during sleep, the scientists did the opposite: inserted small amounts of electrical voltage. They patiently waited until each participant had entered into the deepest stages of NREM sleep and, at that point, switched on the brain stimulator, pulsing in rhythmic time

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Highlight (Yellow) | Location 1920

> I'm sure you can imagine innumerable uses for such a method. That said, you may also feel ethically uncomfortable about the prospect, considering that you would have the power to write and rewrite your own remembered life narrative or, more concerning, that of someone else. This moral dilemma is somewhat far in the future, but should such methods continue to be refined, it is one we may face.

Highlight (Yellow) | Location 2215

> Operating on less than five hours of sleep, your risk of a car crash increases threefold. Get behind the wheel of a car when having slept just four hours or less the night before and you are 11.5 times more likely to be involved in a car accident. Note how the relationship between decreasing hours of sleep and increasing mortality risk of an accident is not linear, but instead exponentially mushrooms. Each hour of sleep lost vastly amplifies that crash likelihood, rather than incrementally nudging it up.

Highlight (Yellow) | Location 2244

> You may find it surprising to learn that vehicle accidents caused by drowsy driving exceed those caused by alcohol and drugs combined. Drowsy driving alone is worse than driving drunk.

Highlight (Yellow) | Location 2291

> Would you feel at peak performance, ready to land a Boeing 747 with 467 passengers on board, should you have the skill to do so? It is during this end phase of flight, known in the aviation industry as “top of descent to landing,” that 68 percent of all hull losses—a euphemism for a catastrophic plane crash—occur. The researchers

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Highlight (Yellow) | Location 2313

> No matter what you may have heard or read in the popular media, there is no scientific evidence we have suggesting that a drug, a device, or any amount

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Highlight (Yellow) | Location 2392

> There is no major psychiatric condition in which sleep is normal. This is true of depression, anxiety, post-traumatic stress disorder (PTSD), schizophrenia, and bipolar disorder (once known as manic depression).

Highlight (Yellow) | Location 2399

> Had psychiatry got the causal direction wrong, and it was sleep disruption instigating mental illness, not the other way around? No, I believe that is equally inaccurate and reductionist to suggest. Instead, I firmly believe that sleep loss and mental illness is best described as a two-way street of interaction, with the flow of traffic being stronger in one direction or the other, depending on the disorder.

Highlight (Yellow) | Location 2541

> Alzheimer’s disease is associated with the buildup of a toxic form of protein called beta-amyloid, which aggregates in sticky clumps, or plaques, within the brain. Amyloid

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Highlight (Yellow) | Location 2605

> Parenthetically, and unscientifically, I have always found it curious that Margaret Thatcher and Ronald Reagan—two heads of state that were very vocal, if not proud, about sleeping only four to five hours a night—both went on to develop the ruthless disease.

Highlight (Yellow) | Location 2637

> Progressively shorter sleep was associated with a 45 percent increased risk of developing and/or dying from coronary heart disease within seven to twenty-five years from the start of the study. A similar relationship was observed in a Japanese study of over 4,000 male workers. Over a fourteen-year period, those sleeping six hours or less were 400 to 500 percent more likely to suffer one or more cardiac arrests than those sleeping more than six hours.

Highlight (Yellow) | Location 2706

> In the Northern Hemisphere, the switch to daylight savings time in March results in most people losing an hour of sleep opportunity. Should you tabulate millions of daily hospital records, as researchers have done, you discover that this seemingly trivial sleep reduction comes with a frightening spike in heart attacks the following day. Impressively, it works both ways. In the autumn within the Northern Hemisphere, when the clocks move back and we gain an hour of sleep opportunity time, rates of heart attacks plummet the day after. A similar rise-and-fall relationship can be seen with the number of traffic accidents, proving that the brain, by way of attention lapses and microsleeps, is just as sensitive as the heart to very small perturbations of sleep.

Highlight (Yellow) | Location 2973

> Stirred by the strength of accumulating evidence, Denmark recently became the first country to pay worker compensation to women who had developed breast cancer after years of night-shift work in government-sponsored jobs, such as nurses and air cabin crew. Other governments—Britain, for example—have so far resisted similar legal claims, refusing payout compensation despite the science.

Highlight (Yellow) | Location 3145

> The scientists were able to predict with significant accuracy the content of participants' dreams at any one moment in time using just the MRI scans, operating completely blind to the dream reports of the participants. Using the template data from the MRI images, they could tell if you were dreaming of a man or a woman, a dog or a bed, flowers or a knife. They were, in effect, mind reading, or should I say, dream reading. The scientists had turned the MRI machine into a very expensive version of the beautiful handmade dream-catchers that some Native American cultures will hang above their beds in the hopes of ensnaring the dream—and they had succeeded. The method is far from perfect. It cannot currently determine exactly what man, woman, or car the dreamer is seeing. For example, a recent dream of my own shamelessly featured a stunning 1960s vintage Aston Martin DB4, though you'd never be able to determine that degree of specificity from MRI scans, should I have been a participant in the experiment. You would simply know that I was dreaming of a car rather than, say, a computer or piece of furniture, but not which car it was. Nevertheless, it is a remarkable advance that will only improve to the point of scientists having the clear ability to decode and visualize dreams. We can now begin to learn more about the construction of dreams, and that knowledge may help disorders of the mind in which dreams are deeply problematic, such as trauma nightmares in PTSD patients.

Highlight (Yellow) | Location 3252

> If there is a red-thread narrative that runs from our waking lives into our dreaming lives, it is that of emotional concerns. Counter to Freudian assumptions, Stickgold had shown that there is no censor, no veil, no disguise. Dream sources are transparent—clear enough for anyone to identify and recognize without the need for an interpreter.

Highlight (Yellow) | Location 3269

> Dreams, like heat from a lightbulb, may serve no function. Dreams may simply be epiphenomena of no use or consequence. They are merely an unintended by-product of REM sleep.

Highlight (Yellow) | Location 3349

> Those who were dreaming, but not dreaming of the painful experience itself, could not get past the event, still being dragged down by a strong undercurrent of depression that remained. Cartwright had shown that it was not enough to have REM sleep, or even generic dreaming, when it comes to resolving our emotional past. Her patients required REM sleep with dreaming, but dreaming of a very specific kind: that which expressly involved dreaming about the emotional themes and sentiments of the waking trauma.

Highlight (Yellow) | Location 3632

> Little wonder, then, that you have never been told to “stay awake on a problem.” Instead, you are instructed to “sleep on it.” Interestingly, this phrase, or something close to it, exists in most languages (from the French dormir sur un problem, to the Swahili kulala juu ya tatizo),

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Highlight (Yellow) | Location 3960

> To do this, the sleep-wake switch in the hypothalamus releases a neurotransmitter called orexin. You can think of orexin as the chemical finger that flips the switch to the “on,” wakefulness, position. When orexin is released down onto your brain stem, the switch has been unambiguously flipped, powering up the wakefulness-generating

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Highlight (Yellow) | Location 4261

> Some committed individuals will even wear yellow-tinted glasses indoors in the afternoon and evening to help filter out the most harmful blue light that suppresses melatonin.

Highlight (Yellow) | Location 4323

> them down and sleep soundly a second night. Finally, Friday rolls around—now three nights after your learning session—and everyone is heading out for a party and drinks. Surely, after being so dedicated to slumber across the first two nights after learning, you can now cut loose, knowing those memories have been safely secured and fully processed within your memory banks. Sadly, not so. Even now, alcohol consumption will wash away much of that which you learned and can abstract by blocking your REM sleep. How long is it before those new memories are finally safe? We actually do not yet know, though we have studies under way that span many weeks.

Highlight (Yellow) | Location 4439

> The brilliant behavioral economist Dan Ariely has suggested an even more fiendish system wherein your alarm clock is connected, by Wi-Fi, to your bank account. For every second you remain asleep, the alarm clock will send $10 to a political organization … that you absolutely despise. That we have devised such creative—and even painful—ways of waking ourselves up in the morning says everything about how under-slept our modern brains are.

Highlight (Yellow) | Location 4488

> Summarizing the findings, the committee stated that sleeping pills only produced “slight improvements in subjective and polysomnographic sleep latency”—that is, the time it takes to fall asleep. The committee concluded the report by stating that the effect of current sleeping medications was “rather small and of questionable clinical importance.” Even the newest sleeping pill for insomnia,

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Highlight (Yellow) | Location 4499

> After a period of intense learning, researchers at the University of Pennsylvania gave animals a weight-appropriate dose of Ambien or a placebo and then examined the change in brain rewiring after sleep in both groups. As expected, natural sleep solidified memory connections within the brain in the placebo condition that had been formed during the initial learning phase. Ambien-induced sleep, however, not only failed to match these benefits (despite the animals sleeping just as long), but caused a 50 percent weakening (unwiring) of the brain-cell connections originally formed during learning. In doing so, Ambien-laced sleep became a memory eraser, rather than engraver.

Highlight (Yellow) | Location 4522

> Kripke and his colleagues set up a well-controlled comparison, examining more than 10,000 patients taking sleeping pills, the vast majority of whom were taking zolpidem (brand name Ambien), though some were taking temazepam (brand name Restoril). He contrasted them with 20,000 very well matched individuals of similar age, race, gender, and background, but who were not taking sleeping pills. In addition, Kripke was able to control for many other factors that could inadvertently contribute to mortality, such as body mass index, history of exercise, smoking, and drinking. He looked at the likelihood of disease and death across a two-and-a-half-year window, shown in Figure 15.fn5,fn6 Those taking sleeping pills were 4.6 times more likely to die over this short two-and-a-half-year period than those who were not using sleeping pills. Kripke further discovered that the risk of death scaled with the frequency of use. Those individuals classified as heavy users, defined as taking more than 132 pills per year, were 5.3 times more likely to die over the study period than matched control participants who were not using sleeping pills. Figure 15: Risk of Death from Sleeping Pills More alarming was the mortality risk for people who only dabbled in sleeping pill use.

Highlight (Yellow) | Location 4548

> Another cause of death linked to sleeping pill use is an increased risk for fatal car accidents. This is most likely caused by the non-restorative sleep such drugs induce and/or the groggy hangover that some suffer, both of which may leave individuals drowsy while driving the next day. Higher risk for falls at night was a further mortality factor, particularly in the elderly. Additional adverse associations in users of prescription sleeping pills included higher rates of heart disease and stroke. Then broke the story of cancer. Earlier studies had hinted at a relationship between the sleep medications and mortality risk from cancer, but were not as well controlled in terms of comparisons. Kripke’s study did a far better job in this regard, and included the newer, more relevant sleeping medication Ambien. Individuals taking sleeping pills were 30 to 40 percent more likely to develop cancer within the two-and-a-half-year period of the study than those who were not. The older sleeping medications, such as temazepam (Restoril), had a stronger association, with those on mild to moderate doses

> suffering more than a 60 percent increased cancer risk. Those taking the highest dose of zolpidem (Ambien) were still vulnerable, suffering almost a 30 percent greater likelihood of developing cancer across the two-and-a-half-year study duration. Interestingly,

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Highlight (Yellow) | Location 4569

> Consider that the original Star Wars movies—some of the highest-grossing films of all time—required more than forty years to amass $3 billion in revenue. It took Ambien just twenty-four months to amass $4 billion in sales profit, discounting the black market. That's a large number, and one I can only imagine influences Big Pharma decision-making at all levels.

Highlight (Yellow) | Location 4586

> Currently, the most effective of these is called cognitive behavioral therapy for insomnia, or CBT-I, and it is rapidly being embraced by the medical community as the first-line treatment. Working with a therapist for several weeks, patients are provided with a bespoke set of techniques intended to break bad sleep habits and address anxieties that have been inhibiting sleep. CBT-I builds on basic sleep hygiene principles that I describe in the appendix, supplemented with methods individualized for the patient, their problems, and their lifestyle. Some are obvious, others not so obvious, and still others are counterintuitive.

Highlight (Yellow) | Location 4608

> So powerful is the evidence favoring CBT-I over sleeping pills for improved sleep across all levels, and so limited or nonexistent are the safety risks associated with CBT-I (unlike sleeping pills), that in 2016, the American College of Physicians made a landmark recommendation. A committee of distinguished sleep doctors and scientists evaluated all aspects of the efficacy and safety of CBT-I relative to standard sleeping pills. Published in the prestigious journal Annals of Internal Medicine, the conclusion from this comprehensive evaluation of all existing data was this: CBT-I must be used as the first-line treatment for all individuals with chronic insomnia, not sleeping pills.fn8 You can find more resources on CBT-I, and a list of qualified therapists, from the National Sleep Foundation's website.fn9 If you have, or think you have, insomnia, please make use of these resources before turning to sleeping pills.

Highlight (Yellow) | Location 4659

> It is hard to make definitive recommendations for the average adult, especially because larger-scale epidemiological studies have not shown consistent associations between eating specific food groups and sleep quantity or quality. Nevertheless, for healthy sleep, the scientific evidence suggests that you should avoid going to bed too full or too hungry, and shy away from diets that are excessively biased toward carbohydrates (greater than 70 percent of all energy intake), especially sugar.

Highlight (Yellow) | Location 4665

> A hundred years ago, less than 2 percent of the population in the United States slept six hours or less a night. Now, almost 30 percent of American adults do.

Highlight (Yellow) | Location 4789

> A recent study from Cornell University surveyed hundreds of US workers and gave them a choice between either (1) $80,000 a year, working normal work hours, and getting the chance for around eight hours of sleep, or (2) $140,000 a year, working consistent overtime shifts, and only getting six hours of sleep each night. Unfortunately, the majority of individuals went with the second option of a higher salary and shorter sleep. That's ironic, considering that you can have both, as we have discovered above.

Highlight (Yellow) | Location 4955

> shifting from a 7:35 a.m. bell to a far more biologically reasonable one of 8:55 a.m. The result was astonishing—a 70 percent reduction in traffic accidents in sixteen- to eighteen-year-old drivers.

Highlight (Yellow) | Location 4998

> Based on recent surveys and clinical evaluations, we estimate that more than 50 percent of all children with an ADHD diagnosis actually have a sleep disorder, yet a small fraction know of their sleep condition and its ramifications.

Highlight (Yellow) | Location 5116

> An estimated 10 million to 40 million gallons of crude oil spilled across a 1,300-mile range of the surrounding shoreline. Left dead were more than 500,000 seabirds, 5,000 otters, 300 seals, over 200 bald eagles, and 20 orca whales. The coastal ecosystem has never recovered. Early reports suggested that the captain was inebriated while navigating the vessel. Later, however, it was revealed that the sober captain had turned over command to his third mate on deck, who had only slept six out of the previous forty-eight hours, causing him to make the cataclysmic navigational error.

Highlight (Yellow) | Location 5153

> The second passive solution concerns electric light. Many of us suffer from overexposure to nighttime light, particularly blue-dominant LED light from our digital devices. This evening digital light suppresses melatonin and delays our sleep timing. What if we can turn that problem into a solution? Soon,

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Highlight (Yellow) | Location 5231

> little. Men could see projections on how much their testicles will shrink or their testosterone level will drop should their sleep neglect continue. Similar risk predictions could be made for gains in body weight, diabetes, or immune impairment and infection.

Highlight (Yellow) | Location 5273

> As Aetna chairman and CEO Mark Bertolini described, "Being present in the workplace and making better decisions has a lot to do with our business fundamentals." He further noted, "You can't be prepared if you're

> half asleep.” If workers string together twenty seven-hour nights of sleep or more in a row, they receive a twenty-five-dollar-per-night bonus, for a (capped) total of five hundred dollars.

Highlight (Yellow) | Location 5403

> Set an alarm for bedtime.