- Hormones / Sleep



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Recent research is revealing what's causing your post-lunch lethargy, why it stalls your productivity and the best ways to get your brain back into gear

It's 2pm, my eyelids are drooping and my thoughts are sluggish. I feel like I need to summon all my willpower simply to remain awake, let alone get my mind into gear for an afternoon's work. Part of me is tempted to enjoy a little siesta, but how can I justify this time away from my desk?

I haven't even eaten a large meal, just a little salad with some bread and fruit juice. Yet the post-lunch slump – known in the scientific literature as 'postprandial somnolence' – has hit me hard. It's time, undeniably, for another espresso.

Exactly what leads us to lose our energy after midday remains a matter of debate, with some research suggesting that it may be due to a natural rhythm that has very little to do with the food we eat – and respecting the brain's cadences may be far more effective than fighting them. Fortunately, this new knowledge offers some practical strategies to nudge your concentration back from its afternoon lull, as well as some tips for the perfect siesta.

THE BLUE DOT

To understand why our focus waxes and wanes throughout the day, we need to explore a tiny bundle of neurons, measuring just a few millimetres across, buried deep in the brainstem above the back of the neck.

The region is called the locus coeruleus, or 'blue dot'. It's a literal description of its appearance and a clue to its function. Cells in the locus coeruleus are the brain's primary source of a neurotransmitter called noradrenaline – the synthesis of which results in an azure pigment that gives the neurons their distinctive colour.

When it's active, the locus coeruleus delivers noradrenaline to the rest of the brain, where the neurotransmitter eases communication in the synapses between neurons. Higher levels mean that the cells are more likely to spike with electricity when they receive input from another neuron, which passes the message on to other cells within their network. This raises your arousal, so that you feel more alert to your surroundings.

Given these effects, you may imagine that pumping out ever-increasing volumes of noradrenalin would bring about more and more processing power. At moderate levels, a regular supply of the neurotransmitter does indeed help the prefrontal cortex (associated with attention control and abstract thinking) to operate more efficiently, allowing you to maintain optimum focus. Once your arousal has passed a certain peak, however, the increased cacophony of brain signals can begin to feel overwhelming and may even push you into a fight-or-flight response. A sense of mounting pressure – caused, for example, by an impending deadline – may lead the locus coeruleus to react in this way and the unfortunate result is that you struggle to think clearly.

For this reason, some researchers now argue that there's a 'Goldilocks Zone' in our noradrenalin levels that's optimum for most intellectual tasks.

In her book *Hyperefficient*, the neuroscience researcher Dr Mithu Storoni describes the locus coeruleus as the brain's gearbox. First gear (low activity) corresponds to sleepy mind-wandering; second gear (medium activity) is ideal for deep focus and concentration; and third gear (a state of high alert) helps you deal with a crisis.

The locus coeruleus's activity naturally varies over the day. It's practically silent

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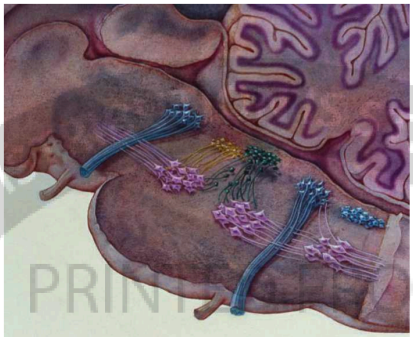

BELOW An illustration of a cross-section of the brain stem, showing the locus coeruleus (in green)

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"VARIOUS STUDIES SUGGEST THAT SHORT NAPS IMPROVE OUR MOOD, AS WELL AS RESTORE OUR FOCUS"

during sleep, but becomes far busier as we wake, and its activity continues throughout the morning – leading us from first to second gear, in Storoni's terminology.

At around lunchtime, however, it temporarily falls back into the lowest gear – a result, Storoni says, of an evolved biorhythm that would have programmed us to nap every 12 hours or so. (This is sometimes known as a 'circasemidian rhythm', which occurs alongside the better-known circadian rhythm that repeats every 24 hours or so.) This leads us to feel drowsy in the early afternoon, even if we haven't consumed anything.

The trough only lasts a couple of hours, meaning that most people will regain their focus by 3pm, though the exact timing will depend on your chronotype – whether you're a night owl or morning lark. "If you're an owl and wake up at 10 in the morning, your dip may shift to later in the afternoon, whereas if you're a lark who has been up since 5am, your dip may happen sooner, even before noon," Storoni writes.

ABOVE LEFT Dr Mithu Storoni

ABOVE A brief afternoon snooze – as depicted here in Van Gogh's *The Siesta (after millet)* – appears to have benefits for our attention in the short-term, as well as our general brain health in the long term

A few studies suggest that eating can deepen the trough in arousal, which impairs cognitive performance, though the precise reason why remains unclear. You may have read that carbs will make you feel sleepier, for example, but the evidence behind this idea is limited. This claim appears to arise from an experiment carried out in the early 1970s, which found that carbohydrate-rich meals raised the levels of the amino acid tryptophan in the blood. This was thought to lower our arousal, since tryptophan is used by the brain to produce the neurotransmitter serotonin and the hormone melatonin – both of which should promote sleep.

If this were true, then a large sandwich or bowl of pasta would send our energy levels temporarily plummeting. The early study was only conducted in rats, however, leading Dr William Orr at the Thomas N Lynn Institute for Healthcare Research in Oklahoma to question whether the composition of a meal makes any difference to human arousal. To find out, his team gave 10 participants high- or low-carb meals and then measured how long it took them to drop off for an afternoon nap afterwards. Surprisingly, Orr and his team failed to find a significant difference between the two groups.

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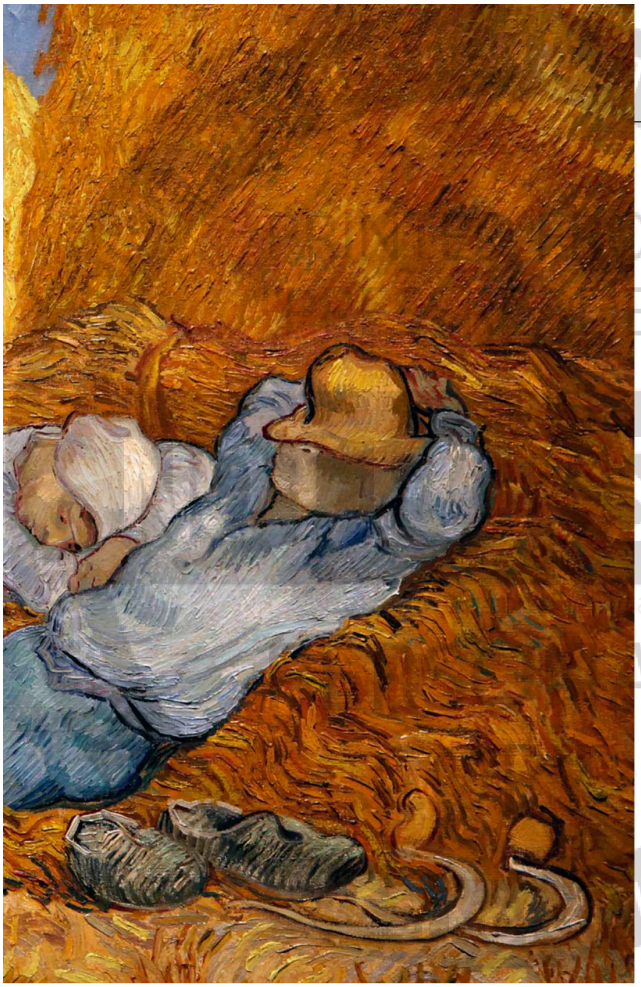

BELOW A link between eating carb-rich meals and a decline in energy levels has yet to be established



You may also have heard the claim that eating diverts blood from the brain to the digestive system, which leads to our foggy heads. In reality, the blood flow inside our skulls seems to be pretty constant no matter what our activity; this is for good reason, given how important it is to deliver enough oxygen to our grey matter.

We can't rule out the possibility that eating may influence our arousal through other pathways, though. The gut is directly connected to the brain through the vagal nerve, which could temporarily reduce activity in regions associated with mental focus. The brain's sleep centres may also be influenced by digestive hormones that control satiety. Scientists have yet to directly test these hypotheses, however.

SLEEP IT OFF?

Whatever the cause of the early afternoon slump, many of us would like to learn how to ease our way through the cognitive fog it produces. The most obvious response may be to sleep it off. Accumulating evidence shows that napping can enhance our wellbeing, so why not give in to the feelings of drowsiness? On awakening, we should feel brighter than ever.

Various studies suggest that short naps can improve our mood, as well as restore our focus and concentration for cognitive tests, and they may even bring long-term benefits to our brain's health. A few years ago, Dr Vicky Garfield and colleagues at the University of Liverpool in the UK examined data from the UK's Biobank, which contains brain scans of hundreds of thousands of participants. Most brains shrink as their owners get older, but Garfield and her colleagues found that people who regularly took daytime naps (three times a week or more) kept hold of more grey matter for longer. "The effect was around 15cm^3 (almost 1in^3), which we said was equivalent to between three to six years of ageing, essentially of brain ageing," Garfield says – though she emphasises that we'll need to test the effects in other groups.

A short snooze can also enhance your physical prowess. "Daytime napping is a common strategy among athletes, particularly during periods of intense training or competition," says Omar Boukhris from La Trobe University in Melbourne, Australia. He argues that taking a short sleep can encourage activity in the parasympathetic nervous system, which is responsible for the body's resting, so that it can repair our tissues and handle life-enhancing processes like digestion. The result, Boukhris says, is reduced inflammation, "contributing to better cardiovascular regulation and overall recovery".

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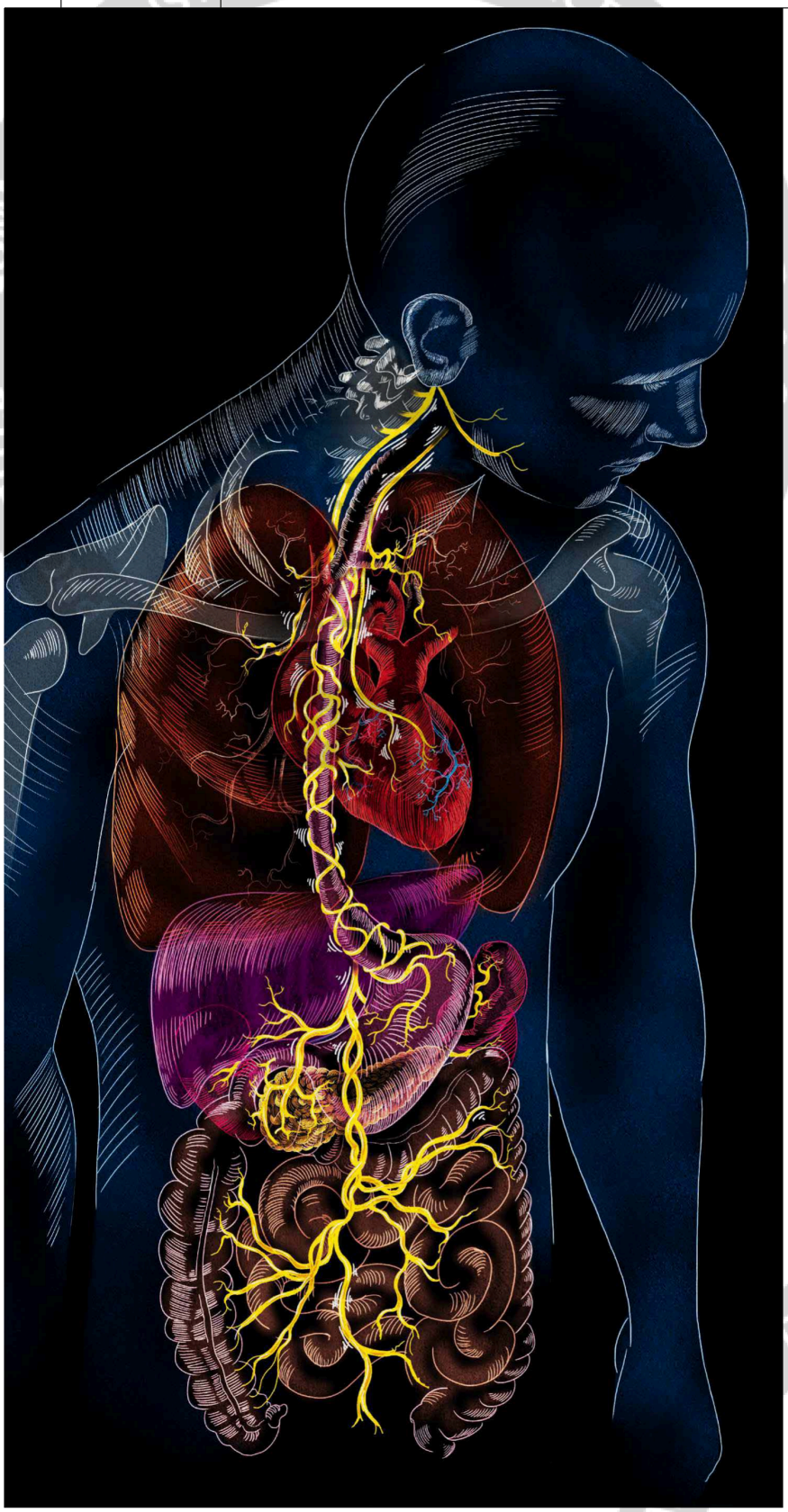

LEFT The vagus nerve (in yellow) provides a link between the heart, lungs, digestive tract and brain

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Taking stock of the available studies in a recent meta-analysis, he found significant benefits for athletes' performances in events requiring short bursts of energy, such as sprinting. Crucially, the timing mattered. "The most beneficial naps were those taken in the early afternoon," Boukhris says, exactly when we're programmed to feel most drowsy.

All of these findings come with caveats, which include the amount of time we spend dozing. "If you nap for too long, then you go into deep sleep – you'll find it harder to wake up and then you'll be less productive for the rest of the day," Garfield argues. It leaves your brain stuck in its lowest gear. Even worse, a longer afternoon nap may prevent you from sleeping at night, meaning that you'll start the next day with an attention deficit. "It becomes a vicious cycle."

There may be many other important reasons to keep our siestas short and sweet. The body clock, after all, is intricately linked to all kinds of bodily processes and a luxuriously long afternoon nap could throw these into disarray. "Circadian misalignment can negatively impact glucose metabolism, increase appetite and fat storage, and impair autonomic regulation," says Dr Alejandro Fernandez-Montero at the University of Navarra.

Fernandez-Montero and his colleagues recently analysed data from nearly 10,000 Spanish graduates, recruited over the past 26 years, who had been asked to report how often they had a siesta each week. Six to eight years after signing up to the study, the participants were also tested for signs of metabolic syndrome, which describes a cluster of health problems associated with the body's energy intake and expenditure that are associated with type 2 diabetes and cardiovascular disease. Its components include elevated blood pressure, high blood sugar, a large waist circumference and a low level of 'good' HDL (high-density lipoprotein) cholesterol.

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Controlling for a whole host of other factors – such as diet, physical activity, working hours and stress levels – the team found that lengthy siestas, lasting more than half an hour, were associated with considerably worse markers of metabolic syndrome. The data seemed to suggest that a 15-minute siesta was better than no siesta at all, however. "The safest and most beneficial window appears to be short naps of 10–20 minutes, enough to improve alertness and cognitive function without triggering adverse metabolic effects," Fernandez-Montero concludes.

Such findings fit with an earlier meta-analysis by Prof Tomohide Yamada at the University of Tokyo and colleagues, who crunched data from 288,883 participants across the US, Europe and Asia. They noted that regularly taking naps of more than 40 minutes increased the chances of developing diabetes, while shorter naps came with no health risks.

If you've been tempted to indulge in a lengthier snooze, try not to schedule anything intense too close after waking, since the lasting feelings of grogginess known as 'sleep inertia' will limit any of the benefits you might have gleaned from the time out. Instead, you should incorporate a buffer zone that allows you to return to full alertness. Boukhris noted as much in his analyses of athletic performance. "The time between the end of the nap and the exercise influenced outcomes: the longer the gap, the greater the performance benefit," he says.

"THEY NOTED THAT REGULARLY TAKING NAPS OF MORE THAN 40 MINUTES INCREASED THE CHANCES OF DEVELOPING DIABETES"

RESPECTING THE BRAIN'S RHYTHMS

If napping isn't possible, there are many other ways to respect the brain's rhythms. You might stop to strike a few yoga poses or take a gentle stroll around the park. "A 30-minute walk can produce cognitive benefits comparable to those of a short nap," says Fernandez-Montero. "Light



BELOW The locus coeruleus falls back into 'first gear' around lunchtime, leaving us feeling drowsy in the afternoon

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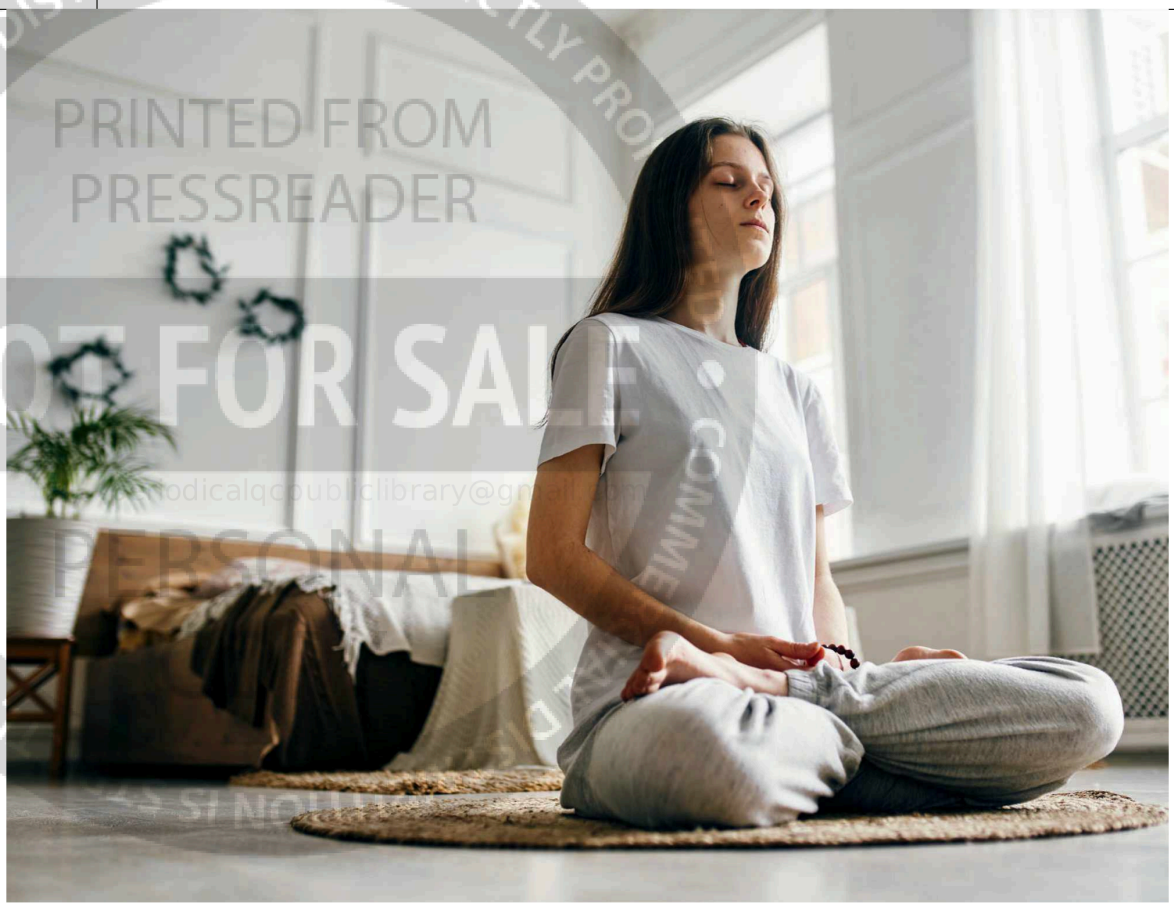

RIGHT Taking a break to do something active can help to perk your energy and attention back up after lunch

physical activity activates the brain and enhances mood and attention, without disrupting circadian patterns."

Garfield agrees, pointing out that any relaxing activity done away from the desk should be beneficial. "You're still resting your brain, even if you're not actually napping," she says.

At the very least, you can alter your schedule so that you avoid tackling the taxing problems while your brain is still in its lowest gear. "Schedule the most 'non-thinking', inconsequential and low-effort tasks into the post-lunch dip period to around 3pm or so," Storoni advises.

None of this should make up for bad nocturnal habits, though. "Adequate nighttime sleep remains the cornerstone of sustained daytime cognitive performance," says Fernandez-Montero.

I've taken note. Over the days that it took to research and write this piece, I've paid closer attention to my body and brain's rhythms. In the past, I'd have relied on espresso shots to power through the dips in my attention, but I've started to take more breaks away from my desk. I find that my attention soon picks up, without the jangling nerves and bad breath that follows my caffeine fix. It's also easier to unwind during the evening and I sleep better at night – leaving me recharged and refreshed to start another day. **SF**

"SCHEDULE THE MOST LOW-EFFORT TASKS INTO THE POST-LUNCH DIP PERIOD TO AROUND 3PM"



by **DAVID ROBSON**
David is an award-winning science writer and author of The Laws of Connection: 13 Social Strategies that will Transform your Life *(Canongate, 2024).*

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