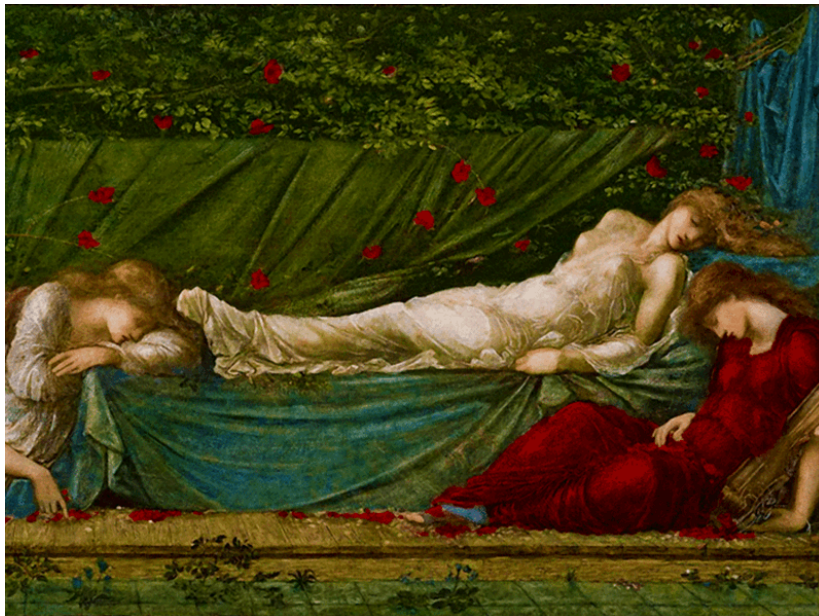


Scientists reveal the secrets to a restorative sleep

by Mark Broatch (/authors/mark-broatch/) / 19 January, 2019



The Rose Bower, from The Legend of Briar Rose series of paintings by Edward Burne-Jones. Photo/Alamy

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A third of New Zealanders don't get enough sleep and it's killing us. Mark Broatch asks sleep scientists what we can do to get a good night's slumber.

If someone promised you a revolutionary new treatment that made you live longer, boosted your memory and creativity, kept you slim and made you better looking, would you be interested? And wait, it also helps guard you from cancer and dementia, lowers your risk of heart attacks, stroke and diabetes, and keeps away colds and the flu. Sound good? You'll even feel happier, less depressed and less anxious. Of course you'd take it.

It's just sleep. Eight hours a night of solid, uninterrupted sleep.

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Chances are very good you know someone with sleep problems. Casual chats with your friends will reveal someone who has difficulty getting to sleep, another who wakes and meditates in the pre-dawn hours to lure back drowsiness, another who takes melatonin most nights, one who uses her awake time to read and another who regularly takes sleeping pills. Insomnia

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A study of 112 adults report level of rarely getting sleep. A 2012 study in the Journal estimated that about 13% of the adult population under 65 regularly suffered insomnia, though Māori were overrepresented at 19.1% (partly explained, it said, by greater

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socio-economic deprivation and more night work) to non-Maori's 8.9%, and the proportion of the population with serious and regular sleep problems is certainly far higher.

"You'd expect that that's gone up," says Massey University sleep researcher Professor Philippa Gander, one of the authors. The study put the cost of insomnia at about \$28m a year, though that's likely to be conservative given the effect on people's physical and mental health, work and family life.

Oh, and the funding available in the New Zealand health-care system for the treatment of insomnia? "Zero dollars," says Gander, director of the university's sleep/wake research centre.



Philippa Gander. Photo/David Wiltshire

Services for people with sleep disorders here are "woefully inadequate". Often, the only thing GPs have in their arsenal is sleeping pills. "Internationally, that's not the No 1 treatment. That's cognitive behaviour therapy (CBT)." In CBT, the patient works with a therapist over a number of weeks, building on basic principles such as reducing screen time, caffeine and alcohol, regular bedtime and wake-up, going to bed only when sleepy and not remaining in bed if awake – with methods individualised for the patient, their problems and lifestyle. Numerous clinical studies have proven CBT for insomnia (CBT-I) is superior to sleeping pills for onset, length and quality of sleep. Some sleep clinics provide CBT-I in New Zealand. In Australia, says Gander, GPs have the option of referring a patient with

insomnia to a registered psychologist for treatment under the Medicare mental health care programme. In the UK, the National Health Service covers CBT-I with or without a GP referral.

There are lots of causes of insomnia, Gander says, from external issues to problems with brain function, which need to be diagnosed carefully and take into account the non-sleeper's behaviours and beliefs. "We really have a huge problem with insomnia in New Zealand. A big part of this is a failure to recognise, at all levels of society, politically, medically, the importance of sleep," says Gander, who in past decades worked for Nasa in its fatigue countermeasures programme monitoring pilots.

"We need to drop this idea that to get more out of a busy life we can cut back on sleep. You can't just expect that a third of your life doesn't matter and expect that everything else will go fine. Sleep is an essential part of being fully human."

Counting our losses

Matthew Walker, a professor of neuroscience and psychology at University of California, Berkeley, and a sleep scientist at Google, lays out the full catastrophe based on the latest scientific studies, brain scans and epidemiological data. Routinely sleeping less than six or seven hours smashes our immune systems, more than doubling the risk of cancer, he says. It is a key lifestyle factor in determining whether we develop Alzheimers's disease.

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Matthew Walker. Photo/Getty Images

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Under-sleeping increases the likelihood of furred and brittle arteries, ferrying us towards heart attacks and strokes. Even moderate reductions of sleep for a week can disrupt blood-sugar levels so severely that a person can be classified as pre-diabetic. Sleep disruption contributes to all major psychiatric conditions including depression and anxiety, says Walker. It lowers testosterone levels and sperm counts in men; reduces follicular-releasing hormones in women, greatly impacting their fertility; messes with menstrual cycles and increases the risk of miscarriage. It makes it easier to gain weight and harder to lose it – swelling concentrations of a hormone that makes you feel hungry while suppressing another that makes you feel full.

Sleep loss makes us tired and groggy, anxious, and more prone to accidents. Gander cites an early 2000s study in this country, which found that injury accidents on Auckland roads could be reduced by an astonishing 19% if people avoided driving when they felt sleepy, if they'd had less than five hours' sleep in the previous 24 hours, or between 2am and 5am, when the physiological sleep drive peaks.

Gander is the lead author of a three-year study into managing fatigue and shift work in hospital-based nursing – a draft code was released for consultation in early December. It's connected to a long-term study tracking more than 70,000 nurses who do a minimum of three night shifts a month. Even at this frequency, over time they are more likely to develop breast, lung and colorectal cancers, type 2 diabetes, cardiovascular disease and to become obese. "The picture is not pretty, and the data in that particular longitudinal survey

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Those who have difficulty sleeping will know the symptoms, the endless remedies, from warm baths to bananas to shakti mats, from nightcaps to giving up booze and coffee, to demanding melatonin or sleeping pills from their doctor. They will know that Billy Crystal ("I sleep like a baby: I'm up every two hours"), Michael Jackson, Vladimir Nabokov and Kim Cattrall are among those who have suffered chronic insomnia – that is, an inability to initiate or maintain sleep and an impaired waking function lasting for at least a month. Cattrall, who has tried cognitive behaviour therapy, had to pull out of a play in London due to the "gorilla sitting on my chest".

Former British Prime Minister Margaret Thatcher said she needed only four hours' sleep but later developed dementia. Incumbent Theresa May has spoken of how any senior government role cuts into shut-eye. When asked what he wanted for Christmas after months of campaigning to be President of the United States, Barack Obama said without hesitation, "Eight hours' sleep". Donald Trump thinks sleep is for wimps.



Barack Obama craved eight hours' sleep. Photo/Getty Images

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How sleep works

Insomnia sufferers will not be surprised that the sleep-health industry, including pills, mattresses and now devices and apps, is worth an estimated US\$40 billion and growing. What they may not know is how science has deepened our understanding of exactly how sleep works, and why we desperately need the recommended seven to nine hours of sleep each night.

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Two main factors determine our sleep patterns. One is a "clock" in our brain called the suprachiasmatic nucleus which, aided by light from the sun, creates a roughly 24-hour cycle that makes us tired and alert at regular times of the day – our circadian rhythm. This clock, a group of about 20,000 neurons, regulates body temperature, our metabolic rate and the



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factor is what's called sleep pressure. It's caused by a chemical called adenosine that builds up in the brain during waking hours, making us sleepy after 12-16 hours of people being awake. We can "mute the signal" of adenosine using caffeine, which competes with it for receptors in the brain.

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Sleep degrades and removes the adenosine, so naps reduce sleep pressure and eight hours will clear it out. The two systems, the circadian wake drive and the sleep drive, actually work independently, though they are usually aligned. So if you work an all-nighter, you'll feel more awake at some hours than others.

So what happens when we sleep? Adults sleep in 90-minute cycles, beginning in what's called non-REM, or NREM, sleep. REM is rapid eye movement, the flickering back and forth under the eyelids that you can see when people are asleep, closely associated with dreaming and accompanied – we know now – by active brainwaves, similar to those we have when we are awake. But first, we enter non-REM sleep, when the eyes and brainwaves are calm. Non-REM sleep has four stages, and as the 90 minutes tick by, we descend into deeper slumber. In NREM stages three and four we enjoy long, slow-wave sleep. REM sleep comes next, and then the cycle begins again.

To restore the brain's capacity for learning, to retain new memories and make new connections, and to be fully refreshed, we need both non-REM and REM sleep. Memory refreshment, Berkeley's Matthew Walker found in one study, was closely related to lighter, stage-two NREM sleep, and what are called sleep spindles – short and powerful bursts of electrical activity in the brain. The more sleep spindles, the better the ability to learn was replenished, the study found.

The eight-hour sleep cycle is not symmetrical, however. REM sleep increases in proportion as we head towards morning, as deep NREM sleep decreases. This pattern appears to help the brain find the ideal balance between keeping what's old but useful and leaving sufficient room for the new.

NREM sleep helps transfer and consolidate newly learned information into long-term memory and weeds out unnecessary neural connections, says Walker, while dreaming REM sleep strengthens those connections. This consolidation and match-up with your existing back catalogue of memories also fuels creativity. Novel links and vast associative networks are created, giving you insights and overarching understanding. NREM sleep, particularly that in the late- morning cycle, which is packed with spindles, also helps cement motor skills, such as riding a bike or playing the piano.

Our emotional intelligence depends on getting our quota of REM sleep. It fine-tunes the emotional circuits of the brain, enabling us to negotiate the daily thicket of expressions, gestures and behaviour, guiding our decision-making and regulating our feelings. This means those early starts to get ahead at work or make it to the gym could be taking a serious toll. REM sleep, argues Walker, a bright-eyed and fit 40-something who gives himself a non-negotiable eight-hour "sleep opportunity" each night, made humans king of the beasts, by boosting our cognitive intelligence and sociocultural complexity.

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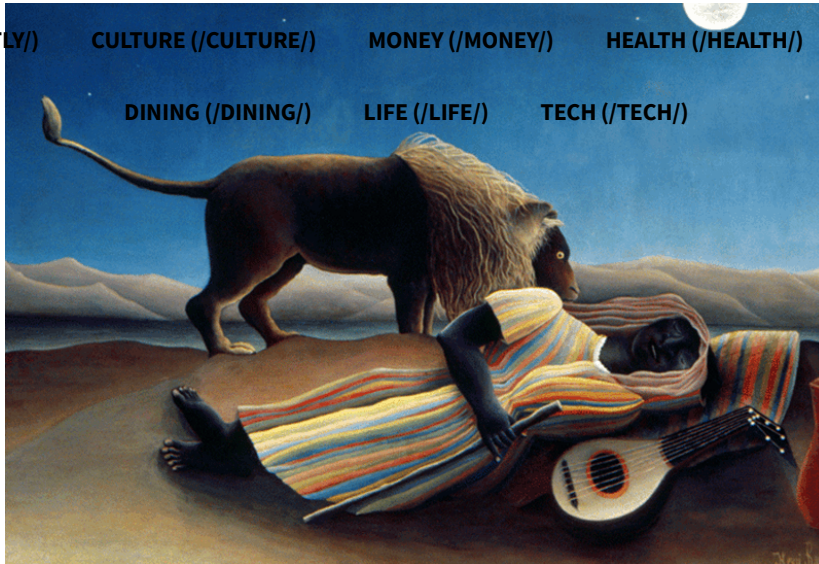
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Rousseau's The Sleeping Gypsy. Photo/Alamy

What's ruining our sleep?

A hundred years ago, less than 2% of the US population slept six hours or less a night, Walker says. Now, almost 30% do. More than 65% of the US population don't get the recommended 7-9 hours of nightly sleep through the week. It's much the same across the developed world. What's to blame? One of the biggest factors is artificial lighting, especially the explosion of LEDs, and digital screens, which are rich in blue light. The circadian clock receives light information exclusively from a special type of neuron in the eye, which is predominantly influenced by blue light at high intensities. Exposure to blue wavelengths in the evening, including from domestic lighting and screens, delays the clock, making it harder to fall asleep and wake in the morning and impeding our attention. Exposure to blue light from the sky is greatest around midday, says a study on the impacts of blue light on health and the environment published by the Royal Society of NZ Te Apārangi in November.

What can we do? We need darkness to release melatonin. Dim half of the lights at night, Walker says, and limit your time in front of devices and the TV. The converse is to get plenty of light during the day, particularly in the morning and early afternoon. You can also choose lights with warmer colours or even buy yellow-tinted glasses that restrict blue light reaching your eyes.

Sleeping pills: Do sleeping pills help or hinder our sleep? Sleeping pills give people a form of sleep, says Gander, but it's not like getting an understanding of people's sleep processes. They are a particular problem for older people, she says, who tend to be taking other drugs as well. Walker notes that they are sedatives, whether the older benzodiazepines or the newer drugs, which are slightly less heavy in their effects. They stop the brain cells from firing, like alcohol. If you compare natural sleeping brainwave activity with that under the newer drugs, the largest, deepest brainwaves are missing, he says. And they can make you groggy, forgetful and more prone to mistakes the next day, fuelling extra caffeine requirements and hence a desire for more pills. People can get addicted to them, and going off them can cause "rebound insomnia", Walker says, frequently worse than the original.

Yet Zopiclone, just one of the insomnia treatments available, was the 14th-highest-volume medicine dispensed in New Zealand in 2013-14, according to GP advisory group BPAC NZ, with about 120 prescriptions being dispensed per 1000 registered patients initially.

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Do they help? A recent meta-analysis by leading researchers of published studies found only “slight improvements” over placebos in the time it took to fall asleep, says Walker. Some studies suggest sleeping pills may actually weaken memory connections normally made during sleep. Even worse: “Sleeping pills are associated with a significantly higher rate of death as well as cancer,” says Walker. The American College of Physicians recommends CBT-I rather than sleeping pills.

Alcohol: Many people believe that a glass or two at night helps them sleep. It doesn't. We become relaxed because booze affects the prefrontal cortex area of our brain first, the impulse-control part. Eventually it begins to sedate other parts. “The electrical brainwave state you enter via alcohol is not that of natural sleep,” says Walker. “Rather, it is akin to a light form of anaesthesia.” More than that, alcohol fragments our night's slumber, waking us up for brief periods and so not letting sleep do its restorative magic. We often don't remember waking, so fail to make the connection with being exhausted the next day. “Second, alcohol is one of the most powerful suppressors of REM sleep that we know of.” Byproduct chemicals called aldehydes that the body produces when metabolising alcohol block the brain's ability to generate REM sleep. And it makes us urinate more.

Caffeine: Found in energy drinks, tea and dark chocolate as well as in coffee, caffeine interferes with the sleep pressure of adenosine in our brains to make us more alert. It has a half-life of six hours, Walker told the *Listener*, but there's still a quarter of it washing around your system 12 hours later. Stop drinking coffee after about 10am, he recommends.

The future of sleep

Technology, the nemesis of sleep, would like to make amends. Many programs now have night-mode options, and a number of apps like f.lux or Twilight reduce blue-light content.

Smart watches, and apps such as Sleep Cycle, Calm, Sleep As Android, Pzizz, White Noise and Pillow, either track and evaluate your sleep cycles by monitoring sounds and movement and promise to wake you at the optimal time, or they play relaxing sounds or white noise, help you meditate or read you stories. But experts such as Alice Gregory, a professor of psychology at Goldsmiths, University of London, argue that sleep should be natural, and focusing on it too much through such monitoring can cause its own problems.

Walker says there has been research to give people's brains small electrical pulses to stimulate deep-sleep brainwaves and sleep spindles, or play them quiet auditory tones, and the early results have been promising.

On the driving-safety front, recent studies suggest it might be possible to have a blood or urine test for sleep-deprivation based on metabolites. Such a tool would be useful for police to get dangerously tired drivers off the road, or perhaps in the near future your car would, like alcohol readers, refuse to let you drive if you hadn't had sufficient sleep.

Gregory says although we can help ourselves in many ways, such as spending less time in front of Netflix, employers can help, too. She notes initiatives such as companies paying staff bonuses to encourage more shut eye, setting up “nap pods” at work, allowing flexible work hours to respect individual differences in sleep-timing preferences and encouraging working from home to reduce time spent commuting.

The answer's simple, even if the question's become more difficult. It's getting enough sleep, of good quality, and getting it at the right time, says Massey University's Gander. “You can't compromise sleep without compromising your waking health.”

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