

Book Reviews

Why We Sleep: it is high time we slept deeper in order to dream bigger.

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Review of: *Why We Sleep* (Scribner: New York, 2017)

Written by *Matthew Walker*

“Not explaining science seems to me perverse. When you’re in love, you want to tell the world”.

— Carl Sagan, 1995 (American cosmologist).

There are many aspects of Sagan’s quote that are in dialogue with Matthew Walker’s *Why We Sleep*. A British medical doctor turned sleep researcher, Walker is totally in love with the phenomenon of sleep, and he certainly wants to share it. So, let me ask: How many hours of sleep do you get every night on average? Do you actively prioritise sleep? Among many fascinating pieces of information in this book, the most striking make you question your own habits. Walker aims to inform us how crucial sleep is not only for our health but for multiple aspects of our lives. Walker wants us to realise that we are, at least collectively (and probably individually), sleep-deprived, and that this is increasing our chances of becoming ill, of having car accidents and being unproductive. Sleeping well is neither a priority for many of us nor the subject of public health efforts to the extent that it deserves.

Walker promises to tell us “the good, the bad and ugly of sleep”. Even if we learn some uncomfortable truths – both about our individual behaviour and about the societal factors contributing to the sleep epidemic declared by America’s Centers for Disease Control and Prevention (CDC) – Walker’s findings are an important wake-up call.¹ Any health topic can be subject to misinformation and sleep is no exception (Robbins *et al.* 2019). In this review, I aim to disseminate some of these findings and provoke the reader to reflect on their habits, while encouraging them to learn more by reading what I think is a very entertaining and well-written scientific text. In the words of Mark O’Connell (2017): “It might be too soon to say this book changed my life, but it was certainly an eye-opener”.

The Circle of Life: Sleep in a Nutshell

“Happiness consists in getting enough sleep. Just that, nothing more.”

— Robert A. Heinlein, 1998 (Starship Troopers).

¹ According to the CDC, 20% of the population suffer from chronic sleep problems.

“Mornings are for coffee and contemplation.”

— Jim Hopper, 2016 (Stranger Things Season 1, Episode 1).

Walker begins with the basics and proceeds to clearly explain the circular pattern of wakefulness and sleep. This rhythm, which has cycles slightly longer than one day, is internally generated in humans independently of light (although light contributes to reset the timer).² As Walker notes, the physiological significance of light was evidenced in 1938 by Kleitman and Richardson, who spent six weeks in a cave totally deprived of sunlight while recording their sleeping times and body temperature. We also learn that there is a fine interplay between our internal clock, sleep pressure and the signalling of darkness, as well as clearly defined cycles of two types of sleep: REM sleep and NREM sleep. The main concepts of sleep are as follows:

Circadian rhythm: *an internal body rhythm, approximately one day, which is generated deep in the brain by the suprachiasmatic nucleus (located above the crossing of the optic nerves). It regulates wakefulness/sleepiness and other bodily functions including eating, metabolism, hormone release and body core temperature.*

Melatonin: *a hormone released by the pineal gland after dusk as a signal of darkness.*

Adenosine: *a chemical that builds up during wakefulness and generates sleep pressure; it is cleared during sleep. Caffeine is a competitor of adenosine for binding to cell receptors.*

Jet lag: *tiredness caused by the mismatch between the day-night pattern and the internal circadian rhythm that occurs after travelling across time zones.*

REM sleep: *rapid eye movement sleep is a deep sleep characterised by synchronous slow waves during which we lose consciousness and is key for the consolidation of memories.*

NREM sleep: *non-rapid eye movement sleep, or paradoxical sleep, is the sleep period during which we dream, characterised by the absence of muscular tone. An 8-hour night sleep is made of 4-5 cycles of NREM + REM sleep phases.*

Having set these bases, we are ready to really understand, at the biological level, that familiar feeling of morning stupor which motivates us to consume caffeine as a result of sleep deprivation. As Walker argues: “the consumption of caffeine represents one of the longest and largest unsupervised drug studies ever conducted in the human race, perhaps rivalled only by alcohol” (27-28). The reason we are still sleepy in the morning is that we didn’t allow enough time for our liver to clear out the chemical adenosine, which signals the need to sleep to the brain. By consuming caffeine, we can temporarily block the effect of adenosine on our cellular receptors, although adenosine levels are still maintained. Therefore, once the caffeine has been metabolised, the sleep pressure we had accumulated will make us sleepy again. Unless, of course, we consume more caffeine... A recurring side effect of trying to conquer tiredness via copious amounts of caffeine is disturbed sleep the following night, since caffeine has a very long life in the body (8 hours – this means that if you had coffee at 4pm, by midnight half of that caffeine dose is still circulating). This

² It was already known in plants since the 1770s thanks to experiments performed by DeMairan.

way, what should be cycles of wakefulness/sleep, finely regulated by our bodies, becomes a vicious cycle of permanent tiredness.

“The Good”: Marvelling at Sleep

“I can just play” (Walker, 124).

Part II of the book, “Why should you sleep”, opens with the statement above, made to Walker by a professional pianist when reflecting on the experience of arising and being able to perform a difficult passage that he’d struggled with the previous evening. Reading this resonated with my own experience as a musician. The comment led Walker to perform several studies in which he showed that time specifically spent asleep helps us improve skill memories, particularly in difficult tasks, and involves phenomena other than short to long-term memory transfer. In that initial study, Walker designed a model exercise that was like playing the piano: he asked participants to learn a specific keyboard sequence and to type it quickly and accurately. He then tested participants after some time, during which one group slept and the other did not and measured their performance increases. He also found that it was precisely the duration of stage 2 (of 4) of NREM sleep which correlated to increases in performance accuracy, and that the effect was more prominent during the last two hours of an 8-hour long sleep. These last two hours are most frequently lost – an important point for anyone practicing motor skills!

This passage (123-128) exemplifies the virtues of Walker’s balance between dramatic effect and empirical rigour, which characterises his engaging scientific style. On one hand, he lures readers in by narrative accounts of scientific discoveries and their significance; for example, by the intriguing meeting between himself and the pianist mentioned above. On the other, he explains to us in a simple but detailed and accurate manner how a sleep research team performs the experiments that have led them to such discoveries. The richness of detail, and attention to key scientific papers (although as a scientist I would have preferred a more complete bibliography!), makes this book appealing to a specialised audience as well as a general one.

“The Bad and the Ugly”: The Dangers of Sleep Deprivation

“All work and no sleep makes Jack a bad doctor.”

“Never waste any time you can spend sleeping.”

— Frank H. Knight, 1998 (American economist).

Sadly, the book quickly moves past such awe-inspiring discoveries (of which many more are found in part III, “Why we dream”), onto less cheerful matters, in particular an exhaustive account of the numerous and far-reaching consequences of the current sleep epidemic: car crashes, cancer, diabetes, Alzheimer’s, teenager’s impaired learning and mental health, poor response to vaccines, medical errors, low productivity, etc.

As disturbing as I found all these revelations, a couple are worth expanding upon. The practice of twenty-four-hour shifts by doctors, still in place in many countries, was promoted by an American physician in the 1890s, whose ability to get by without sleep was directly linked to his cocaine addiction. Shockingly, “1 in 20 residents [in the US] will kill a patient due to a lack of sleep” (Walker, 319). The fact that teenagers’ circadian rhythms are delayed in comparison to adults has been known for decades. There is a causal relationship between sleep quality and academic performance which is ignored by school start times. According to Walker, teenagers are forced to rise at the equivalent of 4am for an adult, impairing their learning and posing risks to their mental health at a difficult stage of their lives. How are these practices justified in the light of all this evidence? Change is needed at many levels.

A Shared Responsibility

“Sleep is a necessity, not a luxury.”

— Dr. Safwan Badr, 2014 (President of the American Academy of Sleep Medicine).

Sleep is probably more fashionable in the scientific world than in daily life; 2017 saw the Nobel Prize bestowed upon Jeffrey C. Hall, Michael Rosbash and Michael W. Young “for their discoveries of molecular mechanisms controlling the circadian rhythm” (Nobel Media, 2019). Yet I suspect that, collectively, we have a fairly negative view of sleep, associating it with laziness. Modern society is characterised by a cult of busyness; Korean philosopher Byung-Chul_Han goes so far as to argue that “today, everyone is an *auto-exploiting labourer in his or her own enterprise*. People are now master and slave in one. Even class struggle has transformed into an *inner struggle against oneself*” (Han, 17). I wonder if looking after our health via (often questionable) diets and exercise is seen as somehow more virtuous than *just* a good night’s sleep. *Why We Sleep* encourages us to think about this apparently “dead” time as a universal remedy for many problems.

So, what should we do about our sleep? The guidelines are simple: have a regular schedule, giving yourself 8 or more hours of sleep opportunity, avoid sleep-disturbing substances and keep your bedroom cool and dark (i.e. free from phones and computers). On the substances-to-avoid list, we find caffeine (from the afternoon), alcohol and large meals (a few hours before bed) and nicotine. Walker also recommends avoiding late naps (after 3pm) and having some wind-down time, which if in the form of a hot bath would also help our body to cool down.

However, given the pressures of modern life, it is worth noting that placing excessive weight on individual behaviour might not be healthy. Darian Leader, author of *Why Can’t We Sleep?* (2018), writes in his 2019 review: “In a world of massive job insecurity, long commutes, economic precarity and the pressure to maintain a positive image, how well can we really be expected to sleep? [...] With the aspiration to become “well-slept individuals”, we see a wholesale redrafting of social problems as individual ones. [...] No one is measuring what it feels like to strive for a sleep that escapes us, or factors in the effects of the resulting sense of

failure"). I think Leader's criticism of Walker's message to us as individuals is slightly unwarranted since Walker does consider these societal factors. Walker states: "Five key factors have powerfully changed how much and how well we sleep: (1) constant electric light as well as LED light, (2) regularized temperature, (3) caffeine [...], (4) alcohol, and (5) a legacy of punching time cards" (265).

I do see some dangers in Walker's vision of technology-aided sleep improvement (325-331) which align with Leader's point of view. In that section Walker imagines a future smart house in which temperature and light levels/colours are fine-tuned to suit individual sleeping schedules (and inner rhythms), all of it monitored by our smartphones. This usage of technology intrigues me, especially when Walker discusses applying it to environments such as hospitals where, paradoxically, sleep conditions are poor. We can't currently *really* assess in a precise way how well we slept last night and with such technology, we could. Heeding Leader's caution against obsessive sleep monitoring, we might react adversely to a quantitative measure of how poor our sleep is. I believe there are currently many low-tech opportunities of intervention for individuals, although I agree with the immediate potential of some more advanced measures in health care spaces.

It is clear that coordinated efforts at many levels are required to face this challenge. One first step that Walker contributes with this book is that of public education: "failed by the lack of public education, most of us do not realize how remarkable a panacea sleep truly is" (107). The US is paving the way by means of their Sleep Awareness Campaign, but this still has a long way to go when compared with other campaigns such as the UK's 5-a-day nutrition campaign.

It probably won't surprise you to learn that the sleep epidemic has more far reaching consequences than immediate health problems, as evidenced by the RAND Corporation report which estimates that industrialised nations lose a few percent of gross domestic product due to sleep losses (Hafner *et al.* 2017). Nike and Google are examples of companies that are learning from the evidence and implementing more flexible work schedules to suit both morning larks and night owls, as well as introducing napping pods which provide a dark and sound-isolated environment.

Final Thoughts

"Sleep well, be well."

— Sleep Education mantra, 2019.

"To sleep, perchance to dream."

— William Shakespeare, 1609, *Hamlet*.

On the purely scientific side, psychologists/psychiatrists will be particularly interested in the section about "How and Why We Dream", since many links are being found between mental illness and sleep disruption patterns, which if explored can increase our understanding of these complex disorders and lead to new therapeutic strategies. Anybody involved in biomedical research should take note of Chapter 8: "Cancer, heart attacks, and a Shorter Life: Sleep Deprivation and the

Body” (164-189), as sleep quality should be treated as a confounding factor in clinical trials of diseases it can affect.

As a student myself, I am guilty of trading sleep for better chances of success; having read this book (especially Chapter 6: “Your mother and Shakespeare knew: The benefits of sleep for the brain”, 107-132) I now reflect upon those choices as poor, and it has already changed the way I prioritise sleep.

Fixing the economic consequences of the sleep epidemic (health care costs, productivity, etc.), may require large-scale action from governments and industry, but surely as individuals the evidence presented in *Why We Sleep* should provoke us to seriously reflect on our habits, strive towards better health, and demand structural societal rearrangements. We need to talk about sleep, and we *desperately* need to sleep.

I leave the reader with Walker’s closing remarks:

“I believe it is time for us to reclaim our right to a full night of sleep, without embarrassment or the damaging stigma of laziness. [...] Then we may remember what it feels like to be truly awake during the day, infused with the very deepest plenitude of being.” (340).

I would add that we may then be able to read such a book and purely wonder at the phenomenon of sleep, and not so much at our lack of it.

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How and Why We Dream. Chapter 9 Routinely Psychotic: REM-Sleep Dreaming. Chapter 10 Dreaming as Overnight Therapy. Chapter 11 Dream Creativity and Dream Control. As one sleep scientist has said, "If sleep does not serve an absolutely vital function, then it is the biggest mistake the evolutionary process has ever made." Yet sleep has persisted. Heroically so. Indeed, every species studied to date sleeps. This simple fact establishes that sleep evolved with "or very soon after" life itself on our planet. Moreover, the subsequent perseverance of sleep throughout evolution means there must be tremendous benefits that far outweigh all of the obvious hazards and detriments. Ultimately, asking "Why do we sleep?" was the wrong question. *Why We Sleep: The New Science of Sleep and Dreams* is a popular science book about sleep by the neuroscientist and sleep researcher, Matthew Walker. Walker is a professor of neuroscience and psychology and the director of the Center for Human Sleep Science at the University of California, Berkeley. Walker spent four years writing the book, in which he asserts that sleep deprivation is linked to numerous fatal diseases, including dementia. The book became an international bestseller, including a #1 *Why should you sleep? Sleeping before learning refreshes our ability to make new memories. Napping increases learning ability (with stable concentration) and you are better at memorising* both by about 20%. Sleep post-learning improves retained information by 20-40%. Sleep provides a nighttime theatre in which your brain tests out and builds connections between vast stores of information. It is not time per se which heals wounds, but instead time spent in dream sleep that provides emotional convalescence. Generic dreaming does not help in itself, it is dreaming of a specific kind: that which expressly involved dreaming about the emotional themes and sentiments of the waking trauma.

305 quotes from *Why We Sleep: Unlocking the Power of Sleep and Dreams*: "The best bridge between despair and hope is a good night's sleep." "Without sufficient sleep, amyloid plaques build up in the brain, especially in deep-sleep-generating regions, attacking and degrading them. The loss of deep NREM sleep caused by this assault therefore lessens the ability to remove amyloid from the brain at night, resulting in greater amyloid deposition. More amyloid, less deep sleep, less deep sleep, more amyloid, and so on and so forth." • Matthew Walker, *Why We Sleep: Unlocking the Power of Sleep and Dreams*. why do humans not sleep so long despite having a relative complex brain to body size? because of a longer REM sleep. longer REM sleep results in less time sleeping, more emotional intelligence and creativity. why do babies kick inside the womb? because of REM sleep activity and a lack of atonia. why is the circadian rhythm of adolescents forward shifted? in order to encourage development of independence. old people and sleep quality means old people don't need less sleep, they are just unable to generate as much sleep as young people, between 70 to 80% sleep efficiency. what big mistake do old people make? seeking treatment for their health rather than their sleep problems. fragmentation means waking up during night. what is a good sleep efficiency? >90%.