

**OUT OF**  
**SYNC**

Digital devices and 24/7 lifestyles are messing with our body's natural rhythms, threatening our health. What does it take to keep our inner clock ticking?

**By Emily Laber-Warren**

PHOTOILLUSTRATIONS BY C.J. BURTON



Sparrow Rose Jones

But Jones possesses a restless intellect. She has taught herself trigonometry, earned an FCC ham radio license and reads history for pleasure. In her mid-30s she decided to return to school—and not just for a high school equivalency diploma. She earned college degrees in both economics and political science, then continued to graduate school at Idaho State University, intent on a doctorate.

Jones was a strong student and even made the dean's list a couple of times. But she had to force herself to function on a daytime schedule, and the effort took a toll. She experienced profound fatigue, unlike anything she had ever felt. Diarrhea and nausea. Optical migraines, which struck without warning and rendered her blind for half an hour at a time. Bouts of depression.

Meanwhile her sleep schedule became increasingly erratic. One summer, free of obligations and the alarm clock, she tracked her sleep and found that she did not return to her usual night-owl ways. Instead her bedtime seemed to be shifting around the clock.

Then she failed a class. "That really scared me," Jones says. She made an appointment to spend a night at a sleep laboratory. Everything checked out normal, but when she showed the doctor her homemade sleep-tracking charts, he recognized, with a ping of excitement, a rare and fascinating malady: non-24-hour sleep-wake disorder, or non-24 for short.

Despite its name, this was not fundamentally a sleep problem, he explained. Jones's sleep issues were the outward manifestation of something much deeper. The sophisticated timing system in her brain had broken, leaving her body chronologically adrift. The biochemical changes that occur each evening to prepare for sleep had disappeared. In fact, all the fluctuations—in blood pressure, body temperature, hormone production,

For much of her life, Sparrow Rose Jones was the kind of late riser about whom other people roll their eyes, the kind who goes to bed at dawn and wakes in the midafternoon. As a kid growing up in Louisville, Ky., she had problems at school, in part because she is on the autism spectrum and struggled socially but also because she was always tired. At 16 she dropped out and resigned herself to dead-end night jobs at bars and fast-food joints. The work was menial, but it enabled her to support herself while heeding her natural sleep needs. "I thought, well, my life was so tired of working," she recalls.

alertness, metabolism and digestion, to name just a few—that happen predictably over the course of the 24-hour day were happening at odd times and were uncoordinated with one another. From a biological perspective, Jones might as well have been living on another planet.

Jones's case is extreme, but more than 27 million Americans—including nurses, firefighters, truck drivers and factory workers—have irregular work schedules that may cause a disconnect from the basic temporal patterns of daily life. Our internal organs operate in patterns called circadian rhythms that repeat over the course of each 24-hour day. And research is revealing that when these physiological rhythms are out of sync—a state known as circadian misalignment—the health impact can be vast, from diabetes and obesity to cancer, heart problems, infertility, mood disorders and mental decline. "Your body is optimized to work with a certain relationship to the natural world. Good health follows from that," explains Martha Glette, a neuroscientist and circadian expert at the University of Illinois at Urbana-Champaign. "In modern life, we've taken the natural world and done with it what we wish."

Because modern routines clash with natural rhythms, scientists are beginning to suspect that virtually everyone is affected to some degree. Staying up late to work or have fun, using laptops, tablets and other screens before bed or to quell insomnia in the middle of the night, indulging in midnight snacks—all these apparently innocuous activities can subtly throw the body off-kilter. The body clock is an ancient system common to all life on earth, that relies on sunlight and dark periods of activity and periods of rest to calibrate itself. Today's society, with its electric lights, 24-hour convenience stores, proliferating digital devices, global economy and "always on" mentality, has scrambled our inner timing systems.

In short, we are living in an age of circadian dysfunction.

Anyone who has flown across time zones knows what it feels like to have a body clock that is out of whack—fatigue, insomnia, digestive problems, headache, dizziness, nausea, and other symptoms. Jet lag is a classic example of circadian misalignment. The body typically adjusts within a week or so. But as we are increasingly subjecting ourselves to the equivalent of permanent jet lag.

The science is so new that no one knows how many of us are affected, but people may experience mild circadian misalignment in a variety of ways without realizing the root cause.

#### FAST FACTS BAD TIMING

- 1 The internal workings of the human body adhere to daily cycles known as circadian rhythms. The brain area called the suprachiasmatic nucleus coordinates the activity patterns of the body's many organ systems.
- 2 Artificial light at night confuses the body's rhythms, raising the risk of diabetes, cancer, depression and even infertility.
- 3 People can learn to regulate their natural circadian rhythms to maintain and restore health.

could present as stomach upset, unexplained insomnia or, more ominously, the shifts in blood pressure, inflammatory markers, insulin resistance and other metrics that signal the implacable onset of heart disease, diabetes or cancer. Happily, research reveals inexpensive and straightforward solutions that will allow most people to reset their inner clock.

### Timing Is Everything

Almost every living thing, from cyanobacteria to leopards, is attuned to the earth's daily rotation. Evolution has smiled on creatures that capitalize on the planet's day-night dichotomy, matching their internal workings to the shifting conditions of the outside world.

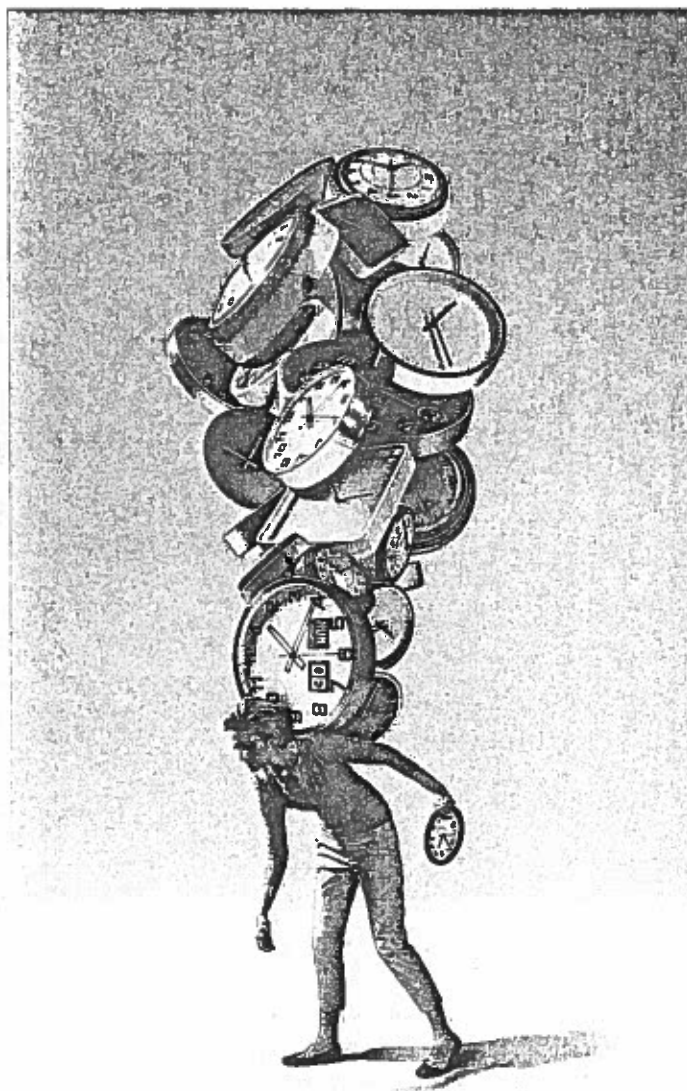
These are the fluctuations known as circadian rhythms (the word "circadian" comes from the Latin for "about a day"). In many animals they dictate the timing of hibernation, courtship and reproduction. Even in plants, circadian rhythms are crucial to survival. In June scientists at the University of Washington found that it is thanks to a circadian gene that the common garden petunia waits until night to release its fragrance, which attracts nocturnal pollinators.

Circadian rhythms also create the ebb and flow of human physiology. They explain why fevers run highest at night, why a late meal can make it hard to sleep, why teenagers are late risers and many other familiar aspects of daily life. And they are grounded in the daily planetary shift between light and darkness.

To align the body with what's going on in the outside world, the suprachiasmatic nucleus, which serves as the brain's master clock and is located deep within the hypothalamus, constantly monitors the intensity of ambient light. Bright light in the morning sets the body clock for the day, and evening darkness nudges organs into their nighttime mode. For example, the drowsiness-inducing hormone melatonin flows, preparing the body for rest. The bladder expands to hold more urine, making it possible to sleep through the night. And the liver makes extra glucose to keep the brain nourished throughout the overnight fast.

But if the master clock encounters bright light at night, it sends "start the day" messages at the time when organs are settling down for the evening. Circadian rhythms get scrambled. This can happen when flying across time zones (and explains

When physiological rhythms are out of sync, the health impacts can be vast: from diabetes and obesity to cancer, heart problems, infertility and mood disorders.



why jet lag is worse when traveling east); when people use an iPad, cell phone or laptop at night (because digital screens emit the same blue wavelengths found in morning sunlight); and when people work the wee hours in a brightly lit space or fall asleep with the television on.

Scientists have been investigating circadian rhythms for decades, but until very recently they did not appreciate how critically important these rhythms are to the regulation of nearly every bodily system. "In the last 10 years or so, work on circadian rhythms and human health has really just exploded," says neuroscientist Colleen McClung, whose lab at the University of Pittsburgh investigates the relation between circadian rhythms and mood disorders.

One of the discoveries: by banishing darkness, modern society has ushered in a host of potential health problems. "We are

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#### THE AUTHOR

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all so used to nighttime light exposure that when you tell people it's unnatural, they are, like, 'What? Light?'" says Laura Fonken, a neuroscientist at the University of Colorado Boulder. "People don't think of light exposure the same way they think of something like a drug or a dietary intervention, but really it does have these very profound effects on our physiology."

An even newer revelation: mealtimes may also be critically important to keeping circadian rhythms in balance. Mounting evidence suggests that the body relies not only on light exposure but also on behavioral cues to orient itself in time—sleep, exercise, social interactions and, perhaps most significant, eating.

The latest research by molecular biologist Satchidananda Panda of the Salk Institute for Biological Studies in La Jolla, Calif., and others suggests that the body is designed to take in food during the day and fast at night. Breakfast, like sunlight, seems to serve as a timing cue, alerting the body clock that it is morning. So snacking long after dark may be as disruptive to natural rhythms as staying up late bathed in the illumination of a digital screen.

### Off the Clock

Sleep never came easily for Jones, who remembers lying wide awake in bed as a small child, often until 2 A.M. "I grew up believing that I was lazy and undisciplined, but it wasn't like it was fun. I was just lying in bed looking at the clock," she recalls.

Much later she would realize she had inherited from her fa-

ther a circadian quirk—delayed sleep phase syndrome—that turns people into radical night owls, naturally inclined to stay up until the wee hours and sleep until afternoon. Scientists are learning that there is a genetic basis to people's natural sleep inclinations. About half the population is predisposed to be either early birds or night owls, and the other half fall somewhere in between. These inherited patterns are known as chronotypes. Extreme chronotypes are rare: delayed sleep phase syndrome, for example, affects three in 2,000 people.

When these extreme night owls hew to their natural schedule, as Jones did for years, they can be healthy and well rested. But working the night shift came to feel to her like an intellectual desert. Jones yearned to engage with the world of ideas—to think, to write. In 2003, at age 36, she plunged into academia. Her new schedule went something like this: She went to morning class, came home and napped, went to afternoon class, came home and napped, went to evening class, came home and then, well,

stayed up all night because this was the time when she felt most awake. On weekends she would sleep all day to compensate, but the exhaustion and uncomfortable physical symptoms accumulated.

Jones had developed a classic case of what circadian experts call "social jet lag"—lifestyle-induced circadian misalignment that occurs when people pursue professional or personal obligations at the expense of their natural sleep needs. Jones, with her reversed sleep schedule, got social jet lag from daytime exertions, but typically it occurs when people stay up late at night to work or socialize.

### Misalignment Made Flesh

Disconnecting from daily rhythms strikes the body at the most basic level: the cell. In 2014 a team led by geneticist John Hogenesch of the University of Pennsylvania made an astounding discovery: Nearly half of all gene activity in mammals is timing-related. Previous estimates had been closer to 15 percent. "This means the circadian clock could be influencing most, if not all, of our physiology and many of our behaviors," Hogenesch says.

Over the course of two days Hogenesch's team removed 12 organs, including the heart, lungs and liver, from a different group of mice every two hours, then analyzed the RNA from those tissue samples to figure out which genes were active in which organs at every hour of day and night. The team learned that organs do not chug along at a steady pace. Instead they are



## Tips for Circadian Health

Keeping your bodily systems working in sync for optimal health is not difficult for most people. Mainly, it requires some commonsense daily habits. Try these basic steps:

- 1. Adjust your light exposure to approximate the natural day-night cycle.** Spending time in low light a few hours before bedtime will encourage your body to produce sleep-promoting melatonin. Try to fall asleep in darkness; draw the shades on your bedroom windows and make sure you are not exposed to light from electronic or other digital devices. In the morning, take a walk outside or eat your breakfast near a sunny window.
- 2. Go to bed and get up at about the same time every day—including on weekends.**

Sleep regularly is an important way that the body keeps its rhythms.

- 3. Block blue light in the evening.** If you use a laptop or smartphone before bed, get a program such as f.lux (<https://justgetflux.com>) to eliminate the blue wavelengths emanating from the screen. Morning sunlight is full of blue light, the same spectrum that beams from digital devices, so texting or playing video games in the evening erroneously informs the brain's master clock that the day is just beginning. Other solutions: wear amber sunglasses at night or equip your bedside lamp with a red or amber lightbulb. General Electric and Phillips are developing home-lighting systems that automatically shift hue as the day progresses.

- 4. Front-load your meals earlier in the day and forgo the midnight snack.** The custom in some societies of eating the main meal at breakfast or lunch seems to promote a healthy metabolism. A 2013 study at Spanish weight-loss clinics by neuroscientist Frank Scheer of Harvard University and nutri-

tionist Marta Garaulet of the University of Murcia found that people who ate their main meal before 3 P.M. lost more weight than those who ate later even though both groups consumed the same amount of calories.

- 5. Eat 12 hours on, 12 hours off.** A December 2014 study by molecular biologist Sachidananda Panda of the Salk Institute for Biological Studies in La Jolla, Calif., found that consuming all the day's calories in a span of nine to 12 hours prevented weight gain in mice even when the animals ate a high-fat diet. Time-restricted feeding also protected mice against diabetes and other health problems, but the practice has not yet been well investigated in people.

- 6. Work out regularly but avoid heavy aerobic exercise before bed.** Heart rate, blood pressure, and core body temperature vary predictably throughout the day, hitting lows in the evening. Revving them when they are meant to be quiet can disrupt sleep and other rhythm-dependent aspects of health.

—E.L.W.

alternately active and quiescent, attending to certain tasks during the day and others at night, with "rush hours" of activity at dawn and dusk.

Another groundbreaking study, published a year earlier, detected the same telltale signs of rhythmic gene activity—in the brain. The work, conducted by the Pritzker Neuropsychiatric Disorders Research Consortium, involved 89 brains taken from people who had donated their bodies to science. Some of the donors had suffered from major depression, others had not. In the healthy brains, as in Hogenesch's mice, hundreds of genes ramped up and slowed down at specific times of day, forming daily patterns so clear and predictable that they could be used to pinpoint time of death for an unmarked sample of brain tissue.

But the brains of depressed people were different. Their gene activity was haphazard and disorganized, lacking these daily patterns. Psychiatrists have long noticed that people with mood disorders tend to have sleep problems and other signs of circadian misalignment. Now here was physical proof that the circadian rhythms of depressed people are weak or nonexistent—circadian misalignment made flesh.

## Flipping a Biological Switch

Jones is not sure exactly when her master clock broke. "At first I didn't notice what was going on," she recalls. "Using alarm clocks and getting up for all these classes sort of masked things." But in the summer of 2007, when she let herself sleep at will, she discovered that her body had adopted a 25-hour schedule, with bedtime shifting an hour later each day. This was the textbook "stair-step" pattern that the doctor at the sleep clinic would immediately recognize as non-24.

Non-24 is a common side effect of blindness because damaged eyes do not transmit the necessary light signals to the master clock. But in the rare instances when non-24 affects sighted people, no one knows the cause. Jones suspects that she was genetically vulnerable and that this physical predisposition, combined with three years of social jet lag, pushed her over the edge. "I think that patchwork schedule kind of flipped some biological switch," she says.

That switch most likely was in her brain's master clock. The suprachiasmatic nucleus functions like an orchestra conductor, keeping time so that the individual rhythms of the heart, liver and other organs can coordinate—a bodily state known as en-

trainment. When the master clock stops working properly—whether because of a biological defect or because of frequent eating, working or socializing late into the night or at odd hours—internal organs begin operating at different tempos, like instrumentalists in a cacophonous orchestra with no maestro. Illness ensues.

Jones's non-24 got progressively worse. Bedtime became a moving target, shifting randomly around the clock. She could not make plans—not even a coffee date with a friend. “You can’t have a life,” she says. “You can’t even say if you’ll be at someone’s wedding or funeral.” Forcing herself awake at times when her body thought it was the middle of the night only made her sicker—more nauseated, depressed, fatigued—as her internal organs increasingly lost track of one another.

“Honestly, if you ask me, I would prefer to have heart failure than a non-24-hour sleep-wake-cycle disorder,” says Robert J. Thomas, a sleep medicine doctor at Beth Israel Deaconess Medical Center in Boston who specializes in circadian disorders. “That’s how badly these patients suffer.”

In 2009, after three years of living with non-24, Jones developed a sudden case of diabetes so severe that even Brussels sprouts caused her blood sugar to spike, she recalls. The medi-

cation regimens for both type 1 and type 2 diabetes failerctors did not know how to help her. Although Jones had risk factors, including being overweight and a family history traces the abrupt onset of diabetes to her circadian disorder and indeed, when she finally got her non-24 in check four later, her blood glucose returned practically to normal.

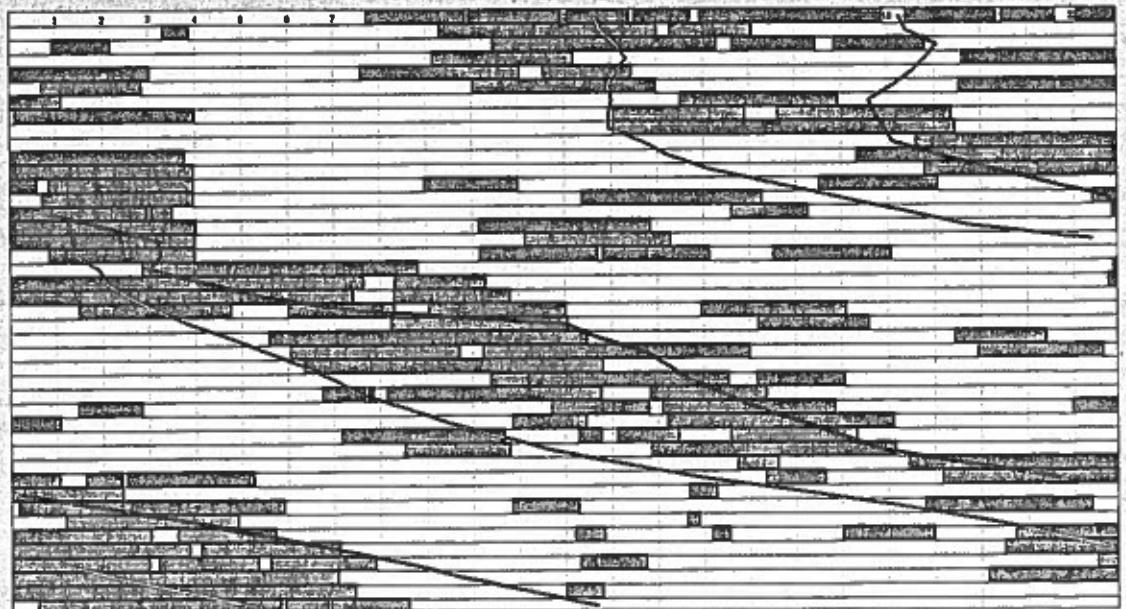
### Organs That Cannot Keep Time

Diabetes affects more than 29 million Americans times as many as a quarter of a century ago. Experts cite ranging from the ubiquity of cheap sugary drinks and foods to sedentary habits. But some scientists are starting to suspect that disrupted circadian rhythms may also underlie many of our mass metabolic dysfunction.

For years, observational studies have shown that people who work nighttime or rotating shifts are susceptible to much higher rates of obesity and diabetes. More recently, scientists have begun to artificially induce circadian misalignment, and one of the most dramatic changes they see is an increased disposition to weight gain and metabolic problems. In a lab, 10 healthy people in a lab, scrambling their mealtimes an

### Off the Charts

Sparrow Rose Jones, who suffers from non-24-hour sleep-wake disorder, uses specialized software to log her sleep. The resulting tab contains a record in which each row covers a day and each column indicates an hour. The blue blocks are hours spent sleeping. In people who go to sleep and wake up at roughly the same time each day, and the red lines, which track sleep patterns, will be mostly vertical. Jones's chart, however, is more erratic. For several days (top of chart), she forced herself to wake up early each morning to connect with a friend in a different time zone. Later she allowed her body's circadian cycle to shift freely, falling asleep and waking up without any alarms. In an effort to reestablish her body's natural (if erratic) clock before her cross-country road trip.



schedules while subjecting them to constant low light. As the participants' inner timekeepers lost track of day and night, their blood pressure, body temperature and hormone production stopped following regular patterns. Most strikingly, levels of leptin, the hormone that alerts people that they have eaten their fill, decreased. People with low leptin levels tend to overeat. In addition, three participants became prediabetic, all in just 10 days' time.

Experiments in animals are yielding equally dramatic results. Multiple labs are finding that when mice are kept in constant light or are forced to eat during their normal resting time, they gain weight—even when they consume the same number of calories. “We’re not as good at metabolizing our food when it’s not eaten at appropriate times of day,” says Erin Zelinski, a Ph.D. candidate in cognitive neuroscience at the University of Lethbridge in Alberta, adding, “You probably don’t want to be eating that kebab at 4 A.M.”

Circadian disruption leads to cognitive as well as metabolic problems. Alertness and motor coordination decline markedly. “If you look at the frequency of industrial accidents, they peak between two and four in the morning,” says University of California, Los Angeles, neuroscientist Christopher S. Colwell. “That’s the time when people should not be doing anything that requires vigilance.”

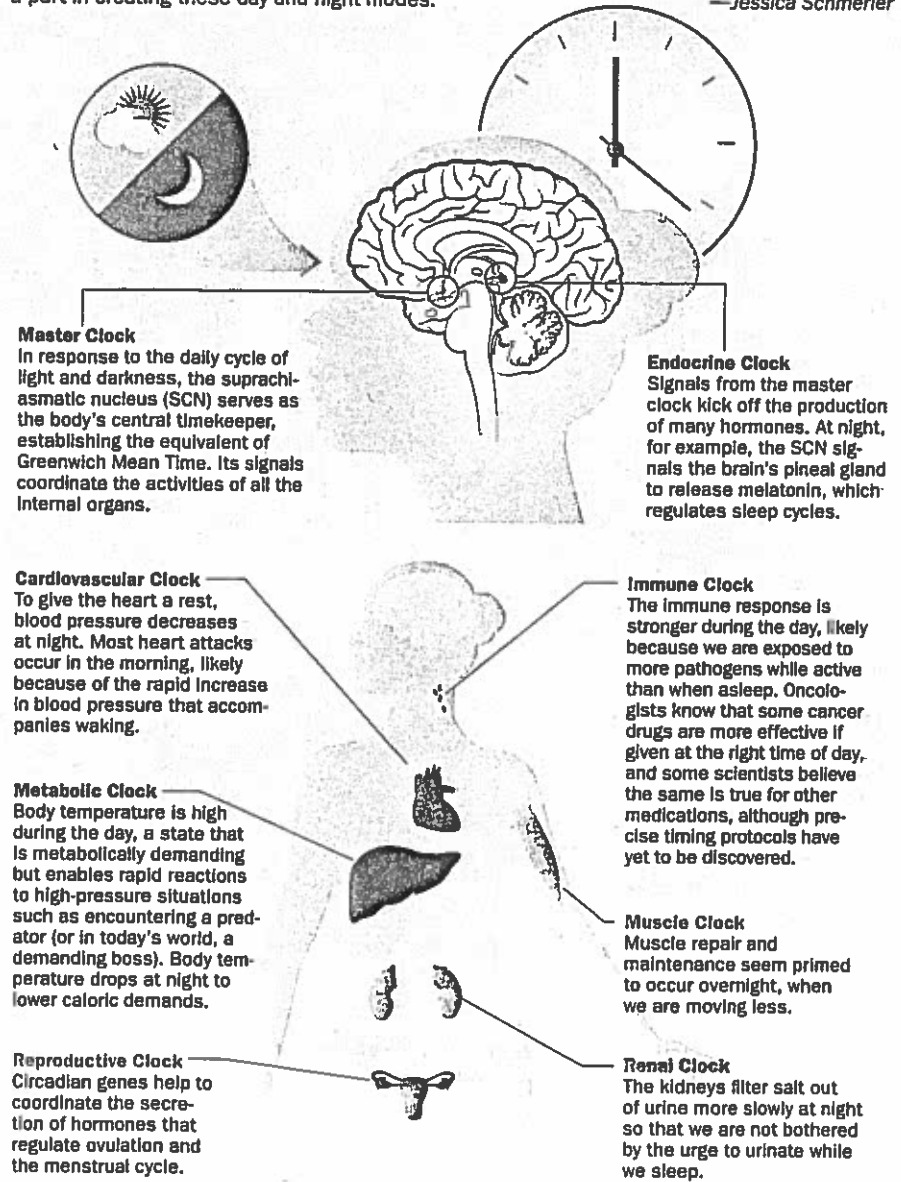
People whose jobs require them to work odd hours also have trouble making agile mental calculations. Emergency room doctors working the night shift showed short-term memory impairments in a 2012 study by David Hostler of the University at Buffalo’s Emergency Responder Human Performance Lab and his colleagues.

Animal experiments are confirming that the hippocampus, the part of the brain central to learning and memory, is highly sensitive to circadian disruption. For example, in studies published in 2013 neuroscientist Robert J. McDonald of the University of Lethbridge found that rats with the equivalent of jet lag have trou-

## A Symphony of Clocks

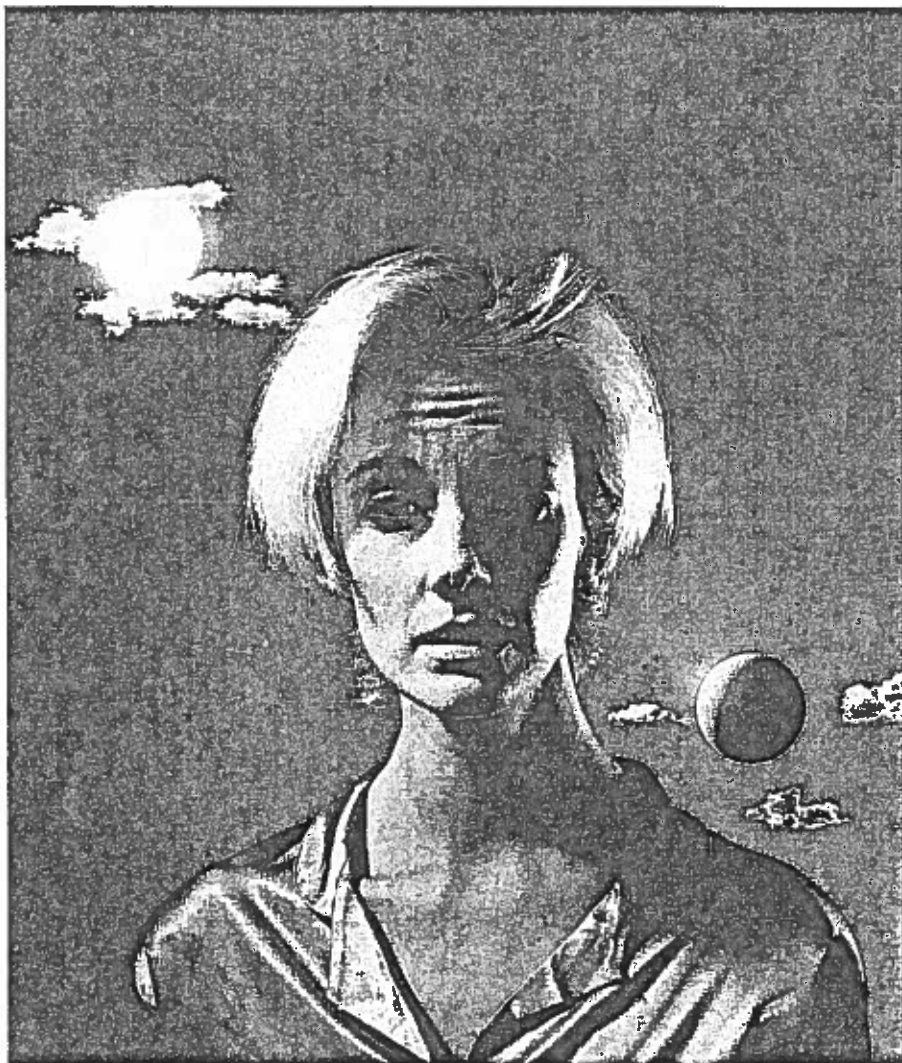
Just about every tissue, gland and organ in our body follows a circadian rhythm of activity, taking cues from the master clock in our brain. Hundreds, if not thousands, of genes play a part in creating these day and night modes.

—Jessica Schermer



ble remembering what they have learned. Rats with longer-term circadian disruption, the kind that afflicts shift workers, have difficulty learning new tasks as well as recalling them.

Practically every month a new study spotlights circadian misalignment in some other ill. In a study published in April scientists at the University of Warwick in England examined uterine lining cells from 70 women and found a higher frequency of circadian disruption in women who suffer multiple miscarriages—suggesting that misalignment of daily rhythms in the womb hampers the ability of the fertilized egg to implant. Pregnancy



is all about timing—an able sperm meets a fertile egg just as it is making its way through the fallopian tube—but it turns out that timing also matters at the cellular level.

For unknown reasons, rhythms shift later during adolescence, then return to normal in young adulthood. Psychiatrist Brant Hasler of the University of Pittsburgh has published several recent studies suggesting that the disconnect between high school start times and teens' natural sleep needs compromises brain areas related to reward and self-control, making them more susceptible to getting hooked on drugs and alcohol. New studies also link circadian misalignment to greater risk of post-traumatic stress disorder, breast cancer and inflammatory bowel disease.

### The Value of Repetition

Circadian rhythms are old-fashioned. They are conservative. They are your grandmother's medicine. Go to bed at a reasonable hour. Eat a good breakfast. Do not push yourself

too hard. Something in our modern spirit rebels against these strictures. We will stay up until 3 A.M. binge-watching *House of Cards* if we feel like it. We will fall in love with people in faraway places and use Skype and cell-phone apps to erase the time differences.

But the need for structure and daily repetition is woven into our DNA. Sunrise and sunset bookended our ancestors' days. "We evolved on a planet that has a roughly 24-hour day, and we are biologically prepared to function better if we are in a regular rhythm," says psychologist Ellen Frank of the University of Pittsburgh.

Most people have a choice, but for Sparrow Rose Jones, something as simple and humdrum as a daily routine seemed totally out of reach. Her body had lost some innate, primal logic and was taking her on an endless fun-house ride. She tried operating on 28-hour days because six of them fit neatly into a week. That did not work. She tried exposing herself to bright light at specific times to nudge her system back toward regularity. That did not work, either. On her sleep doctor's advice, she tried slap-

ping herself and icing her skin to stay awake during daylight hours so that she would sleep consistently at night. She began hallucinating from fatigue.

Jones dropped courses until she was taking only one, and even so she was frequently absent. Colleagues offered advice such as "Just go to bed earlier" or "Drink warm milk"—as if instead of a neurological disorder, she had a mild case of insomnia. In 2012, one course and a dissertation shy of her degree, Jones dropped out.

Giving up on grad school was a blow, but it gave her much needed time to refocus and heal. A fellow non-24 sufferer she had connected with in an online support group suggested three hours of bright artificial light in the morning to jump-start her clock and six blackout hours before bed (during which time, red light-bulbs and light-filtering goggles enabled her to be productive). It was an extreme, comic-book version of what everyone should do to maintain healthy circadian rhythms: get sun in the morning and turn down the lights a couple of hours before bedtime.



It worked. Jones began sleeping regularly from midnight to 5 A.M. At last, her body was on a regular schedule, and her health began to improve.

### Circadian “Hygiene”

If Jones deviated even slightly from her newfound regimen, she lost her entrainment. Still, she was discovering that even her extreme misalignment was correctable. And for most people, the solutions are much simpler [see box on page 35].

Melatonin supplements improve mood and memory in people with dementia, who suffer from disturbed sleep and other hallmarks of circadian dysfunction. Sitting near a device called a light box to get bright light in the morning is a boon for peo-

“I would prefer to have heart failure than a non-24-hour sleep-wake-cycle disorder,” says sleep medicine doctor Robert J. Thomas.

ple with seasonal depression. And forward-thinking nursing home administrators are finding that when they provide varied illumination instead of keeping the lights on 24/7, elderly residents are less disoriented.

People with bipolar disorder are especially vulnerable to circadian disruption: pulling an all-nighter or traveling overseas can trigger an episode of mania or depression. Conversely, regularizing routines can stabilize their moods. A therapy developed by Frank asks patients to record daily when they get out of bed, when they first interact with other people, when they begin their daily routine, when they have dinner and go to bed—and then to tweak those times over a period of weeks to establish a schedule they can stick to. “We’re looking to keep routines very regular, seven days a week, no shifts on weekends,” she explains. The treatment, called interpersonal and social rhythm therapy, has proved effective in two large trials.

Circadian rhythms naturally deteriorate with age—which may account for some of the sleep and memory problems of the elderly. But strengthening circadian rhythms may be a hedge against cognitive decline. In research by McDonald, old hamsters with strong circadian systems outperformed misaligned younger animals on memory tasks.

Changing habits is not easy. But if more people understood the potential long-term benefits to their mood, sleep quality, cardiovascular health, weight-loss goals and mental sharpness, they might make the effort. “We should consider sleep and circadian hygiene just as important as washing our hands,” says Colwell,

editor of the new book *Circadian Medicine*. “It’s really critical for good health and well-being.”

### Back to Basics

Managing non-24 made it impossible to hold down a job, but Jones has a character, shaped in part by autism, that is fundamentally optimistic and animated by passionate, sustaining interests. After leaving graduate school, she self-published a book of personal essays and a CD of original music. Then she conceived a radical new life plan. Jones decided to give up her apartment in Pocatello, Idaho, and drive cross-country, becoming a modern-day nomad—sleeping in a tent, indulging her love of nature, and visiting train yards, science museums and the graves of famous writers along the way. Her goal: to arrive on the East Coast to meet her love for the first time—the person whose advice helped to stabilize her rhythms and with whom she has developed a long-distance romance. If things work out, she can settle close by; if not, she is mobile.

But Jones had an additional motivation for pulling up stakes—a theory that living outdoors, as our ancestors did for millions of years, experiencing the full force of the sun every day and true darkness at night, might cure her circadian disorder. “It would be pretty sweet if a primal hobo life does automatically what modern medicine struggles to accomplish,” she wrote in an e-mail before her May departure. By June, when this article went to press, her rhythms seemed to be naturally and effortlessly stabilizing to a regular 8 A.M. wake-up time—but this progress disappeared whenever she visited friends and slept indoors. “It’s a shame that sleeping outdoors is such a radical ‘therapy’ that few will be able to replicate it,” she wrote, “because I am overjoyed with how well it is working for me.”

There is a lesson here for the rest of us, with our overextended, brightly lit, Starbucks-fueled lives. Modernity has made it possible to stretch beyond the confines of the 24-hour day, but in the process we have become untethered from the fundamental pulse of our planet. Science is revealing that we do so at our own risk. M

### FURTHER READING

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  - **An Odd Sense of Timing.** Pascal Wallisch; February/March 2008.
  - **The Clocks within Us.** Keith C. Summa and Fred W. Turek; *Scientific American*, February 2015.

